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FACULTY OF SOCIAL SCIENCES
Center for Economic Research and Graduate Education

Dissertation Thesis

2026 **Flavio Malnati**

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Essays in Long-Run Development and Economic History

Dissertation Thesis

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Abstract

This dissertation empirically investigates how long-run economic development is shaped by historical institutions, technological change, and social norms. While these forces typically evolve slowly, discrete shocks and historical events can generate sharp changes that allow their effects to be studied using quasi-natural experiments and modern econometric methods. The first chapter focuses on the rise and decline of the Teutonic Order in East Prussia between the thirteenth and sixteenth centuries. The analysis shows that economic development in areas under the Order's rule closely followed the expansion and contraction of its state capacity. It also further documents more persistent pro-market institutions, stronger bureaucratic capacity, and greater economic integration in the Order territories relative to neighboring Polish areas. The chapter further documents persistent pro-market institutional arrangements and greater economic integration. The second chapter, co-authored with Christian Ochsner, studies the economic impact of transportation technology shocks. It exploits the unexpected repeal of the automobile ban in the Swiss canton of Grisons in 1925. The results show an immediate increase in firm registration and economic activity in Grisons compared to neighboring regions without any ban. The positive economic effects are more pronounced and more sustainable in places with a better starting position, indicating heterogeneous effects of technology usability and boom-and-bust cycles in disadvantaged and remote places. The third chapter, co-authored with Martina Miotto, investigates the long-term cultural consequences of colonial agricultural policies on gender norms in Africa. It shows that exposure to British colonial cash-crop production led to persistent changes in gender norms, increasing female empowerment among descendants of populations living in historically cash-crop-intensive districts.

Keywords

Long-run development; Economic history; Institutions; Persistence; Quasi-natural experiments

Abstrakt

Tato disertační práce empiricky zkoumá, jak je dlouhodobý ekonomický rozvoj utvářen historickými institucemi, technologickými změnami a společenskými normami. Ačkoliv se tyto síly obvykle vyvíjejí pomalu, jednorázové šoky a historické události mohou vyvolat náhlé změny, které umožňují studovat jejich účinky pomocí kvazi-přirozených experimentů a moderních ekonometrických metod. První kapitola se zaměřuje na vzestup a úpadek Řádu německých rytířů ve Východním Prusku mezi třináctým a šestnáctým stoletím. Analýza ukazuje, že ekonomický rozvoj v oblastech pod správou Řádu úzce souvisel s expanzí a kontrakcí jeho státní kapacity. Dále dokládá přetrvávající protržní instituce, silnější byrokratickou kapacitu a vyšší míru ekonomické integrace na územích Řádu ve srovnání se sousedními polskými oblastmi. Kapitola rovněž dokumentuje trvalé protržní institucionální uspořádání a vyšší ekonomickou integraci. Druhá kapitola, jejímž spoluautorem je Christian Ochsner, se zabývá ekonomickými dopady šoků v dopravních technologiích. Využívá nečekané zrušení zákazu automobilů ve švýcarském kantonu Graubünden v roce 1925. Výsledky ukazují okamžitý nárůst registrací firem a ekonomické aktivity v Graubündenu ve srovnání se sousedními regiony, kde žádný zákaz neplatil. Pozitivní ekonomické efekty jsou výraznější a udržitelnější v místech s lepší výchozí pozicí, což naznačuje heterogenní účinky využitelnosti technologií a cykly rozmachu a propadu ve znevýhodněných a odlehlých oblastech. Třetí kapitola, jejímž spoluautorkou je Martina Miotto, zkoumá dlouhodobé kulturní důsledky koloniálních zemědělských politik na genderové normy v Africe. Ukazuje, že vystavení britské koloniální produkci tržních plodin vedlo k trvalým změnám genderových norem a posílilo postavení žen mezi potomky obyvatel žijících v okresech historicky intenzivně pěstujících tržní plodiny.

Klíčová slova

Dlouhodobý ekonomický rozvoj; Hospodářské dějiny; Instituce; Perzistence; Kvazi-přirozené experimenty

Declaration

1. I hereby declare that I have compiled this thesis using the listed literature and resources only.
2. I hereby declare that my thesis has not been used to gain any other academic title.
3. I fully agree to my work being used for study and scientific purposes.

In Prague on
23/06/2026

Flavio Malnati

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To all wanderers in search of fortune and adventures—be they knights, merchants, women, or... motorists.

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Introduction

The common saying "Rome was not built in a day" reminds us that economic development in complex societies emerges through the gradual accumulation of long-run forces unfolding over time. Institutions, technology, culture, norms, and the state evolve slowly, often over centuries, and shape outcomes across generations. Assessing and measuring their effects is challenging as their origins lie in the distant past, they are rarely subject to direct policy intervention, and available data are often incomplete or lost. This raises a central question: how can their impact be identified when change is slow, variation limited, and origins blurred by time? These three chapters take a first step in showing how modern econometric methods, combined with quasi-natural experiments, can be used to study the economic impact of long-run factors in specific historical contexts. While long-run factors usually evolve gradually, shocks or historical events can disrupt this trajectory and produce rapid transformations. The empirical analyses in this thesis relies on diverse historical sources, including archival documents, records of historical buildings, and digitized maps, which are consolidated into new datasets. In this way, historical episodes and systematic data provide opportunities to examine the mechanisms through which long-run forces operate and to assess their economic and social effects.

The first chapter studies the influence of a pre-modern state on economic development, leveraging the historical case of the Teutonic Order state in Prussia. Robust empirical evidence shows that modern states foster economic development by establishing and exercising control over military, bureaucratic, and taxation systems. By contrast, the role of pre-modern states remains largely underexplored. In these contexts, rulers typically shared military power with elites and relied on personal resources, rather than exercising centralized institutional control. To examine how early states can foster economic development, I focus on the rise and fall of the Teutonic Order in Prussia. Established to coordinate crusader campaigns, the Teutonic Order state offers a natural experimental setting to compare centralized governance under a unified elite authority with the fragmented rule of neighboring Polish territories. This centralized structure reflected greater capacity for collective action and public goods provision, though primarily directed toward military action and mobilizing resources for the crusades.

I use a regression discontinuity design at the borders of the Teutonic Order state in Prussia to compare development trajectories with neighboring Polish principalities, measuring economic outcomes through the number of buildings and town charters per century. My findings indicate that pre-modern states can drive economic development, and I further show that such development was closely tied to the persistence of the pre-modern state: once the Teutonic Order collapsed following military defeat, the difference in development compared to the Polish territories ceased to exist. Additionally, I show that the former presence of a pre-modern state is associated with a higher capacity of the Teutonic Order state for revenue collection, official oversight, and market facilitation. Finally, my analysis reveals that the economic effect of pro-market institutions, once established under the ruler's influence, persists even after the state's dissolution. These results suggest that while pre-modern state structures alone do not guarantee long-term development, the promotion of pro-market

institutions plays a crucial role in ensuring economic persistence beyond a state-collapse scenario.

The second chapter investigates how a shift in access to transportation technology affects regional economic activity. Innovations in transportation have transformative social and economic effects, but their economic consequences depend on how agents respond to them and how they reshape the spatial distribution of economic activity. The automobile, in particular, represents one of the most emblematic transportation innovations of the twentieth century. By diffusing across all layers of society, it radically expanded the space available to both firms and individuals. Identifying the economic impact of the car, however, is challenging. Its effects are difficult to trace over time (whether they lead to sustained growth or to a temporary boom-and-bust cycle) and across space (whether benefits are evenly distributed or concentrated geographically). The Canton of Grisons in Switzerland offers a unique setting to study these questions. The canton maintained a strict ban on automobiles from 1901 to 1925, strongly opposing the social and economic changes associated with motorization. Unexpectedly, in 1925, a popular vote lifted the ban, which abruptly changed the accessibility of places in Grisons from, broadly speaking, one day to the next.

Focusing on the 1920–1930 period, this chapter exploits this policy change as a natural experiment. Using the event-study and difference-in-differences designs, the chapter compares economic activity in Grisons' municipalities with that of neighboring municipalities that were never subject to the ban, before and after 1925. Economic activity is measured through firm registrations, firm closures, firm survivals, and municipal taxable income. The results show a sharp increase in firm registration in Grisons during the first two years after the end of the automobile ban, driven primarily by manufacturing and retail, followed by a slowdown in 1927–1928 and a weaker recovery thereafter. The initial expansion of economic activity is broadly distributed across municipalities. However, long-run sustainable economic effects measured as firm survival and local taxable income are concentrated in larger and railway-connected municipalities. These findings indicate that transportation technology acts as a catalyst for economic activity, but its long-run impact depends on local conditions and pre-existing infrastructure. The automobile initially encouraged widespread entry, as entrepreneurs responded to new opportunities and expectations of rising demand. Over time, however, market selection favored locations with better connectivity and scale advantages. As a result, the introduction of the automobile generated short-run entrepreneurial expansion but more persistent gains in already-better-connected areas, suggesting a process of learning and adjustment rather than uniform development. At the same time, disadvantaged places face a kind of boom-and-bust cycle, driven by some over-optimistic perceptions of the new technology that never really materialized.

The second chapter is coauthored with Christian Ochsner. He provided the research idea and guidance on the general framework, coordinated the project, and personally supervised the provision of the primary archival sources and the data collection. I contributed to data collection and digitization, and I was fully responsible for consolidating, merging, cleaning, and reclassifying the data to construct the final dataset. The main analysis, robustness checks, and mechanism explorations were conducted jointly, including the choice of final specifications. With the exception of the introduction, I prepared the initial draft, while Christian played a strategic role in supervision, revision, and proofreading. The introduction

was written jointly.

The third chapter analyzes how the introduction of market-oriented production disrupted traditional divisions of labor and gender norms, shaping women's empowerment. Specifically, it examines how the spread and intensity of cash-crop cultivation influenced the empowerment of present-day women. Cash crops, including cocoa, coffee, copra, cotton, groundnuts, and palm oil, were primarily grown for export, in contrast to food crops, which were oriented toward subsistence production. In the empirical setting, cash crops were introduced primarily by British colonizers in Africa. Their introduction represented more than just a shift in agricultural production: it marked the expansion of a cash- and market-based economy over traditional subsistence systems and, with it, the redefinition of gender roles and labor division in agriculture and in society more broadly. Historical literature highlights how cash crop production marginalized women, confining them to domestic and subsistence farming activities, while men assumed control over cash crops as colonial officials recognized them as producers and primary taxpayers in a cash-based system. At the same time, the higher productivity of cash crops and the fiscal demands of British rule increased women's involvement in both domestic and agricultural labor, as men increasingly relied on their contribution. This shift in labor dynamics opens the possibility for a different interpretation: according to recent economic literature, greater women's involvement in productive activities can enhance their bargaining power within the household and, over time, foster empowerment.

The research tests which effect prevails in the long run by linking historical cash crop intensity in colonial districts to the empowerment of present-day women from those areas. Demographic and Health Survey data are used to construct two measures of subjective and self-perceived empowerment: a beating-free index, which captures women's rejection of partner violence, and a decision index, which reflects decision-making power within the household and society. To assess causality, cash-crop production is instrumented with measures of crop suitability based on Food and Agriculture Organization of the United Nations (FAO) land-suitability data. The results show a positive relationship between historical cash-crop intensity and women's empowerment. Moreover, the effect of cash-crop cultivation in colonial districts persists regardless of present-day economic and social conditions and is transmitted intergenerationally through norms rooted in ethnic groups and local communities. The effects are stronger in areas where labor was already male dominated prior to colonization. The analysis further shows that the results are driven by cocoa and palm oil cultivation, cash crops that historically required women's involvement in the production chain. These findings suggest that colonial institutions, by promoting a shift toward cash- and market-oriented agriculture, interacted with pre-existing economic structures and gender roles, leading to persistent changes in gender norms and women's empowerment.

The third chapter is coauthored with Martina Miotto. While the project originated from her job market paper, I contributed to refining the research question in light of recent economic literature. In terms of data collection, I was responsible for spatial analysis and Geographic Information System (GIS) work: digitizing colonial districts from historical maps, aggregating cash crops at the district level, and linking districts and ethnic groups to spatially defined variables such as distance to rivers, coastline, railways, and population density. Martina constructed the variables from the Demographic and Health Surveys (DHS) Program, including the two main outcome measures. Under her supervision, I conducted

multiple rounds of regression analysis. The baseline specification was defined jointly, and I carried out the robustness checks. I also analyzed the main mechanisms, focusing in particular on the interaction between cash crops and pre-colonial gendered labor divisions based on hoe-culture. Finally, I drafted the chapter, which Martina supervised and revised.

In these three chapters, the analysis focuses on how state institutions, technological change, and norms, as three representative long-run factors, shape society and the economy. Their impact can be studied and quantified over different time horizons (centuries, decades, and years) and across multiple spatial levels (international, national, regional, and local) using quasi-natural experiments. Each chapter examines these forces in contexts where industrial development was limited and economic activity remained largely agrarian: the pre-modern Teutonic Order state, the lifting of the car ban in Grisons, and the spread of cash crops in the British colonies. The evidence shows that their effects did not arise solely from industrialization but rather accompanied and fostered it over a long and gradual process of development.

Chapter 1

Pre-Modern States and Economic Development

Evidence from Teutonic Order Prussia

1.1 Introduction

"War made the state, and the state made war" (Tilly, 1975, pg 42), but do war and state create economic development? The centralization of military power under a single ruling elite is fundamental to state building and its core functions of defense and security, but it remains uncertain whether a state defined solely by this centralization process can drive economic development. Recent literature that examines the relationship between military conflicts and power, state, and economic development, focuses on contemporary states (Gross and Sampa, 2023; Juhász et al., 2024) or on pre-industrial and weak states (Allen et al., 2023; Dincecco, 2023; Ali and Fjeldstad, 2023; Garras and Sellars, 2024; Acemoglu et al., 2020; Sánchez de la Sierra, 2020; Paik and Vechbanyongratana, 2019; Dell et al., 2018; Besley and Persson, 2010). Despite these contributions, the direction of causality, the timing, and specific conditions under which states begin to influence economic development remain subjects of debate. In particular, these studies struggle to isolate the impact of military centralization from other factors typical of modern states, such as bureaucracy, professional armies, fiscal capacity, representative institutions, and urban self-governance. As a result, it is unclear whether military centralization by itself is able to drive economic development, or if additional factors are also necessary.

In this paper, I employ an arguably exogenous need for military coordination before the rise of the modern state to investigate how pre-modern states with centralized military power are able to foster early economic development. The Teutonic Order, a militaristic religious society, coordinated crusading activities in Prussia between the 13th and 16th centuries. The Teutonic Order achieved a markedly higher degree of centralization in their territory than other polities in the region and, more broadly, other European monarchies, as they held all rights and authority over the land (Tilly, 1990; Sarnowsky, 1993; Czaja and Radziminski, 2016). They achieved this while operating within the same feudal framework as their neighbors, namely the "segmentary state" model, in which the king was "also the biggest landowner and the main military commander" and local functionaries exercised authority through personal patronage rather than formal institutions (Heldring, 2025, pg. 80). In 1230, Polish lords[1], the Pope, and the Holy Roman Emperor[2] granted the Teutonic Order an exceptional mandate over Prussia with the task of coordinating crusade efforts and consolidating control over the region, as its borders were contested by Polish settlers and Prussian pagan tribes. I use this unique setting over a time-span of 600 years - from the 12th to the 17th century - to compare economic development in this Teutonic Order state with surrounding Polish territories, where power was fragmented among multiple elites.

I use the 13th-century border of Prussia as a cutoff in a sharp regression discontinuity design (RDD), repeated over the period of analysis, to establish a causal interpretation of the results.

[1]From 1138, the Kingdom of Poland was fragmented into various autonomous entities or principalities. It was not until the early 14th century that the kingdom was unified again into a single kingdom (Davies, 2005).

[2]During these centuries, the Pope and the Holy Roman Emperor represented the two universal authorities in Catholic Christendom - the Pope as the supreme religious leader and the Emperor as the temporal authority. The Holy Roman Empire, centered in what is now Germany, included territories that are now part of several other countries, including the Czech Republic, Austria, the Netherlands, Belgium, Italy, and France. It was a key political, military, and religious neighbor to medieval Poland.

This design addresses the possibility that unobservable factors may have influenced territory selection by the Order or by Polish lords, arising from latent differences in suitability for economic development between the Order's state and Polish territories. The 13th-century East-Prussian border historically represented the limit of the Order's mandate from the Emperor and the Pope, and legitimized its military actions. I demonstrate that key drivers of economic development - including land suitability, trade access, geography, and pre-13th-century development - are balanced across the Teutonic Order and Polish territories' borders. This evidence aligns with historical literature suggesting that East Prussian borders were frequently contested between Polish settlers and Prussians, resulting in a lack of clear-cut boundaries. Thus, prior to the Order's arrival, there was likely little distinction in terms of ethnicity, demographics, or development in the region.

I use the number of public buildings and town charters, aggregated into 20x20 kilometer grids across modern Poland as proxies for early development following the rise and fall of the Teutonic Order. Public buildings and town charters represent public-capital accumulation and the dissemination of pro-market institutions, respectively, serving as indirect proxies for two facets of state capacity associated with economic development; revenue collection and support for the markets (Besley and Persson, 2010). The data on historical public buildings was compiled and classified by the Polish Ministry of Heritage (Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage], 2020b) and includes a broad range of structures, including castles, churches, walls, cemeteries, and mills, as well as civil buildings like squares, town halls, and historic city centers. In line with Cantoni et al. (2020), and Cantoni et al. (2024), these structures represent public-capital formation. I construct a dataset of town charters by combining sources from Najgrakowski (2009), Cantoni et al. (2018), and the IHPAN dataset (IHPAN, 2021). Town charters were legal documents granted by local lords to establish towns, and conferred political and economic freedoms on their inhabitants. As in Dittmar and Meisenzahl (2020), and Doucette (2026), town charters reflect the ruler's capacity to promote urban and economic institutions and to grant autonomy to urban centers and economic elites.

I find positive and significant effects for both public-capital accumulation and the dissemination of pro-market institutions. The territories in the Teutonic Order's Prussia were associated with an average increase in the number of new public buildings and town charters during the 14th century of approximately 0.3 and 0.4 standard deviations respectively, compared to the surrounding Polish territories. Additionally, I exploit the collapse of the Order at the beginning of the 15th century to test whether the effects persist across the borders after the Order lost dominance in East Prussia. The coefficient loses significance from the 15th century as the Order experienced military defeats. This evidence supports the idea that state capacity and economic development persist only so long as the concentration of military power in the hands of the Order remains intact. Furthermore, the weakening of the effects provides evidence that the outcomes observed should be attributed solely to the Teutonic Order's state. Finally, the results are robust to different bandwidths (optimal bandwidth, 30 km, 50 km, 100 km), and applying a staggered event study design, and a spatial regression discontinuity design (RDD).

A key challenge is that my results may be biased in two main ways. First, buildings may not accurately reflect economic development, as they may express specific interests of the religious

and military ruling elites but not necessarily indicate civil economic advancement. Second, there could be a survival bias favoring certain types of public buildings, selected based on aesthetic or cultural criteria rather than economic significance. This bias also arises as I employ a dataset compiled by the Polish Ministry of Heritage, which focuses on historical importance and modern-day preservation. To address these issues, I reclassified buildings by civil, religious, or military function. Additionally, I used population and urbanization estimates from the HYDE 3.2 database (Klein Goldewijk et al., 2017) as proxies for demographic and urban development by century to provide a measure of development that is less dependent upon survival bias or selection by particular agents, including the Ministry of Heritage. The analysis shows that civil buildings are the main driver of the results, with an average increase in the numbers of new public buildings in the 14th century of 0.26 standard deviations within the Order's territories as compared to Polish territories. However, after the Order's collapse in the 16th and 17th centuries, the difference in the numbers of civil buildings becomes insignificant, mirroring the decline in overall building activity. This evidence supports the hypothesis that within extractive institutional environments, a pre-modern state with centralized military power is more effective at stimulating public capital for civil and economic functions. These findings are reinforced by the higher urbanization rate in Prussia compared to the Polish territories, which persisted even after the fall of the Order.

I explore whether economic development was linked to the capacity of a military-centralized state to raise revenues, control officials, and support markets. I collect data on land holdings of the rulers (the Order and the Crown of Poland) and length of service and turnover of officials (commanders and castellans) in each of their provinces as indicators of fiscal and bureaucratic capacity. Additionally, I collect information about major communication routes to compare market integration between the Order and Polish territories. I find that land ownership by rulers was greater in the Order's domain, and is associated with revenue capacity, as land was the primary productive asset in a feudal economy. Consistent with these results, historical accounts describe the Order's tight control over the state and its resources, even within a patrimonial framework where the roles of landlords and rulers overlapped (Czaja and Radziminski, 2016; Sarnowsky, 1993; Arnold, 1989). Analysis of officials' length of service reveals a higher turnover in the Order's state than in the Polish Kingdom. This finding provides evidence of stronger centralized control by the Order over its bureaucracy, consistent with historical literature (Czaja and Radziminski, 2016; Pluskowski, 2024).

Moreover, I find significant and positive effects of the interaction between the Teutonic Order's state and communication routes over the numbers of public buildings. This evidence suggests greater economic integration in the Order's territory, and is also consistent with the Order's capacity to mobilize men and resources for military campaigns. Finally, I use town charters as an additional treatment to separate the effects of pro-market institutional dissemination from those of pre-modern state on economic development. Military power initially drives the results, but its effect diminishes after the Order's military defeats in the 15th century, while the institutional effects persist and even strengthen. This suggests that, while coercion alone is insufficient to sustain economic development, long-run growth requires pro-market institutions that foster autonomy for economic actors.

My paper primarily speaks to the literature investigating the relationship between states and early economic development. Heldring (2025) surveys the literature and identifies divisions

between a co-operative demand side and an extractive, supply-side approach. The demand side highlights the public good nature of a state, suggesting a single provider or coordination among providers (Allen et al., 2023; Blaydes and Chaney, 2013; Dell et al., 2018). Conversely, the supply side focuses on the extractive character of a state and the danger that ruling elites will capture public interest and extract resources for their own specific interests (Schönholzer and Francois, 2023; Mayshar et al., 2022; Sánchez de la Sierra, 2020; Olsson and Mayoral, 2019; Oto-Peralías and Romero-Ávila, 2017). Both streams of literature employ the 'Military Revolution' as a key turning point in the passage from a feudal to a modern state. Goldstein and Magiya (2024), Cox et al. (2025), Mangini and Petroff (2022), Gennaioli and Voth (2011), and Besley and Persson (2010) highlight the negative or positive effects of military power concentration or economic decentralization, without separating the two factors. My paper offers a setting prior to the 'military revolution' to explain how centralization of military power alone can foster early economic development. Furthermore, while part of the literature explores how development shapes the state (Allen et al., 2023; Cox et al., 2025; Dincecco and Katz, 2016) I provide evidence, through a natural experiment, that the relationship also works in the opposite direction. Thus, I show that the state can foster early economic development.

My paper also contributes to the literature on state capacity, specifically on how the state actively shapes society and the economy (Dincecco, 2023; Gross and Sampa, 2023; Juhász et al., 2024; Besley and Persson, 2010). Several papers link state capacity to the ability to extract fiscal resources (Cantoni et al., 2024; Dincecco and Katz, 2016), gather information from the society (Suryanarayan and White, 2021; Sánchez-Talanquer, 2020; Brambor et al., 2020; D'Arcy and Nistotskaya, 2017; Lee and Zhang, 2017), and act effectively through a bureaucratic apparatus (Suryanarayan, 2021; Garfias, 2018; Rogowski, 2018; Acemoglu et al., 2016). While the majority of studies require the existence of a bureaucratic modern state or a contemporary welfare state, my paper focuses on the feudal state, a minimal entity in which power, primarily military, was fragmented among various elites. In this context, I trace the original source of state capacity to the ruler's military control over the territories and other, competing, military elites.

Finally, the results of this study are in line with the "Little Divergence" literature, which defines and investigates the drivers of early economic development in Europe and the differential development between West and Center-East Europe during the late Middle Ages and the early Modern Age (Raster, 2019; Cantoni et al., 2018; Malinowski, 2016; Grosfeld and Zhuravskaya, 2015; Hornung, 2014; Voigtlander and Voth, 2013; Voigtländer and Voth, 2014). In my study, Prussia acts as an empirical setting positioned on the frontier between Western and Eastern Europe, and exemplifies how a concentration of military power can drive early economic development. I identify the concentration of military power in West European feudal states compared to its absence in Central-East European states as a potential cause of divergence in development between the two regions.

After briefly introducing the historical setting in Section 1.2, I describe the relevant data and the regression discontinuity design of the main empirical model in Sections 1.3 and 1.4, respectively. I also verify that the data support the assumptions required for the causal identification of the model. In Section 1.5 I exploit the expansion of the Teutonic Order in an RDD framework to show how the rise and fall of the Order's power influenced economic

development and, ultimately, state capacity in Prussia. Sections 1.6 and 1.7 explore state capacity as the main channel, along with alternative mechanisms that link the pre-modern state to economic development and account for the persistence of its effects during and after the collapse of the Order. Section 1.8 concludes.

1.2 Historical Background

In this section, I outline the history of Teutonic Order Prussia, highlighting the unique character of the Prussian crusades and the institutional structure of the Teutonic Order's state, especially in contrast to other feudal entities in the region. I also summarize the chronological evolution of the Order's presence in Prussia, describing the rise of its state, its territorial expansion, and eventually its decline and fall, which began in the 15th century. This historical timeline offers suggestive evidence that the Order's intervention and the choice of East Prussia as the site of its state were driven by external military contingencies beyond its control.

1.2.1 The Teutonic Order and its State in Prussia

The Teutonic Order was a monastic military order created in the Holy Land in 1191 during the Holy Land Crusades.[3] Its members were characterized by Germanic ethnic ties and connections with the Holy Roman Empire. The monastic rule and the statute were modeled on the Templar and Hospitaller knights and, in general, the preaching of Bernard of Clairvaux about the ideal of knighthood. Although it is not easy to have a complete picture of the Order's effective membership, the majority belonged to the *Ministeriales* class ("knights-servants" at the service of another nobleman) and, from the 14th century, to the *Wohlgeboren* (low Germanic nobility). Their vows included "chastity, renunciation of property, and obedience to God and the Blessed Virgin Mary" (Perlbach, 1890, pg 127). The experience and limits of the previous waves of Crusaders in Prussia influenced the Teutonic Order. Therefore, the Order was not necessarily tied to a general idea of knighthood and a temporary Crusade but rather to a specific and more permanent commitment to a mission and mandate in a specific region, which continued after a specific Crusade (Christiansen, 1980; Czaja and Radziminski, 2016; Querengasser, 2021).

Multiple historical reasons contribute to the fact that the Teutonic-Order organization and state had higher centralization of military power than its neighboring territories. First, the campaign of the Teutonic Order in Prussia also assumed the character of armed colonization that, contrary to other military expeditions in the area, was driven by a well-organized and systematic elite movement from Western Europe. In 1231, just seven knights of the Order, supported by knights supplied by Konrad of Mazovia, founded a temporary stronghold in Thorn/Torun (Czaja and Radziminski, 2016). Since then, a restricted number of Teutonic-

[3]The Holy Land Crusades and the Northern Crusades are different historical episodes. The Holy Land Crusades (1096-1270) refer to the Crusades to reconquer the Holy Lands from the Seljuk Empire and from the Arabs. The Northern Crusades (1147-1410) refer to the expeditions against the pagan population living on the east side of Elbe river, or more generally in North-Eastern Europe (Christiansen, 1980).

Order knights (700 in Prussia during the 14th century, 300 in 1453) led regular raids on the periphery of East Prussia. The Order recruited European nobility in order to support and participate in these raids twice a year, alternating the summertime "building raids" and the wintertime "devastation raids" (Querengasser, 2021). The practice of calling on the nobility was named *"Preußenreisen"* and established precise and consolidated itineraries from Western Europe to Prussia (Paravicini, 1989), initially for military men, then for pilgrims, merchants and settlers moving to Prussia.

Parallel to the summertime raids, the Order extended its zone of influence by building new fortifications, initially in timber and later in brick (Querengasser, 2021). At the institutional level, the Teutonic Order supported the colonization and movement of German settlers, and merchants, who adopted the most modern contemporary legal and administrative institutions, including the knight service, authority over ecclesiastical institutions and systems of chartering settlements and founding towns (Czaja and Radziminski, 2016). Following the example of several towns within the Holy Roman Empire, the Teutonic Order adopted the Magdeburg Law, or Magdeburg Rights, as a model for municipal charters in its territories.[4] The Magdeburg Rights served as a foundational legal framework for towns, establishing them as distinct and autonomous entities within the broader feudal landscape. These rights conferred extensive privileges on townspeople, including economic, political, and judicial autonomy, and marked a clear legal and administrative separation between urban settlements and the surrounding countryside dominated by the feudal law. Furthermore, town privileges were grounded in the well-established body of rights, customs, and judicial rulings derived from German-Saxon law. This legal tradition was enforced through a hierarchy of municipal courts, with the High Court of Magdeburg serving as the supreme appellate authority. In the specific case of the Teutonic Order, however, this function was assumed by the court in Kulm/Chełmno, under the locally adapted Kulm Law(Harreld, 2015; Czaja and Radziminski, 2016; Lück, 2018). Finally, during the Northern Crusades, the Teutonic Order's state in Prussia was characterized by a strong ideological and religious framework. Religion, in the context of a Crusade, served to legitimize the actions of the Teutonic Order both internally and externally, even after its complete conquest of East Prussia (Querengasser, 2021; Czaja and Radziminski, 2016).

1.2.2 East Prussia and the Teutonic Order

At the beginning of the 13th century, the region of modern day Poland was the frontier of Western Europe and Catholic Christendom. The Vistula river divided the region between a christianized south-western region and a north-eastern region still inhabited by Pagan populations. East Prussia, immediately on the east side of the Vistula, was one of the last

[4]The Magdeburg Law was a family of municipal legal charters originating in the German city of Magdeburg, which was the first to adopt such a charter and provided a legislative model widely emulated by other towns in Central and Eastern Europe. In particular, the Teutonic Order adopted a specific variation of the Magdeburg Law named the "Kulm Law", from the name of Kulm/Chełmno city inside the Teutonic-Order state. The key distinction between the Magdeburg and Kulm Laws lay in their judicial hierarchy: under the former, the Magdeburg court served as the supreme appellate body, whereas under the latter, this role was assumed by the court in Kulm/Chełmno. This adaptation allowed for a localized yet still Germanic legal structure, granting legal autonomy while centralizing judicial authority within the Teutonic state itself.

regions to be converted. Figure 1.1 shows how the division between East Prussia and the rest of Poland already existed before the 13th century and reflected a political division. Except for Chełmno Land, Prussian territory was divided among several pagan tribes of Baltic ethnicity and culture. Conversely, the west side of the Vistula and Mazovia on the south-eastern side was divided into political entities that derived from the fragmentation of the Polish Kingdom in the 12th century. Since the 10th century, the borders between Prussian tribes and Polish Principalities, often loosely defined, had been a subject of ongoing dispute, particularly regarding control over Chełmno Land.

Prussian tribes and Polish Principalities had disputed the borders, often loosely defined, and for supremacy over Chełmno Land (Christiansen, 1980; Urban, 2003).

[Figure 1.1 about here]

At the beginning of the 13th century, the fight between Prussian tribes and Polish Principalities increased in intensity and was framed within the more general phenomenon of the Northern Crusades, a series of military expeditions to convert the Pagan tribes living in Prussia and the Baltic Region. The campaigns saw the direct and indirect participation of a broader range of actors, including the Pope, the Holy Roman Empire and, in general, the participation of Germanic-origin crusaders. However, the crusaders were more undisciplined than professional warriors, who would be capable of settling a permanent garrison during the winter (Christiansen, 1980), and their expeditions resulted in temporary raids that were inefficient for conquering and converting the Prussians.

In 1226, the Duke of Mazovia invited the Teutonic Order to fight the East Prussian tribes. This appeal came after an unsuccessful campaign against these tribes, culminating in a raid on the capital of Mazovia by the East Prussians. The Duke gave the Teutonic Order Kulm/Chełmno and several small estates (Czaja and Radziminski, 2016). The 1235 Golden Bull from Emperor Friederik II and a Protection Bull from Pope Gregory IX in 1234 granted a formal mandate for the presence of the Order in Prussia. The temporary coincidence of the two spiritual and temporal authorities in providing a mandate to the Order was not common; it was the product of the diplomatic ability of the Grand Master, and was certainly not anticipated by the Polish Principalities. In 1295, with the end of the last Prussian Uprising, the Order concluded and consolidated its conquest of East Prussia.

There is no clear historical evidence about the real intention of the Duke of Mazovia. However, it is difficult to imagine he would have anticipated a relatively rapid takeover of East Prussia by the Order, nor the rise of a competing and powerful military state entity on the borders of Mazovia. In 1308, the Order conquered Gdansk on the west side of the Vistula. The takeover of Gdansk inaugurated a new phase of the Teutonic Order, characterized by a more aggressive stance against its neighbors, including the pagan Duchy of Lithuania, but also Christian Polish Principalities and, later, the Kingdom of Poland. The 14th century represented the peak for the Teutonic Order in political and administrative terms.[5] Ultimately, the Battle of

[5]Nevertheless, several setbacks perhaps anticipated the defeats in the following centuries: the war against Poland (1326–1332), a Christian kingdom, contributed to partially delegitimizing the Order's mission. The strategic victory of Polish troops in the Battle of Płowce in 1331 blocked the advancement of the Order in Kuyavia, and was a setback to the Teutonic Order's expansion in Poland. It also contributed to stabilizing

Grunwald (1410) and the Thirteen Years' War (1454-1466) not only determined significant territorial losses for the Order (including Chełmno land), but also the institutional, economic, and political collapse of the Order's state in Prussia. In 1525, the Grand Master gave up his title to become the duke of Prussia, secularizing the remaining territories of the Order in Prussia under the formal authority of the King of Poland.

1.3 Data

The dataset used in my analysis combines historical and administrative sources, including records on public buildings and town charters as proxies for economic development, along with information on the expansion of the Teutonic Order's state to trace the formation of a pre-modern state. The analysis is further complemented with data on land quality, crop suitability, market access, and indicators of economic and social development prior to the Order's arrival. Additional information on fiscal revenues and administrative capacity is also incorporated for both the Order's state and the neighboring Polish territories.

1.3.1 Data Sources

I introduce a novel dataset accounting for the flow and stock number of new buildings constructed in Medieval Poland during each century analyzed, from the 11th to 17th centuries. The number of buildings measure development, specifically public-capital formation as in Besley and Persson (2010); Cantoni et al. (2018). As a primary source, I employ the "Immovable Buildings" dataset collected by the Polish National Institute of Cultural Heritage (Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage], 2020b). The dataset includes 71,470 observations, for constructions or buildings of historical importance for the government of Poland. It classifies each observation by spatial position and social function and covers 10 centuries, from the 11th to 20th centuries. I restrict the period of analysis to the 11th to 17th centuries. Furthermore, I reclassify the building categories in the dataset into six macro categories (religious, military, civil, cultural, and palace/mansion). As in Figure 1.2, I aggregate the observation into a 20x20km grid. At the time of the conquest of Prussia, no common administrative division existed between the Teutonic-Order state and its neighboring territories. Thus, I choose a 20×20 km grid to approximate the spatial scale of an "opole", the smallest administrative unit of the medieval Kingdom of Poland, grouping several settlements with common legal responsibilities (Bardach et al., 1987). The "opole" began to disappear in the 13th–15th centuries with the spread of Magdeburg rights, making it the most appropriate spatial unit in the absence of a common administrative boundary applicable to both sides of the studied border.

I measure the Magdeburg-Law spread as a particular type of town charter based on Saxon-German Law, which granted townsmen (originally German merchants and settlers) specific economic, political, and institutional freedoms (Lück, 2018). As the spread of the Magdeburg

the borders in East Prussia on the Vistula and Chełmno Land territory. Furthermore, after the conversion of Lithuanians to Christianity in 1387, in 1403–1404 Pope Boniface VIII stopped "the Litauenreisen," the campaign against Lithuania (Querengasser, 2021; Paravicini, 1989).

Law is linked to the spread of German settlers and German institutions it provides a good measure of the spread of settlers and merchants from the Holy Roman Empire within the more general diffusion of urban institutions and autonomy. I rely on two primary sources to study the propagation of Magdeburg Law: the Deutsches Städtebuch, edited by Erich Keyser and digitized by Cantoni et al. (2020), and the Magdeburg-Law database, collected and managed by the Zentrum Für Mittelalterausstellungen Am Kulturhistorischen Museum Magdeburg [Center for Medieval Exhibitions at the Cultural History Museum in Magdeburg] (2020). The two sources collect the cities that adopted a town charter according to the Magdeburg Law or another law deriving from the Magdeburg Law (Lübeck or Kulm/Chełmno Law) with information about the year of adoption and the type of town charter. For the historical buildings, I geolocate the observations in both datasets, and aggregate them in a 20x20km grid (Figure 1.3).

[Figures 1.2 and 1.3 about here]

I use historical atlases and books as the primary sources to identify the geographical and historical variation of the Teutonic-Order state. For the territory within the Teutonic-Order state, I mainly rely on the seminal work of Christiansen (1980), and on the specialized publications by Pluskowski (2012), and Czaja and Radziminski (2016). For Poland, I employ Olczak et al. (2006) to draw the border of the Piast Poland in the 10th and 11th centuries, the fragmentation of the realm from the 12th to 14th centuries, and for the reunified Kingdom of Poland in the 14th and 15th centuries. From the 16th century, I mainly rely on the IHPAN (2021) digitization project of the Kingdom of Poland's borders.

At the level of the mechanisms, I collected and digitized administrative information about the Teutonic Order's Prussia and the Polish Principalities and Kingdom. As in Figure 1.4, I collected data on land holdings of both the Order and the Polish King in the 14th century as a proxy of the ruler's revenues, combining Sarnowsky (1993) for the Teutonic Order state and IHPAN (2021) for the Kingdom of Poland. Given the heterogeneity of financial sources available to feudal rulers and the differences in revenue collection between the Teutonic Order and the Polish Crown, I focus on land ownership, as revenues from the ruler's estates were a central source of income in a feudal system. This is in line with the patrimonial nature of the state and the importance of agriculture as the primary economic sector during the Middle Ages. Furthermore, this source of income allows me to assess how intensive was the ruler control and the revenue-extraction power by administrative unit. Finally, I could also collect more precise information about land revenues. For the Order I have the account of yearly revenues from Sarnowsky (1993). Conversely, for the Polish Crown I have a rough estimation from Guzowski (2018), amounting to 15,000 golden marks. To measure the ruling elite's control over subordinates and resources (Figure 1.5), I employ sources from historical literature to assemble a dataset with the duration of service for each commander and castellan governing a province in the Order's state and in the Polish territories. In particular for the Teutonic Order commanders, I use Czaja and Radziminski (2016). For the castellans in the Polish Principalities and in the Kingdom of Poland, I digitized the information provided by the IHPAN (2014) serie "Urzędnicy dawnej rzeczypospolitej XII-XVIII wieku [Officials of the

former Republic of Poland 12th-18th centuries]".[6]

[Figures 1.4 and 1.5 about here]

For the potential confounding variables, I rely on several sources to encompass the majority of dimensions that can estimate the economic potential of East Prussia compared with its neighbouring territories. For land-suitability measures and the presence of Luvisol, I rely on the Global Agro-Ecological Zones version 4 (GAEZ v4) database created by the Food and Agriculture Organization of the United Nations and the International Institute for Applied Systems Analysis (Food and Agriculture Organization (FAO), and International Institute for Applied Systems Analysis (IIASA), 2021). Barley, rye, and wheat represent the land's suitability for agriculture, as their cultivation represented the leading economic sector in the Middle Ages. Luvisol is a type of earth with high clay content, making the ground particularly fertile. Combined with land suitability, it is an indicator for heavy plough suitability (Andersen et al., 2016). I use the Copernicus data for the navigable rivers (European Environment Agency (EEA), and Copernicus Land Monitoring Service, 2019b) and elevation and slope (European Environment Agency (EEA), and Copernicus Land Monitoring Service, 2019a), and Holterman et al. (2021)'s project for the street network, as it reconstructs the main communications network in the Holy Roman Empire, the Baltic, and Medieval Poland. The combination of river access, river distance, street access, and street distance represent the accessibility of main communications routes and are a proxy for suitability to trade. Similarly, slope and elevation could be obstacles to both trade and agriculture. To control for social and demographic development before the Teutonic Order's invasion, I use the archaeological dataset from the Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage] (2020a) as a proxy. The number of observations is 7,796, characterized by spatial position and time period (Prehistoric and Stone Ages, Bronze Age, Iron Age, and High Middle Ages). I separate the sites by period, and I aggregate the number of archaeological sites in a 20x20km grid. Thus, I can calculate the number of archaeological sites in a certain square from a certain time period, proxying the demographic and chronological evolution of a geographical area.[7]

[6]There was no uniform administrative division between Polish and Teutonic Order territories, as reflected by their differing territorial structures. Therefore, I selected the smallest territorial division for which data was available. While Prussia was divided into commanderies, ruled by commanders, the Polish territories were organized into castellanies, governed by castellans. The Teutonic Order's commanders functioned as part of a quasi-bureaucratic organization, as their role involved ruling a well-defined administrative district. In contrast, castellans represented a more feudal form of governance, where they served as lords of castles on behalf of the king. However, the role of castellans also became increasingly bureaucratized over time (Gloger, 1900).

[7]Links. NID: https://mapy.zabytek.gov.pl/nid/; Davide Cantoni: http://davidecantoni.net/; Zentrum für Mittelalterausstellungen E. V.: https://magdeburg-law.com/; FAO-GAEZ: https://gaez.fao.org/; Instytut Historii PAN im. Tadeusza Manteuffla: https://atlasfontium.pl; European Environment Agency: https://www.eea.europa.eu/en; Viabundus: http://www.landesgeschichte.uni-goettingen.de/handelsstrassen/index.php

1.3.2 Descriptive Statistics

Table 1.1 summarizes the descriptive statistics for the main outcome variables that measure economic development. The main outcomes, measured at the level of a 20×20 km grid-square, include the total number of buildings, the number of civil buildings, religious buildings, military buildings, Magdeburg-Law towns, and towns built in the 12th century (Panel A), 13th century (Panel B), and 14th century (Panel C). The sample is restricted to observations within 50 km of the 13th-century borders. Columns (1) and (2 i.e., the constructions built in a given century (12th, 13th, and 14th centuries). I restrict the sample to 50 km from the 13th century borders, to have more homogeneity between the treatment and control groups. Tables A.1 to A.3 report the descriptive statistics, applying different distances (20 km, 100 km, 200 km) from the borders. A comparison of the 12th and following centuries shows a general increase in buildings in the regions in question, independently of their function. This evidence is in line with the general development of the area, starting from the 13th century. Similarly, there are no town charts for the 12th century as the German settlers' movements only began at the end of the century and were more extensive from the 13th century.

[Table 1.1 about here]

Table 1.2 summarizes the descriptive statistics for each possible confounding variable. I restrict the dataset to observations within 50 km of the 13th century border. In Appendix A, Tables A.4 - A.6 show the descriptive statistics for the possible confounding variables, adopting a different distance from the border (20 km, 100 km, 200 km). The region considered was highly suitable for barley, wheat, and rye.[8] The terrain is flat, and does not present relevant heights. This evidence aligns with the morphology of Northern Poland. The region also has good access to rivers and the major communication routes. As a consequence, the area is suitable for economic activity and supporting urban growth. Due to the irregular time period of each age, it is difficult to trace a demographic trend by examining the presence of archaeological sites. However, according to the archaeological evidence, the area began to be populated during the Iron Age, and does not show signs of demographic decline in the Middle Ages when compared to the Iron Age.

[Table 1.2 about here]

1.4 Regression Discontinuity Design

In this section, I discuss how economic development is linked to pre-modern state formation by analyzing the evolution of Teutonic-Order Prussia through a regression discontinuity design. I also outline the key assumptions underlying the empirical identification strategy and provide supporting evidence that these assumptions hold within the empirical setting.

[8]Following Andersen et al. (2016), I reclassify the suitability index as a dummy variable, where each point on the map is classified as 1 when its suitability index is classified as good or more ($SI > 55$). Then I average each point score within a given square unit.

1.4.1 Empirical Model

To identify the impact of the development of the Teutonic-Order state on economic development, I adopt regression discontinuity design (RD) as the main identification design, developed by Angrist and Pischke (2009), Imbens and Lemieux (2008), and Lee and Lemieux (2010). For the main empirical application of the RD to historical and geographical contexts, I follow Dell et al. (2018),Grosfeld and Zhuravskaya (2015), and Dell (2010). I consider the following empirical specification:

$$Y_s = \beta\, Teutonic\_Order_s + f(Distance\_border_s) + X'_s + \zeta_s + \epsilon_s \tag{1.1}$$

Y_s denotes an outcome variable measuring economic development. I use a 20x20km square of a grid covering all of Medieval Poland as the main unit of observation. For the main outcome, I use the stock and flow number of buildings, the number of town charters, and the number of town charters according to the Magdeburg Law in a 20x20km square during a century. I repeat the RDD model for each century, starting from the 11th, two centuries before the Teutonic Order's invasion, until the 17th,[9] to study the evolution of economic development over time. $Teutonic\_Order_s$ is an indicator function, equal to 1 when s is part of the 13th century Teutonic-Order territory, and 0 otherwise. $f(Distance\_border_s)$ is a non-linear polynomial, controlling for the distance in kilometers from the cut-off. For this specification, I use a second-order polynomial. Therefore, the 13th century borders represent the cut-off. $X'_{s,t}$ is a set of covariates. In particular, I control for the presence of Iron-Age and High Middle-Ages' archaeological sites as a proxy for socio-demographic development in the periods before the Crusades. I also control for the presence of Luvisol as a proxy of heavy-plough and agricultural suitability, and for elevation as a proxy for the Polish region's morphology. I also control for zone fixed effects, denoted by $\zeta_s$and shown in Figure B.3, which partition space into macro-regions along an east–west and a north–south axis, with an economic and historical interpretation. Along the east–west axis, economic development in medieval Poland declined with distance from the Holy Roman Empire, spreading from west to east. Along the north–south axis, distance from the sea and the direction of the Order's conquest justify the division of Prussian space into northern and southern regions.

I apply the optimal bandwidth for RDD proposed by Calonico et al. (2014) and Calonico et al. (2017) because, as compared to Imbens and Kalyanaraman (2012), this allows me to adjust the estimate and the confidence intervals for the small bias that remains at the optimal window, keeping inference reliable. I cluster the standard error by combining the territories of the Prussian tribes for East Prussia and the division in dioceses during the 11th century for the rest of Medieval Poland. This division represents the main level of variation for clustering. A consolidated religious and administrative division, prior to the Teutonic Order, between a Christian Poland, divided in dioceses, and a pagan East Prussia, divided in

[9]The choice of the 17th century is because this was the last century of the Duchy of Prussia. The secularization of Prussia led to the creation of the Duchy of Prussia, formally under the Kingdom of Poland. Progressively, the Duchy gained more independence and power in the area. In the 18th century, the ascension of the Duke as the king of Prussia opened a new phase of conquest in the region. However, by this century, the kingdom was a totally different entity, politically and institutionally. Thus, I conclude the analysis before the 17th century.

tribes, historically justifies this level of clustering. Furthermore, from a political perspective also, this division seems the most stable for territory and is robust to the main political changes in Medieval Poland before the Northern Crusades. In section 1.5.5, I verify the robustness of my results, applying the Conley HAC standard errors (Conley, 1999, 2010).

1.4.2 Main Assumptions

The main assumption behind the RD identification strategy is that the borders are set arbitrarily by the Teutonic Order and the Polish Principalities. Thus, potential confounding variables should be smooth at the border, which serves as the cut-off. Historical research supports the evidence that the stabilization of the border by the Teutonic-Order borders is, if not arbitrary, strictly exogenous to the economic motivations that can potentially affect the causal relationship between a pre-modern state and economic development. There was a division between pagan Prussian tribes living in East Prussia, and Polish Principalities in Mazovia and in Greater Poland. However, since the 10th century, Polish Principalities and Pagan tribes were contending the borders, with territories such as Chełmno Land colonized, if not controlled by, the Polish settlers and nobility. Furthermore, during the period of Teutonic-Order domination, the Order actively sought to expand its territories outside Prussia. Only the Battles of Płowce (1331) and the Grunwald (1410) brought an end to its expansion (Czaja and Radziminski, 2016; Urban, 2003; Christiansen, 1980). As a further check, I test the regression discontinuity in the centuries before (11th and 12th centuries) the Northern Crusades and the arrival of the Order and after the collapse of the Order following its military defeat (16th and 17th centuries).

[Figure 1.6 about here]

Table 1.2, column (3), assesses, through a series of t-tests, the balance between the treatment and control group to evaluate if the better economic suitability of East Prussia, compared to its neighboring territories, drove the border choice of the Teutonic Order. In Figure 1.6, I repeat the t-test to assess balance between the control and treatment groups, using residuals obtained by regressing the analysis dimension on the latitude and longitude of each grid square. This approach allows me to assess differences in economic suitability while controlling for fixed geographical position and associated unobservable factors.

Similarly, table A.7 tests if some potential co-determinants of the economic development show any discontinuity across the cut-off, using a RDD analogous to the main model. I categorize potential confounding variables into key economic dimensions that may influence or reflect development potential: social and demographic factors prior to the Order's arrival (presence of archaeological sites from the Stone Age, Prehistory, Bronze Age, Iron Age, and High Middle Ages); morphology (elevation, slope); land suitability (suitability for barley, rye, and wheat; presence of luvisol soils; interaction between luvisol and barley suitability); and accessibility to main communication routes (proximity to rivers and roads).

The t-tests and RDD reveal no systematic differences in all economic dimensions and controlling for latitude and longitude yields no significant results. The RDD indicates differences only in the presence of Luvisol - an indicator of heavy plough suitability, especially

when combined with barley suitability - and in the distribution of archaeological sites from Prehistory and the Iron Age. I follow the approach proposed by Grosfeld and Zhuravskaya (2015) to address a possible strategical selection of the border by the Teutonic Order according to economic potential. Thus, in my main specification, I control for wheat and barley suitability, river access, and the presence of archaeological sites during the Iron Age and High Middle Ages, which immediately preceded the Northern Crusades. I also control for Luvisol presence and for an interaction between Luvisol presence and wheat suitability as a measure of heavy-plough suitability, following Andersen et al. (2016).

1.5 Results

Through a regression discontinuity design, I show how the formation of a pre-modern state fosters economic development. Specifically, the establishment of the Teutonic Order state in Prussia led to an increase in economic development, from the 13th to the 15th centuries, as compared to neighboring Polish territories. I also provide evidence that the positive impact fades after the collapse of the Order's state following military defeats in the 15th century. Consequently, in the 16th and 17th centuries, the difference in economic development between Prussia and surrounding areas is no longer significant. Finally, I verify the robustness of these results. I control for regional fixed effects, geographic coordinates, land suitability, and pre-existing development. I also test alternative models, including an event study design and a spatial regression discontinuity design.

1.5.1 Flow Number of Buildings

I start by considering the number of buildings as the outcome of eq. 1.1, measuring public-capital formation in the area. Figure 1.7a plots and orders chronologically the coefficients and their coefficient interval of the RDD by each century (11th - 17th century). The evolution of the coefficients shows a hump-shaped behavior, which reflects the rise and fall of the Teutonic Order. Prior to the arrival of the Order in Prussia, the coefficients are non significant and close to 0. These results support the absence of a discontinuity between Prussia and its neighbouring territories prior to the Crusades. The coefficients are significant and positive during the three centuries of Teutonic-Order domination, peaking in the 14th and 15th centuries. However, in the 16th and 17th centuries, the RDD coefficients drop and lose significance, following the collapse of the Order. A significant increase in the standard error is already visible starting from the 15th century. Overall, these results show a case of anti-persistence after the Order's collapse, but they are consistent with the role of a pre-modern state as a driver of economic development.

[Figure 1.7 about here]

The action of the Teutonic Order state in mobilizing military elites for the military campaign, and men and resources to support the military conquest may explain the rise and fall of economic development responding to the military fortune of the Teutonic-Order state. The peak in economic development for the Order coincides with the centuries (13th to 15th

centuries) of highest internal power and external prestige for the Teutonic-Order state. The state of permanent crusade attracted men-at-arms from all Europe, but also settlers and merchants attracted by the opportunities offered by the Prussian frontier. Conversely, the collapse of the Teutonic Order determines at the same time the decline in economic performance and development in the Order's territories. The loss of the centralization of military power of the Order after the Battle of Grunwald, and the military defeat by another Christian power delegitimized its role in the eyes of European military elites. Furthermore, military and economic instability, already evident in the 15th century, had undermined the economic opportunities for merchants and settlers.

1.5.2 Stock Number of Buildings

So far, I have focused on the flow number of buildings in a century. However, as the buildings persist into the next century, the presence of buildings erected in the previous centuries can still affect future economic development cumulatively over time. This hypothesis is in line with economic theory because buildings as a proxy of public-capital formation and infrastructure can facilitate or stimulate further construction and investment. As a consequence, in Figure 1.7b, I use the stock number of buildings as the outcome and I compare the RDD coefficients across centuries to test the persistence of economic development in the following centuries. The specifications using the cumulative number of buildings per century show a trend similar to that with the flow number. Thus, a cumulative effect of past buildings on the next centuries' buildings is not visible.

The most relevant difference is that the coefficients in the 16th and 17th centuries remain positive and significant, as development accumulated from the 13th to 15th centuries still affects the stock in the following centuries. However, the coefficient growth decreases, starting from the 16th and 17th centuries, while the standard error increases, reflecting the trend in the flow number of buildings. The trend in the stock number of buildings also highlights that, after the collapse of the Order any convergence phenomenon from neighboring territories is absent, as the coefficients' growth remains positive: otherwise, the results would show a decreasing trend in the coefficients. This outcome means that the weakening of the Order's authority over the borders does not translate into an economic stimulus for the territories outside of the Order's state to catch up with its territories. Furthermore, these results provide evidence that the presence of the Teutonic Order did not play a negative role in the development of the neighbouring territories, either directly or indirectly.

1.5.3 Spread of Magdeburg Law and Town Charters

Next, I consider the spread of the town charters and the Magdeburg Law as a proxy of the development of urban institutions and the spread of German settlers in the area. The results in 1.7c and 1.7d show that the Teutonic Order played a role in the propagation of the town charters and Magdeburg Law, starting from the 13th century. Before the 13th century no data are available, confirming that the propagation of the town charters and Magdeburg Law started in Poland from the 13th century (Harreld, 2015; Czaja and Radziminski, 2016; Lück,

2018). Overall, the effects of the Order on these phenomena remain relatively weaker than for the buildings. For the town charters, the coefficients show a positive but weak growth over the period considered. For the Magdeburg law, the coefficients show a hump-shape trend, similar to the buildings, with a drop starting from the 15th century. It is also relevant to notice that the standard error increase is apparent from the 14th century. As I consider only the cumulated number of Magdeburg-Law towns, the convergence from the neighboring territories in catching up with adoption of the Magdeburg Law explains the drop in the coefficient in the 15th century.

These results highlight how the general effect of the Teutonic Order on urbanization and general diffusion of urban institutions is weak. Moreover, they show that the buildings and town charters' trend seems to be partially driven by different factors. There are multiple explanations for this evidence. First, the town charter was a more general phenomenon, also broadly applied by Polish Principalities within the general process of modernisation of the state and warfare. Second, as the Order was a centralized state, it was only interested in granting some degree of autonomy to towns when necessary. Furthermore, the Order, as the ruler, and the towns were often in competition, if not economically, and were politically antagonistic (Górski, 1977). This evidence is also in line with Bosshart and Dittmar (2021) who highlight how the towns on the east side of the Elbe river had limited bargaining power with the feudal lord to demand economic and political freedom. Regarding the Magdeburg-Law towns, the results are higher because its spread was connected to the movement of German settlers and merchants demanding to regulate the businesses in their communities according to the German-Saxon Law. Therefore, to attract German settlers, the Teutonic Order explicitly introduced the Magdeburg Law in all towns founded, to attract German settlers.

1.5.4 Heterogeneity

I further test my RDD by analyzing specific segments of the 13th-century borders, which differ in exogeneity and stability due to historical and geographical factors. As shown in Figure B.1, I divide these borders into two main segments: northern (green) and central-southern (blue). The central-southern borders are expected to be not only more stable but also more exogenous to the variables of interest. These borders remained largely constant, shaped by natural barriers like the Vistula River and the "Große Wildnis" (the Great Wilderness). However, Polish settlers had already begun colonizing parts of these areas, such as Kulmerland, before the arrival of the Teutonic Order. A distinct part of the central-southern segment is classified as natural borders (red), where the Vistula River defined and reinforced the boundary for two centuries (13th and 14th centuries). In contrast, the northern borders, also defined by the Vistula in the 13th century, ceased to exist in the 14th century when the Teutonic Order conquered Gdansk and began colonizing the western banks of the Vistula. Thus, I expect that discontinuities will be more pronounced across the central-southern and natural borders than across the northern border. Figures 1.8 - 1.9 analyze the discontinuity of buildings, town charters and Madgeburg Law, focusing on different segments of the border. The central-southern and natural borders show similar hump-shaped trends for the buildings (Figs. 1.8 and B.2). As expected, they seem to be not only significant but also to be driving

the results on the 13th century total borders. Furthermore, the natural borders also present higher results between the 14th and 15th centuries than the central-southern borders, as the treatment has the highest intensity. Conversely, the northern borders (Fig. 1.9) present a weakly positive coefficient in the 13th century. In the following centuries, they present non-significant results with coefficients close to zero. These results are in line with the initial hypothesis.

[Figures 1.8 and 1.9 about here]

The results for the Magdeburg Law and town charters are more difficult to interpret. The differences between the northern borders, central-southern and natural borders is still present, with the central-southern and natural borders having significant and positive results. In contrast, the northern borders show non-significant and close to 0 coefficients. However, the natural and central-southern borders present a difference in trend as well. While in the 13th and 14th centuries the coefficients are positive and significant across both borders, after the 15th century, the natural borders' coefficients drop and lose significance. Conversely, the central-southern borders remain persistently positive and significant (for the town charters, the trend is increasing), and the process of colonization eastward and the eastward propagation of the town charters might provide an explanation for this difference. The data show an increase in the number of town charters and Magdeburg-Law charters in the eastern areas (central-southern borders), due to the movements of settlers and the propagation of the town charter model eastward. Conversely, the propagation process slows down in already colonized areas with a high density of town charters (natural borders).

1.5.5 Robustness of Main Results

Table A.16 tests the robustness of my results according to several specifications and control variables. I verify the robustness only for the 13th and 14th centuries as they represent the peak of the Teutonic Order's power. A linear parametric model is used as it is more flexible and allows a better comparison of models with different control variables. However, the results remain robust even when I adopt the non-parametric, second-order polynomial specification used in the baseline (Figures 1.7a and 1.7b). However, the results are robust even when a non-parametrical and second-order polynomial model is adopted, as in the baseline specifications adopted in Figures 1.7a and 1.7b. In Table A.16, I test the robustness of my results by progressively augmenting the baseline specification - from a specification without zone fixed effects, to one including them (as in Figure B.3), to one where zone fixed effects are interacted with measures of agricultural suitability and agro-ecological potential. These factors may have shaped the west-to-east direction of colonisation by the Order and Germanic settlers and could otherwise confound the estimated development gap between Prussian and neighbouring territories. Column (1) adopts a specification that controls for only the variables that show any jumps, as in Tables 1.2 and A.7. Thus, the specification includes wheat and barley suitability, Luvisol presence, interaction between Luvisol and barley suitability, river access, elevation, number of Iron-Age archaeological sites, and number of High-Middle-Ages archaeological sites. Column (2) introduces the macro regions fixed effect. I adopted this specification in the previous analysis (Figures 1.7a and 1.7b). Finally, in columns (3) to (7) of Table A.16, I interacted the macro regions with measures of agricultural suitability (presence

of Luvisol, suitability for barley, rye and wheat, and the interaction between Luvisol and barley as a measure for heavy-plough suitability). The results are robust and significant across all the specifications. Similarly, in Table A.17, I test the results, controlling for the longitude and latitude of each centroid, my unit of observation (column (2)). In columns (3) to (7) I interact latitude and longitude for the suitability measures mentioned above. Again, the coefficients remain positive and significant.

I also repeat the above procedure, using the Magdeburg Law and town-charter propagation as the outcome (Tables A.18-A.21). The coefficients are robust to all specifications. In particular, the coefficients remain significant for the Magdeburg-Law diffusion and the 13th century. For the 14th century, controlling for the square centroids' longitude and latitude and the presence of Luvisol increases the significance of the coefficients (Table A.19, columns (2), (6), (7)). A possible explanation is that urban centers needed a constant surplus of food from the countryside to survive and grow, which could only be possible in areas that are highly suitable for agriculture.

In the main specification, I employ the optimal bandwidth selection method (Calonico et al., 2014, 2017), which changes according to the border selected and to the outcome distribution by century. Thus, I verify the robustness of the results by introducing a fixed bandwidth (50 km in Tables A.22 and A.23; 30 km and 100 km are available upon request). In this spatial setting I verify the robustness of the results adopting the identification design proposed by Grosfeld and Zhuravskaya (2015) and Dell (2010), a two-dimensional RD specification. As in eq. 1.1, $Y_{s,t}$ are the flow number of buildings realized in a given century and within a square s, measuring economic development. However, I use a quadratic polynomial function of the square centroids' coordinates.[10] The results (A.24 and A.25) are also robust to this specification.

[Figure 1.10 about here]

In Figure 1.10, I exploit the dynamic variation of the Teutonic-Order territory and borders across centuries to verify the robustness of the results in the event-study framework. The model adopted is the following:

$$Y_{st} = \sum_{j=-3}^{+5} \beta_j \Big(Teutonic\_Order_s \times \mathbf{1}[Cen_t = j] \Big) + \theta_s + \lambda_t + \zeta_{st} + X'_{st}\gamma + \epsilon_{st} \qquad (1.2)$$

Y_{st} is the outcome in region s at time t; θ_s is fixed effects for the region; λ_t is time fixed effects; X_{st} represents a set of control variables. $Teutonic\_Order_{st}$ is an indicator function, which is equal to 1 when s was part of the Teutonic-Order territory in a given century t and 0 otherwise. $\mathbf{1}[Cen_t = j]$ is a set of indicator functions for each century, which equal 1 when $t = j$ and 0 otherwise. Thus, I calculate 2 leads and 5 lags that account for the evolution of the Teutonic-Order effect by century, before and after the treatment century.[11] I use the

[10] The polynomial takes the following function: $f(Lat_s, Lon_s) = Lat_s + Lon_s + Lat_s^2 + Lon_s^2 + Lat_s^3 + Lon_s^3 + Lat_s * Lon_s + Lat_s^2 * Lon_s + Lat_s * Lon_s^2$ controlls for the squares centroids' coordinates (Lat_s, Lon_s).

[11] For East Prussia, the treatment started in the 13th century, while for Gdansk and Pomerelia it started in the 14th century.

period -1 (one century before the treatment, i.e., in the 12th century) as the benchmark to calculate the other leads and lags. The baseline control vector X'_{st} includes wheat and barley suitability, river access, presence of archaeological sites during the Iron Age and High Middle Ages, Luvisol presence, and an interaction between Luvisol presence and wheat suitability as a measure of heavy-plough suitability, following Andersen et al. (2016). I interact all controls with century fixed effects to allow their effects to vary flexibly over time. I also control for zones fixed effects, denoted by ζ_{st}, as in Figure B.3, interacted with centuries' leads and lags. I introduce the Conley HAC standard errors (Conley, 1999, 2010) to account for the possible presence of spatial auto-correlation in the calculation of error ϵ_{st}. The leads' coefficients are close to 0 and are non significant. This evidence supports the parallel trends assumption required by the causal identification of an event-study design. Furthermore, I restrict the sample to the observations within a given distance from the border (30 km, 50 km) to guarantee homogeneity between treatment and control groups around the cut-off.[12] The event study's results confirm the hump-shape trend, with positive coefficients starting from the 13th century, and with a peak in significance and positivity in the 14th century. Then, starting from the 15th century, the coefficients begin to decrease and lose significance.

1.6 Mechanisms

In this Section, I present suggestive evidence that the economic development observed in Prussia can be attributed to the presence of the Teutonic Order's state, and in particular, to its relatively high capacity for a pre-modern state in the region. In Section 1.6.1, I show that civil buildings, rather than military or religious ones, primarily drive the results. This suggests that, within the framework of extractive elites and institutions, the ruling elites of the Order had a comparatively greater ability, both directly and indirectly, to invest in public infrastructure supporting civil and economic functions. Sections 1.6.2, 1.6.3, and 1.6.4 provide further evidence of the Order's higher capacity relative to Polish Principalities and the Kingdom of Poland. This includes greater capacity in revenue extraction and land control, in overseeing officials, and in promoting market integration. Finally, in Section 1.6.5, I demonstrate that the economic impact of the pro-market institutions introduced by the Order not only increases over time but also persists even after the collapse of the central state.

1.6.1 Teutonic Order: Positive or Negative Leviathan?

Are public buildings a good measure of economic development? To test this question, I classified the buildings in the Polish historical building dataset (Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage], 2020b) in religious, military, civil, cultural, and

[12] In Tables A.26 - A.28 I verify the robustness of the event study, applying the sample restrictions to observations within 30 km, 50 km, 100 km, and 200 km from the border. Due to the variation of the Teutonic-Order territories and borders across time, in Figures B.4a (a) - B.4c (c), I apply the sample restriction using different borders as the cut-off (the 14th century borders, a combination of the 13th and 14th century borders, and the natural borders).

palace/mansion buildings. This classification reflects the buildings' classification in Cantoni et al. (2018). Thus, I repeated the RDD designs for each century, restricting the analysis to the number of monuments by category. Due to the scarcity of the last two categories, I restrict the study to the first three categories (religious, military, and civil).

[Figure 1.11 about here]

There are two main concerns regarding the reliability of buildings as indicators of economic development. The first is measurement-related: buildings may be affected by survival bias due to differential selection between Prussia and the surrounding region.[13]. Additionally, since the data source is the Polish Ministry of Heritage, the selection and documentation of buildings may prioritize historical or artistic value, rather than the economic or civic criteria that I need to assess regional advancement from an economic development perspective. The second concern is theoretical: even if buildings accurately reflect public capital formation, it is unclear whether such capital formation genuinely promotes economic development or merely reflects the interests of a religious and military elite. While a strand of the literature (Cantoni et al., 2024; Cox et al., 2025; Mangini and Petroff, 2022; Gennaioli and Voth, 2011; Besley and Persson, 2010) highlights the positive effects that war played in increasing state capacity, another strand of the literature (Acemoglu and Robinson, 2023; Bisin and Verdier, 2024; Malinowski, 2016; Raster, 2019) shows how despotic states or states ruled by a specific elite could harm long-term economic development. Thus, the reclassification of buildings in three categories - religious, military, and civil buildings - could be a proxy for the respective interests of the religious elite, the military/noble elite, and the merchants or economic elite.

The results show that buildings also reflect the civil and economic development of the territory. Furthermore, I can exclude the hypothesis that the building are mainly expression of a state captured by the military and religious elites. Figures 1.11a - 1.11c show how coefficients relative to military and religious buildings show higher coefficients than civil buildings. Conversely, the civil buildings are the only category that shows increasingly positive and significant results in the treatment group compared to the control group over the three centuries of the Teutonic Order's domination, driving the results of the main specification. On the other hand, religious buildings do not show a clear trend, while military buildings show positive and significant results during major military instability and political tension, i.e., in the 13th century and during and after the 15th century.[14] Looking at the partial borders, the central-southern borders drive the total 13th century borders' results (Figs. B.5a, B.5c, B.5b), while the northern borders (Figs. B.6a, B.6c, B.6b), as in the main specification, show non-significant results during the Teutonic Order's domination, and negative and significant results for civil and military buildings in the 16th and 17th centuries.

[13]After reunification, Prussia became part of the Duchy, then the Kingdom of Prussia, and later the German Empire. This history of nation-building and nationalism may have influenced the specific selection and preservation of buildings from the Teutonic Order period. Conversely, systematic destruction from aerial bombing during World War II likely targeted areas directly controlled by Germany (the Third Reich), as shown in Fig. B.8

[14]Historically, the logic of penetrating and securing the entire East Prussia territory during the Northern Crusades justifies the results in the 13th century. Similarly, the outbreak of war between the Order and the Kingdom of Poland and the Grand Duchy of Lithuania explains the positive coefficients in the 15th and 16th centuries.

In Figure B.9, I use the HYDE dataset, which combines historical population estimates from sources such as Livi-Bacci (2007) and Maddison and Centre (2001), based on archival records and historical documentation. For that reason, the measure should be less biased by survival bias. To calculate the effect of the Teutonic Order state I adopt a staggered event study analysis, standardized for the century before the treatment. The results align with the building analysis, showing positive and significant outcomes during the treatment period and immediately after (coinciding with the 13th, 14th, and 15th centuries) and non-significant results both before the Order's arrival and after its collapse. Similar findings are also confirmed by the analysis of Town Charters and the spread of Magdeburg Law, both based on historical documentation rather than the material survival of buildings.

1.6.2 State Capacity and Land Ownership

In this section, I test whether the Teutonic Order had greater capacity to collect revenues and control land compared to the neighboring Kingdom of Poland. These two dimensions are crucial for assessing state capacity as they indicate the state ability to finance itself and its action. In the absence of a formal fiscal system this function largely depended on the ruler's personal income, which primarily derived from the revenues generated by their own landholdings. In Figure 1.12, I compare the evolution of the Teutonic Order's land revenues over time, both before and after the Battle of Grunwald, with the estimated revenues of the Polish Crown in 1370, which amounted to 15,000 golden marks. The values have been standardized by the size of the state in square kilometers (km^2) for both Teutonic Order Prussia and the Kingdom of Poland. Before the battle of Grunwald, which significantly weakened the Order's financial capacity, the Order's average revenues were almost double those of the Polish Crown. After the battle the revenues were still higher. A partial explanation could be that the Order relied more heavily on rent than land, given their pervasive control of the territory, while the Kingdom of Poland relied more on other revenue sources, such as the royal mint, customs duties, and monopolies over salt and lead mines (Guzowski, 2018). Nevertheless, this evidence indicates a higher extractive capacity of the Teutonic Order at both the territorial and production levels, given the higher productivity of the Order's estates compared to those of the Polish Crown (Arnold, 1989). Due to the limited information on the Polish Crown's land revenues, I use land ownership by the ruler (the Polish Crown and the Teutonic Order) as a proxy for land revenues, leveraging the availability of this data for the Polish Crown in the 16th century. The land ownership data is standardized by the smallest administrative units available for the 15th century (commanderies for the Order and castellanies for the Polish Crown), and measured in hectares, as this was the unit used in the original sources. Table 1.3 shows that the Teutonic Order controlled more land per administrative unit, with a 0.55 standard deviation higher than the Polish Crown. Despite the small sample size (62 observations), the result remains robust when controlling for variables such as average land suitability, terrain morphology (elevation and slope), access to routes and rivers, and the presence of archaeological sites prior to the Order's arrival. This specification uses the Teutonic Order's 13th-century territory for comparison with the RDD baseline. In Table A.30 I demonstrate that the results hold for the Order's 14th-century territory as well, with the exception of the specification that includes all controls.

1.6.3 State Capacity and Bureaucratic Control

Control over officials reflects a ruler's ability to govern a territory effectively through appointed agents. In this section I present evidence that the Teutonic Order exercised stronger control over its officials compared to the neighboring Polish Principalities before unification and the Kingdom of Poland afterward. In Figures 1.13 and 1.14, I measure the turnover of subordinates to the ruler (commanders in the Order's territories and castellans in Polish territories) within each administrative unit of the Order's state and Polish territories. Figure 1.13 shows the confidence interval for the OLS coefficient, regressing the Teutonic Order state on the duration of subordinates' service, using a sample period of 50 years starting in 1250. Turnover is higher in the Order, with significant coefficients from 1350 to 1450, and nearly a six-year difference between the Teutonic Order and the Kingdom of Poland from 1350 to 1400. Figure 1.14 employs a DiD design to analyze exploiting territorial switches between the Order and Poland. The DiD coefficients are compared with those of an OLS regression (first coefficient) on subordinate duration within the territories that did not change ruler from 1250 to 1450. The second coefficient focuses on Pomerelia and Gdansk, which joined the treatment in 1308; this coefficient is negative and significant; higher than the OLS. Finally, the third coefficient leverages the incorporation of Kulmerland, Malbork, and Pomerelia into the Kingdom of Poland following the Second Peace of Torun and the Order's definitive defeat. Here, the treatment is passing from the Order to the Polish Kingdom. Thus, I expect lower turnover among Polish castellans compared to the Order's commanders. The coefficient is indeed positive, though not significant, likely due to the limited sample and short treatment period (1466-1500).

Historically, The Order's higher turnover can be attributed to its stricter control over subordinates and, generally, over its members. Commanders were selected and reviewed annually (on September 14) by a central council, the "general chapters," where "every office would be reconfirmed or handed over to another individual" (Pluskowski, 2024, pg 30). Commanderies, a feudal innovation introduced by the Monastic Order during the Crusades, served as real administrative units, allowing high-ranking officers to oversee the Order's estates directly without any mediation with local lords. Operating within a strict hierarchical structure, commanderies connected lower-ranking territorial officers to higher Order levels, contrasting with castellanies, which were more based on the material presence of a castle as center of power. In the Teutonic State, commanderies combined military and economic functions, strategically expanding and consolidating the Order's territories (Ekdahl, 2002; Urban, 2003). Thus, I argue against the claim that "[Teutonic] Knights had wide discretion within their own extensive domains, just so long as revenues flowed to the Knights" (Tilly, 1990, pg 22). On the contrary, the Order exhibited significant control over its subordinates, resembling a proto-bureaucracy. Furthermore, I dismiss the idea that the higher turnover resulted from military instability, as the peak turnover occurred between 1350-1400, the height of the Order's power.

1.6.4 State Capacity, Elites Movement and Market Integration

Historical research provides evidence that the strategy of conquest and colonization of Prussia consisted of the systematic invitation of knights ("Preußenreisen") from the European elites, the lower nobility, and the ministeriales class (Querengasser, 2021; Paravicini, 1989; Friedrich Bruns, 1875). In this section, I test the hypothesis that the Teutonic Order's major capacity in organizing the movements of the European military can be a channel of development in Prussia. The mobilisation of men and resources and market integration would follow from the need for the Order to support the movement of the elites economically. This historical evidence is in line with Epstein (2000), who describes how market integration was a driver of development in a pre-modern state.

[Figure 1.15 about here]

To test this channel, I employ the main-routes' networks from Friedrich Bruns (1875), digitized by Holterman et al. (2021)'s project. There is consolidated historical evidence about the itineraries of the knights directed to Marienburg. There, they paid homage to the Grand Master before heading to the eastern territories of Prussia (Paravicini, 1989; Friedrich Bruns, 1875). As in Figure 1.15, I select all the main routes from the west directed to Marienburg and Elblag. There are two main routes to reach the Teutonic-Order state. The first set of routes passes from Wroclaw (more rarely from Poznan) and then from Torun and Chełmno Land in the southern part of the Order's state (central, southern, and northern routes from Frankfurt to Elblag, the south-western route from the Holy Roman Empire to Elblag (HRE henceforth), Gorlitz-Elblag, and the southern route from the HRE to Elblag). The second set of routes passes from Gdansk or generally from the north-west of the Teutonic-Order state (northern route from the HRE to Elblag, and the northern route from Frankfurt to Elblag). Within the main RD framework, I introduce the distance from each route to Elblag and the interaction between each route's distance and the Teutonic-Order territories.[15] I test in particular two hypotheses based on historical and theoretical evidence:

1) In the 13th and 14th centuries, the overall development across the main trade routes directed to Elblag should increase. In particular, as the direction of conquest proceeded from south (Chełmno Land) to north, and Gdansk was conquered in 1308, the southern routes (from Wroclaw and Frankfurt and passing through Torun) should show more evidence of development than the northern routes passing through Gdansk. 2) The interaction between the Teutonic-Order territories and the trade routes should contribute positively to economic development during the rise of the Order (in the 13th and 14th centuries). Conversely, the Order's military defeat undermined the "Preußenreisen" from the 15th century, which should negatively affect development along the routes, specifically in the Teutonic-Order state. This evidence should prove that the development in the Teutonic-Order territory is stronger than in the rest of Poland due to the centralizing effect played by the order in mobilizing economic resources.

[15] I adopt a linear regression model as it allows a better management of the control variables, including the interaction term, and to include the more general effect represented by the routes.

[Table 1.4 about here]

Table 1.4 shows how the routes' closeness positively affects development, starting from the 13th century.[16] On average, the southern routes seem to present higher and more significant results than the northern routes from the 13th and 14th centuries. Thus, hypotheses (1) seems to be verified. The interaction between the Teutonic Order and routes seems positive for economic development, starting from the 13th century, but also significant in the 14th century. Furthermore, after the 15th century, the coefficients drop and are not significant and, from the 16th century, the effect on economic development is negative. In both cases the evidence is coherent with hypothesis (2). Tables A.32 - A.39 look separately at the civil, religious, and military buildings. Considering the interaction between the routes and the Teutonic Order, the northern routes show a significant coefficient only for the religious buildings. Conversely, the southern routes also show significant results for the civil and military buildings. These results provide further evidence for hypotheses (1) and (2).

1.6.5 The Teutonic Order and Urban Autonomy

The comparison between the RD on the number of buildings and the town charter and Magdeburg-Law spread across the total borders (Fig. 1.7) and partial borders (Fig. 1.8 and B.2) show that buildings and urban institutions follow trends partially driven by varying factors. On the one hand, the Teutonic Order's centralization of military power tended to stimulate the spatial and administrative centralization of development. On the other hand, the spread of town charters tended to promote the administrative and spatial decentralization of development and economic activities. The significant and positive results relative to buildings across the natural borders and the central-southern borders in section 1.5.3 are evidence of the town-charter spread along the main routes. In contrast, the town charter and Magdeburg Law show significant results only across the central-southern borders. From the persistence perspective, the two phenomena show different behaviors. The flow and stock number of buildings present a hump-shaped trend, while the Magdeburg-Law and town charters show a positive growth trend. However, using buildings as a comprehensive measure of economic development makes it difficult to separate the effect of the Teutonic Order's centralization of military power from the institutional channel, measured by the Magdeburg Law and the town-charter propagation. Thus, I study the interaction between the Teutonic Order and urban autonomy in determining early economic development, as measured by the number of buildings. I introduce the following specification:

$$\begin{aligned} Y_{st} = &\sum_{j=-3}^{+6} \beta_j \Big(TO_s \times \mathbf{1}[Cen_t = j] \Big) + \sum_{j=-3}^{+6} \beta_j \Big(TC_s \times \mathbf{1}[Cen_t = j] \Big) + \\ &+ \sum_{j=-3}^{+6} \beta_j \Big(TO_s \times TC_s \times \mathbf{1}[Cen_t = j] \Big) + \theta_s + \lambda_t + \zeta_{st} + X'_{st}\gamma + \epsilon_{st} \end{aligned} \tag{1.3}$$

[16] the coefficient is negative as the higher the distance from the main routes, lower is the economic development.

According to the following specification, Y_{st} is the number of buildings measuring economic development; $TC_s \times \mathbf{1}[Cen_t = j]$ measures the spread of Magdeburg law as an autonomous phenomenon, proxying the effect of urban autonomy over EED. $TO_s \times \mathbf{1}[Cen_t = j]$, as before, measures the effect of the Teutonic Order on economic development. Because I control for the urban-autonomy phenomenon, the Teutonic-Order effect can represent the state capacity for mobilizing and centralizing resources. Finally, $TO_s \times TC_s \times \mathbf{1}[Cen_t = j]$ represents the triple interaction between centuries, town charters, and the Teutonic-Order state. I employ an event-study design for the identification because it considers multiple drivers more flexibly than an RD framework. The baseline control vector X'_{st} includes wheat and barley suitability, river access, presence of archaeological sites during the Iron Age and High Middle Ages, Luvisol presence, and an interaction between Luvisol presence and wheat suitability as a measure of heavy-plough suitability, following Andersen et al. (2016). I interact all controls with century fixed effects to allow their effects to vary flexibly over time. I also control for zones fixed effects, denoted by ζ_{st}, as in Figure B.3, interacted with centuries' leads and lags. To make this design comparable with designs adopted in previous sections, I restrict the sample to observations within a 50 km distance of the 13th century borders.[17]

[Figure 1.16 about here]

The results confirm the difference in persistence between the Teutonic Order and urban autonomy. The town charter's effect (Fig. 1.16b) seems persistent and increases over time. Conversely, the Teutonic Order continues to show non-persistence during the crisis and after its fall (Fig. 1.16a). The difference seems intuitive and is in line with the literature. Urban autonomy, above all the Magdeburg Law, has permanent and positive effects on development after the consolidation of the town's identity and its economic and political organization. Furthermore, institutional effects are persistent after the treatment as they permanently change norms, customs, human interactions, and expectations in the target social community (North, 1990). On the other hand, the state capacity is less persistent, as its existence relies on the persistence of a central authority, the Teutonic Order, in the case of this analysis. Thus, after the treatment the effect of state capacity ceases to affect economic development. In conclusion, the results highlight that other forms of state capacity, complementary to and in addition to centralization of military power, are necessary for long-run growth. If the state that ensures the centralization of military power ceases to exist, its effect on economic development is not durable. Conversely, the effect of urban institutions is not only permanent through time but also increases.

1.7 Alternative Mechanisms

In the following sections, I test alternative channels to rule out explanations other than state formation. These include the impact of settler migrations and the exploitation of

[17] Figure B.10 and Table A.40 show the robustness of the results according to different distances from the borders: 0 km, 50 km, 100 km, 200 km, respectively, in columns (1), (2), (3), (4). Alternatively, I do not restrict the sample, but I control for the distance from the border and the interaction between the distance and the Teutonic-Order effect (column (5)).

Native Prussians (Section 1.7.1), the effects of the Black Death in the 14th century (Section 1.7.2), and enhanced security due to the Teutonic Order's presence as a hegemonic power in Prussia (Section 1.7.3). In Figures B.14 and B.15, I test alternative mechanisms beyond the centralization of military power, using data from the pollen dataset in Izdebski et al. (2022). This dataset was initially collected to assess the economic impact of the Black Death in Europe but also provides insights into land use and agricultural production during the period analyzed. These insights are grounded in palynology evidence, independent of written sources or ex-post estimates. The dataset indicates the extent of land use for cereal production, herding, or short-term (fast succession: 5–10 years) and long-term (slow succession) land abandonment. I use these measures to focus on social dynamics related to the rise of the Teutonic Order, distinct from the state dynamics introduced by the centralization of military power. Figure B.13 displays the locations of pollen sample sites. Given the limited sample size for Polish and Order territories (35 sites and 305 observations over time), I conduct t-tests for each indicator of agriculture, with the sample restricted to 50-year intervals from 1250 to 1450. I compare the Order and Polish territories using both the 13th and 14th century boundaries of the Order (Figs B.14 and B.15).

1.7.1 Settlers Immigration and Exploitation of Native Prussians

The Order actively encouraged immigration of settlers from Germany, who may have introduced technological innovations, such as the heavy plough, more rapidly or intensively than surrounding territories. This could have positively impacted development by increasing agricultural surplus from the land. In both Figures B.14 and B.15, however, there is no systematic difference in land use for cereals or herding between the Order's and Polish territories. Only in the period 1250–1300 does the Order show a significantly higher index for cereals and herding, but this difference disappears in the following century.

An additional channel could be the exploitation of the native Prussian population by the new settlers, which may have generated a surplus that facilitated urban development and public capital formation. To explore this, I used data on the distribution of Prussian villages from Erlen (1992), digitized the data, aggregated village counts within 20x20 km grid cells, and included this as an additional control variable. The coefficients of the Teutonic Order do not change significantly (Table A.41) controlling for the number of the Prussian villages.

These findings align with recent historical literature, which describes the military conquest, settler-Prussian interactions, and Prussian assimilation as relatively gradual or, at least, less traumatic than 19th- and 20th-century narratives suggest (Pluskowski (2024); Wenskus (2017); Biskup (1991)). Native Prussians played a role in colonizing the Great Wilderness, and over time, the Order progressively reduced the status of serfdom among this population, while simultaneously limiting the rights of the new settlers. The majority of German and Polish settlers arrived in the 14th century. Thus, the Order likely relied heavily on native Prussians and Poles during the latter half of the 13th century to militarily secure Prussian territory and to establish essential buildings and infrastructure for the conquest. Therefore, the hypothesis that economic development depended solely on the arrival of external settlers is inconsistent with the positive and significant results emerging from the 13th century, one

century prior. Furthermore, the 13th-century borders were already contested by Poles and Prussians, and even with the later arrival of German settlers, these areas maintained a mixed ethnic identity.

1.7.2 Plague

I use the same pollen data to test whether the Black Death epidemic of 1351 affected the Order's state and Polish territories differently or had distinct economic impacts across the two regions. The Plague is often associated with early economic development, the crisis of traditional elites, and the rise of the urban and economic class (Gingerich and Vogler, 2021; Dittmar and Meisenzahl, 2020; Voigtländer and Voth, 2014). However, there is no consensus on the extent of the Plague's reach in Polish territories or its economic impact. Izdebski et al. (2022) sheds new light on this topic with modern palynological evidence. The t-test comparison of pollen data from 1350 to 1400 (Figs. B.14c and B.15c shows no significant differences between the Teutonic Order's state and Polish territories, except for the "fast succession" indexes in Figure B.14c, which indicate short-term land abandonment. These findings could align with the Plague's arrival, but they appear to be temporary and do not impact on more economic indexes such as the herding and cereal coefficients. I therefore conclude that the Plague likely did not contribute to economic development differences between the Order's state and Polish territories.

1.7.3 Security

I then test for differences in rulers' abilities to ensure military security, measured by abandonment rates (both slow and fast succession), between the Teutonic Order's state and Polish territories. Increased security aligns with the idea that, prior to the Order's arrival, Prussian borders were contested by Polish and Prussian tribes, and that the establishment of the Order would have naturally reduced political instability, positively impacting regional development. This reasoning is consistent with the "stationary bandit" theory, where a military elite provides protection to inhabitants in exchange for financial revenue (Tilly, 1985). Accordingly, the developmental impact would stem primarily from securing Prussian territory and establishing a state entity - regardless of the state's specific organizational capacity - rather than from a centralization of military power. This explanation contrasts with the baseline results, which indicate an absolute difference in development between the Order's and Polish territories, independent of prior conditions. Additionally, the development differential persists into the 14th century, when both Polish territories and the Order's Prussia were organized as feudal states. Thus, it seems unlikely that Prussia's positive development effect can be attributed solely to the Order's role in stabilizing the political situation relative to prior instability.

The analysis of pollen data finds no significant or systematic difference in abandonment rates between the Order's state and Polish territories. From 1250 to 1300 (Figs. B.14d and B.15d), there is a significant difference in short-term abandonment (fast succession), measuring sudden shocks from pandemics or military conflicts, consistent with the Order's

conquest of Prussia. Although abandonment levels before the Order's arrival (1200-1250) are unavailable, it is plausible that the initial decade of the Order's presence introduced a period of instability from military conflicts, contrasting with the positive development observed in the same century. Additionally, long-term abandonment, which better aligns with public capital and pro-market institution formation, does not differ. Conversely, in the period 1400-1450 (Figs. B.14e and B.15e), there is evidence of significantly higher long-term abandonment in the Order's Prussia. This finding aligns with the political and military instability in Prussia following the Order's military defeat and suggests that long-term abandonment may reflect, or even drive, economic decline in the Order's state, supporting the previous findings.

1.8 Conclusion

Can a pre-modern state with higher military power centralization affect economic growth? In this paper, I analyze the role of the Teutonic-Order state as a driver of economic development in East Prussia within the framework of the Northern Crusades. The analysis of the Teutonic-Order state in Prussia represents a case of higher centralization of military power compared to neighboring territories in Prussia. This setting shows that a form of state capacity can be a leading factor for economic development even before the Military Revolution and at the dawn of the modern state. Through an RDD, I compare development in East Prussia and the neighboring territories controlled by the Polish Principalities, using the 13th century borders as the main cut-off. I use the number of buildings completed in a certain area and a given century (from the 11th to 17th centuries) as the leading measure of economic development.

I find a positive causal relationship between the Teutonic Order and early economic development. However, the coefficients show a hump-shaped trend. Before the 13th century, I do not find signs of discontinuity between the Teutonic-Order territories and the neighbors. From the 13th century, the coefficients are positive and significant, with a peak in the 14th and 15th centuries. After the 15th century, with the military defeat of the Order, the coefficients drop and they lose significance. Thus, these results represent evidence of the non-persistence of the centralization of military power once a military shock reduces it. I also evaluate the effect of the Teutonic Order on the awarding of town charters and the Magdeburg Law as a further measure of development, focusing on urbanization and the capacity to attract German settlers and merchants. The results for these outcomes are positive, but weaker. Furthermore, they highlight a higher persistence in time (also after the 15th century), mainly in the eastern part of Prussian territory.

Analyzing the mechanisms, I assess if the Teutonic-Order state represents a case of state capture by religious or military elites negatively affecting Prussia's long-run economic development. I classify the buildings in the main dataset as religious, military, and civil buildings, where each category measures the interests of the religious, military, and economic elites. I then repeat the RDDs for each category. In the case of a state captured by the military and religious elite, the first two categories would drive the results in the main specification. Conversely, all three categories move in the same direction, and civil monuments are the only category that shows a significant discontinuity in the 13th, 14th, and 15th centuries, thus driving the main specification results.

Additionally, I demonstrate that the rise of the Teutonic Order correlates with increased state capacity, both in revenue collection and control over subordinates. To measure revenue capacity, I collected data on land revenues and the land area controlled by the Order versus the Polish crown, as land revenues were a primary source of income for feudal monarchies without formal taxation systems. The Order's land revenues consistently exceeded those of the Kingdom of Poland (even after its military defeat), and the land ownership held by the Order significantly surpassed that of the Polish King. This evidence aligns with the notion that the Order held hegemonic power in Prussia, while the Polish King shared authority with nobility and clergy who could rival him in military and financial power.

The Order also exercised greater control over its subordinates. By comparing the tenure of Order commanders to that of Polish castellans - the principal officials in each state - I found that the commanders had significantly higher turnover and shorter tenures. This aligns with historical accounts noting that commanders were subject to annual reviews by a central council with authority to reassign them as needed. The Order's hierarchical organization of commanders and commanderies functioned more like a modern state bureaucracy, while the Polish castellans' roles were more rooted in feudal loyalty dynamics.

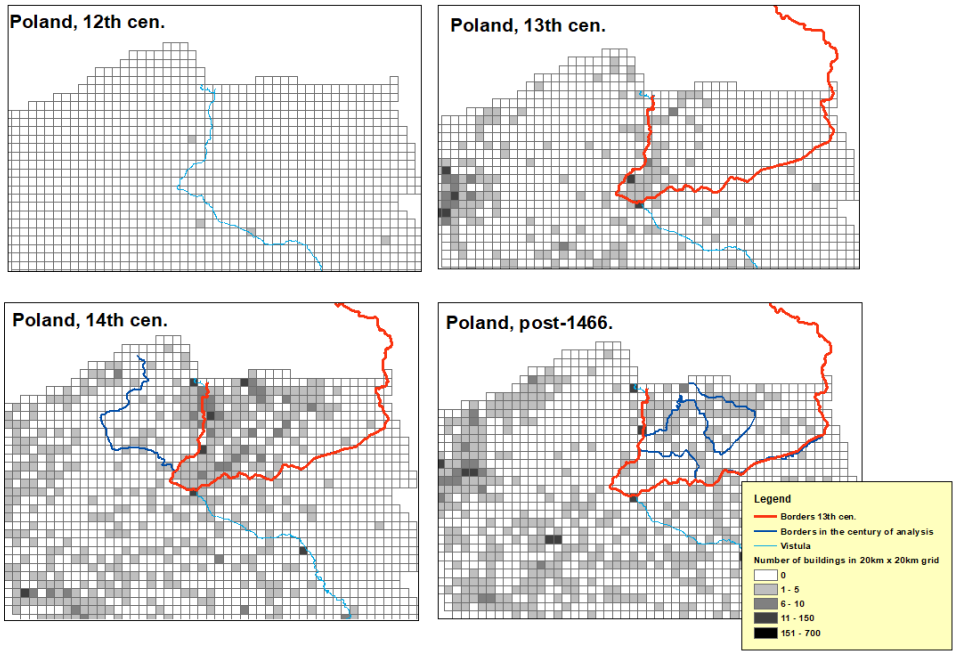
I further add the interaction between the Teutonic Order and the distance from the main routes directed to Elblag/Marienburg to the main RDD specification. Thus, I demonstrate that part of the development is attributed to the Teutonic Order's capacity to mobilize military elites from Western Europe, leading the way for the movement of merchants and settlers and for market integration. The coefficients' hump-shaped trend, coinciding with the rise and fall of the Order as in the main specification, supports this evidence. Finally, I interact the centralizing role of state capacity with the decentralizing role of urban autonomy over the economic development in Prussia. I introduce a triple difference design, in which the Teutonic Order measures the presence of a pre-modern state, and the Magdeburg Law measures the urban autonomy. The results highlight how the Teutonic-Order effect returns a hump-shaped trend following the rise and fall of the Order. Conversely, the Magdeburg Law has a more persistent and increasing effect over time, also including the military defeat of the Order. From these results, I can deduce that centralization of military power is insufficient and other forms of state capacity, such as institutional capacity, are required in order to have persistent long-run development during and after the treatment.

1.9 Figures

Figure 1.1: **Medieval Poland before and after the arrival of the Teutonic Order**

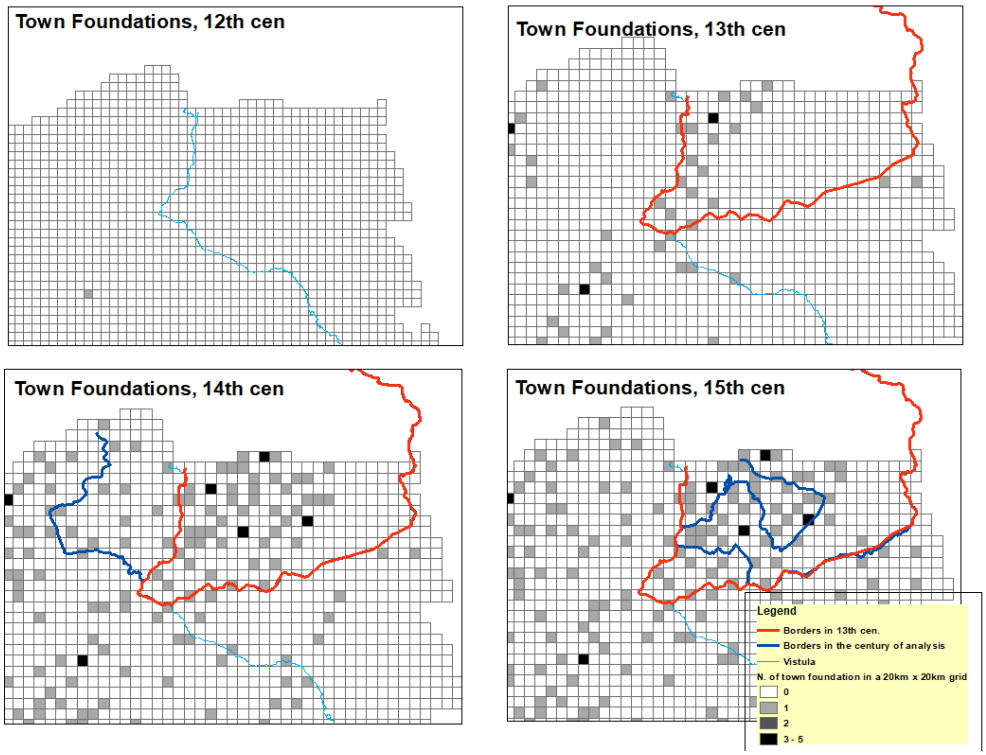
Map showing the border of Prussian tribes at the beginning of the 13th century (brown line), the territory of the Teutonic Order in Prussia by the end of the 13th century (red line), and the division of the Kingdom of Poland following the death of Bolesław III in 1138 (grey borders). Various shades of grey indicate the expansion of the Teutonic Order's territory between the 13th and 14th centuries, with darker shades representing areas conquered earlier. Dots mark the political and religious centers of the Polish Principalities from the 12th to the 15th centuries. **Source:** see text

Figure 1.2: **Geographic distribution of new buildings per century**



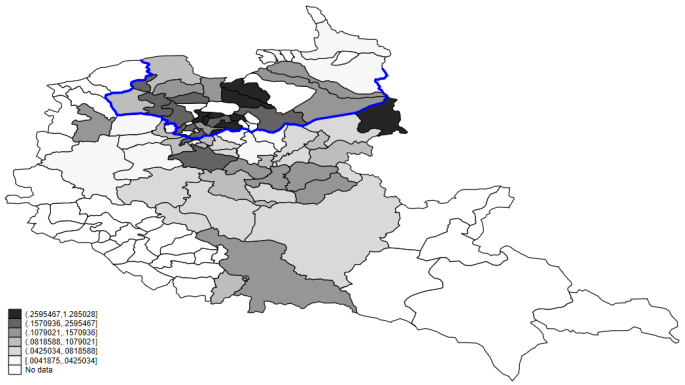
Number of buildings plotted on maps and aggregated in a 20x20km squares grid. The darker a point is, the more buildings were constructed in a given century. **Source:** see text

Figure 1.3: **Geographic distribution of town charters per century**



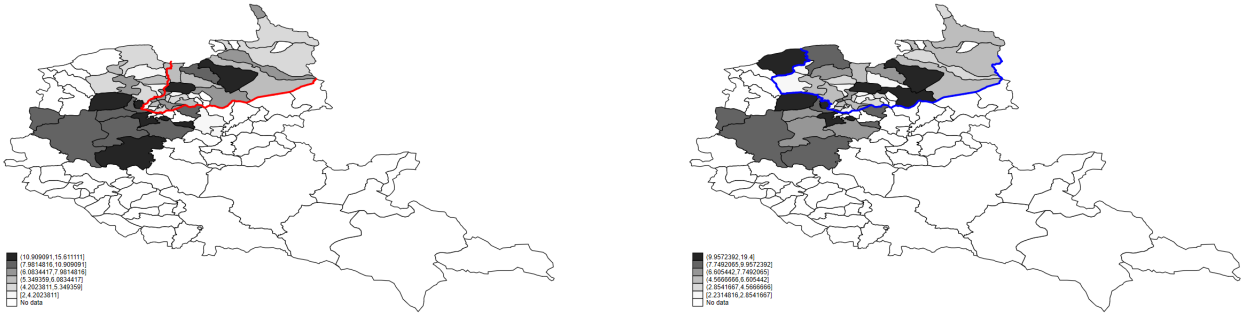
Number of town charters plotted on maps and aggregated in a 20x20km squares grid. The darker a point is, the more buildings were constructed in a given century. **Source:** see text

Figure 1.4: **Land ownership of the Teutonic Order**



Land ownership of the Teutonic Order and the Crown of Poland by administrative district size (hectares). Darker administrative units represent a higher proportion of land owned by the monarch. The borders of the 14th-century Teutonic Order's territory are outlined in blue. The territorial divisions are based on 14th-century districts: 'castellanies' in the Polish Kingdom and 'commanderies' in the Order's state.

Figure 1.5: **Duration of service of commanders and castellans**

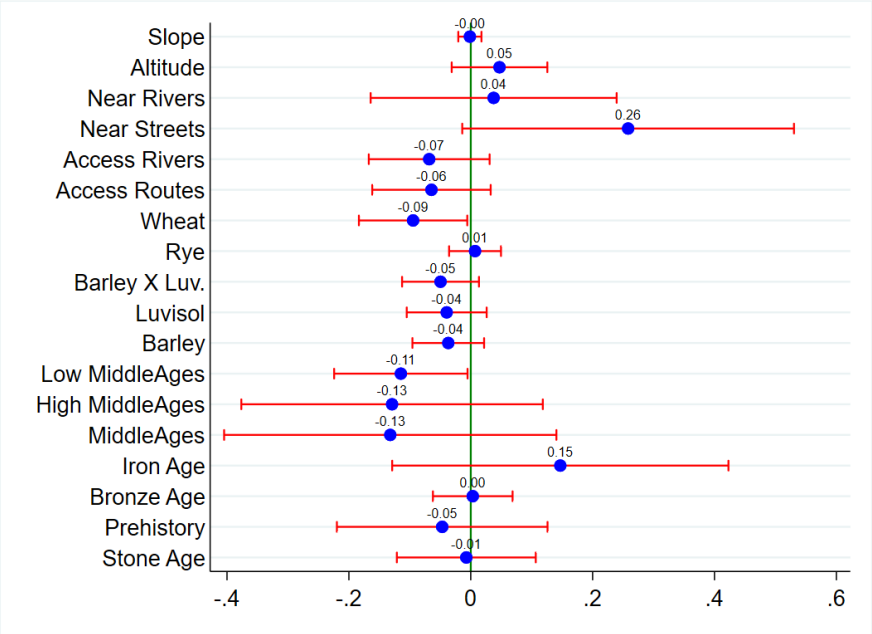


(a) 13th century

(b) 14th century

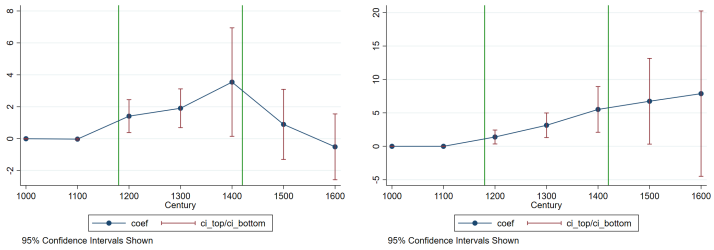
Duration of service of Teutonic Order commanders compared to Polish castellans in the 13th and 14th centuries. Darker administrative units represent longer durations of service. The borders of the Teutonic Order's territory in the 13th and 14th centuries are outlined in red and blue, respectively. The territorial divisions are based on 14th-century districts: 'castellanies' in the Polish Kingdom and 'commanderies' in the Order's state.

Figure 1.6: **Balance table, controlling for latitude and longitude**

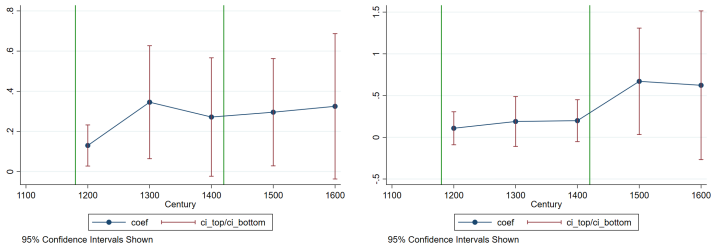


Coefficient plot with t-test coefficients with potential confounding variables as the outcome. I use the residual from a regression controlling for latitude and longitude. Coefficients 1-2 test for the presence of jumps for the morphology of the land (slope and height). coefficients 3-6 test for the presence of jumps for the accessibility to the main land and water routes. Coefficients 7-11 test for the presence of jumps for land suitability. Coefficients 12-18 test for jumps in socio-economic development prior to the Northern Crusades, as measured by the presence of archaeological sites in a 20x20km square.

Figure 1.7: **RDD: Teutonic Order's impact on development 13th century borders**



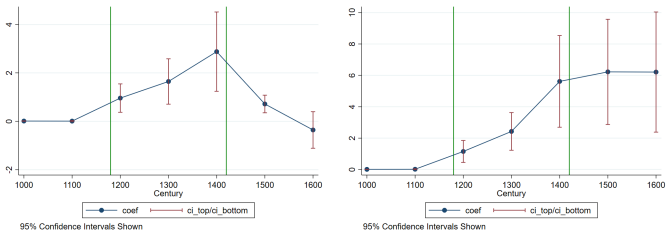
(a) Flow number of buildings (b) Stock number of buildings



(c) Number of towns with a Magdeburg-Law charter (d) Number of towns receiving a town charter

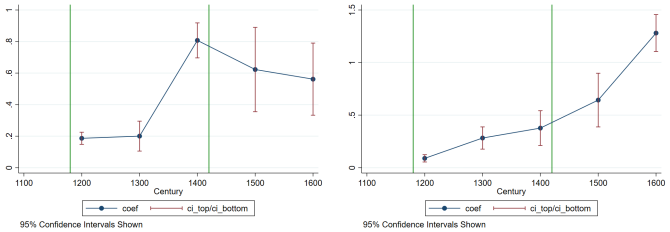
RDD coefficients and standard errors according to the specification in eq. 1.1. Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the total 13th century borders as the cut-off. Figure (a) evaluates the RDD using the flow buildings as the outcome. Figure (b) evaluates the RDD using the stock buildings as the outcome. Figure (c) evaluates the RDD using the Magdeburg-Law towns as the outcome. Figure (d) evaluates the RDD using the towns adopting a town charter as the outcome. The green vertical lines signal the beginning of the treatment (13th century) and the period after the treatment (mid-15th century).

Figure 1.8: **RDD: Teutonic Order's impact on development Central-southern 13th century borders**



(a) Flow number of buildings

(b) Stock number of buildings

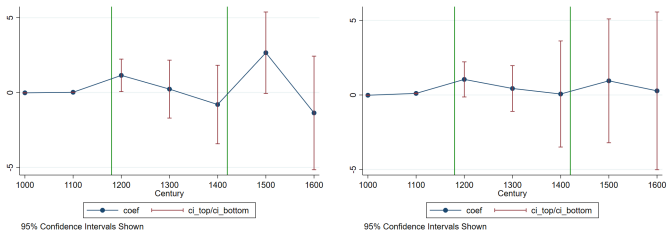


(c) Number of towns with a Magdeburg-Law charter

(d) Number of towns with a town charter

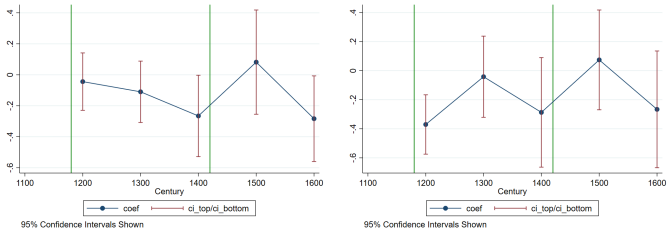
RDD coefficients and standard errors according to the specification in eq. 1.1. Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the central-southern 13th century borders as the cut-off. Figure (a) evaluates the RDD using the flow buildings as the outcome. Figure (b) evaluates the RDD using the stock buildings as the outcome. Figure (c) evaluates the RDD using the Magdeburg-Law towns as the outcome. Figure (d) evaluates the RDD using the towns adopting a town charter as the outcome. The green vertical lines signal the beginning of the treatment (13th century) and the period after the treatment (mid-15th century).

Figure 1.9: **RDD: Teutonic Order's impact on development Northern 13th century borders**



(a) Flow number of buildings

(b) Stock number of buildings

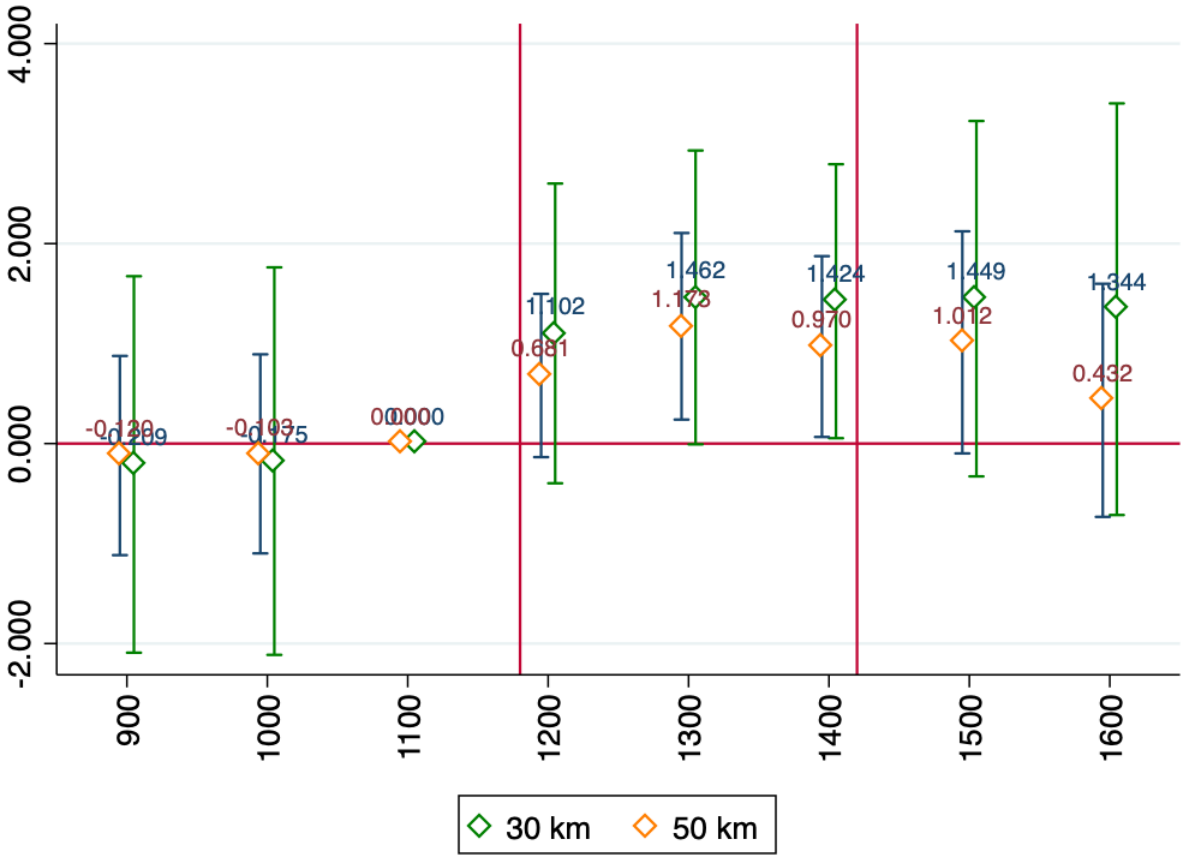


(c) Number of towns with a Magdeburg-Law charter

(d) Number of towns with a town charter

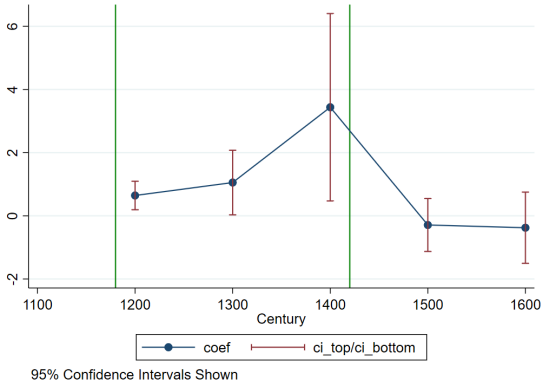
RDD coefficients and standard errors according to the specification in eq. 1.1. Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the northern 13th century borders as the cut-off. Figure (a) evaluates the RDD using the flow buildings as the outcome. Figure (b) evaluates the RDD using the stock buildings as the outcome. Figure (c) evaluates the RDD using the Magdeburg-Law towns as the outcome. Figure (d) evaluates the RDD using the towns adopting a town charter as the outcome. The green vertical lines signal the beginning of the treatment (13th century) and the period after the treatment (mid-15th century).

Figure 1.10: **Event-study analysis for monuments: 13th century borders**

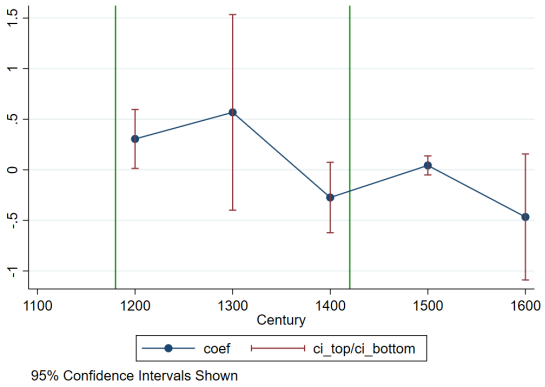


Event-study analysis showing the evolution of the coefficients interacting the treatment with each century and their standard deviation. In the green coefficient I restricted the sample to observations within 30 km of the 13th century borders.

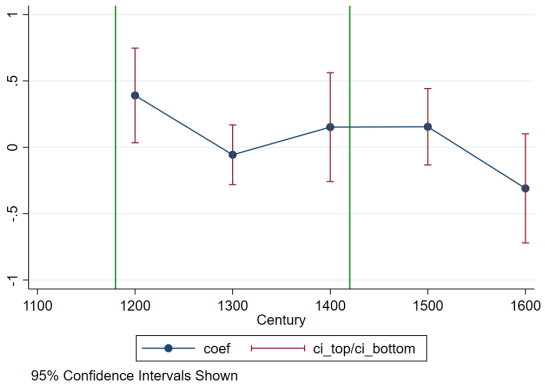
Figure 1.11: **RDDs over time on the total 13th century borders by function**



(a) Civil Buildings



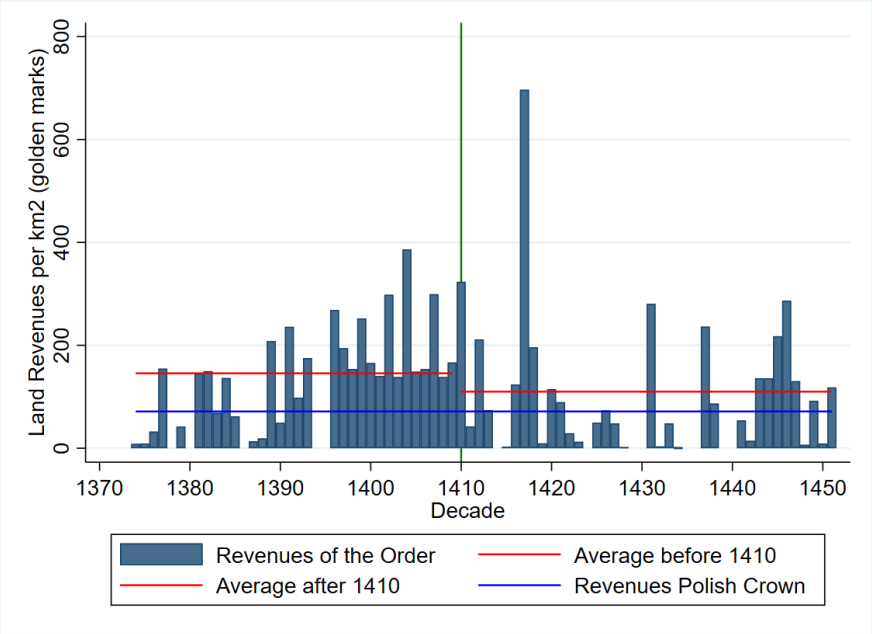
(b) Religious Buildings



(c) Military Buildings

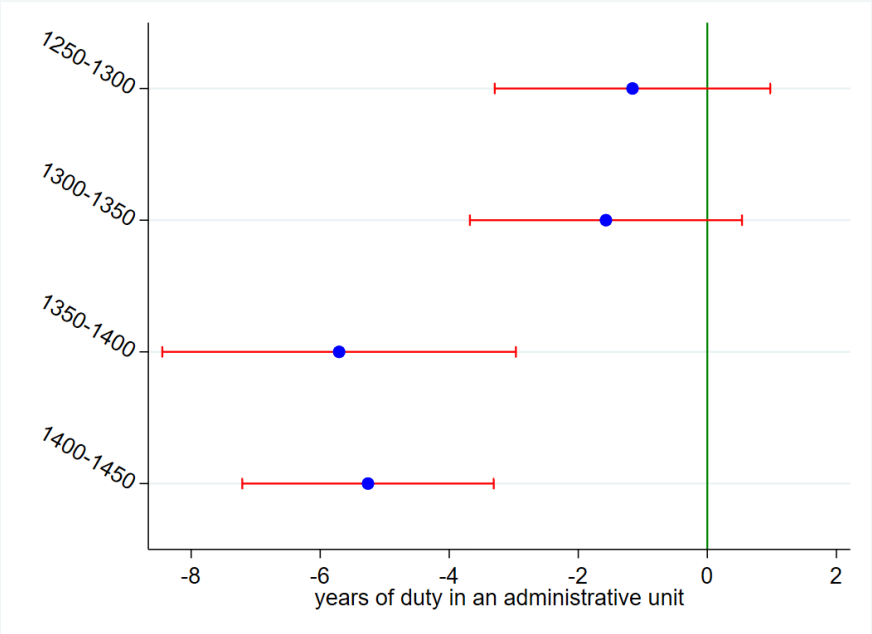
RDD coefficients and standard errors according to the specification in eq. 1.1, where the main outcome is the new buildings by function (civil, religious, military). Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the northern 13th century borders. Figure (a) evaluates the RDD considering the civil buildings as the outcome. Figure (b) evaluates the RDD for the religious buildings. Figure (c) evaluates the RDD for the military buildings. In this specification I use the distance from the 13th century borders

Figure 1.12: **Land revenues of the Order**



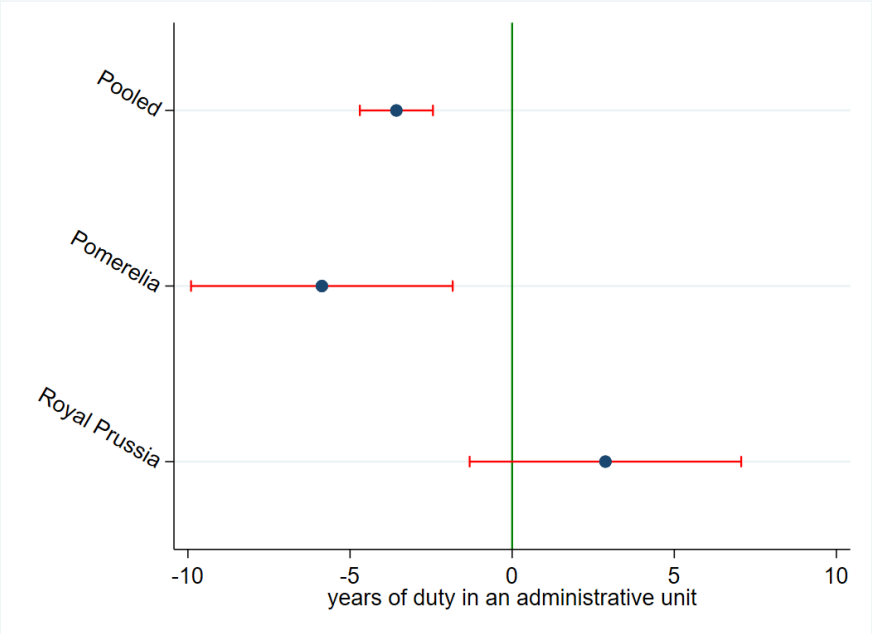
Land revenues of the Teutonic Order per state size (in km2) over time, compared with the estimated revenues of the Polish Crown around 1370 (blue line). Red lines represent the average revenues before and after the Battle of Grunwald.

Figure 1.13: **Commanders' and castellans' duration by 50-year periods (OLS)**



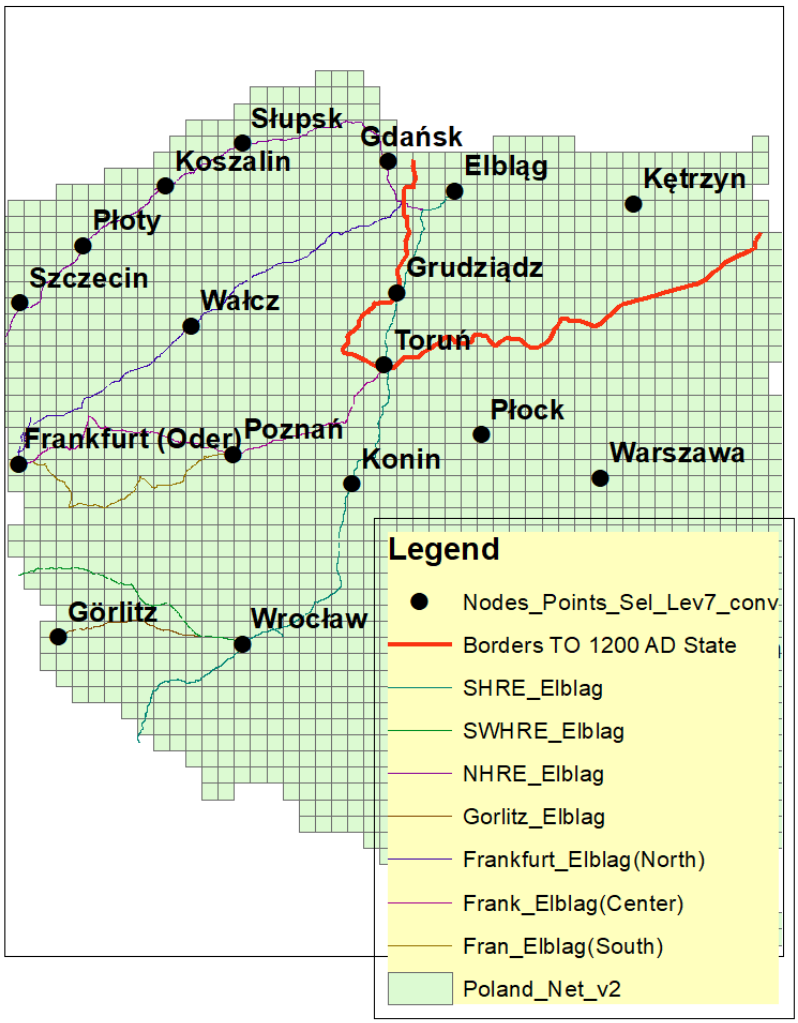
OLS coefficients by half century: Impact of Teutonic Order presence over the duration of the Order's commanders and Polish Castellans.

Figure 1.14: **Commanders' and castellans' duration. OLS, DiD comparison**



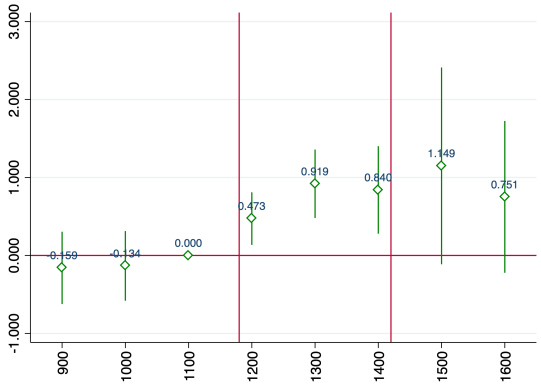
Coefficient comparison of different specifications measuring the impact of Teutonic Order presence on the duration of the Order's commanders and Polish castellans. The first is an OLS coefficient excluding Pomerelia. The second is a cross-sectional DiD coefficient, comparing Pomerelia and Polish territories and leveraging the Teutonic Order's conquest of Pomerelia in 1308. The third is a cross-sectional DiD coefficient which exploits the loss of Kulmerland, Pomerelia, and Malbork (Royal Prussia) after 1466, following the Second Peace of Torun. The third specification measures how the passage from the Order to Polish crown, and from commanders to castellans, affect their length of service.

Figure 1.15: **Main routes to Elblang from the 13th century**

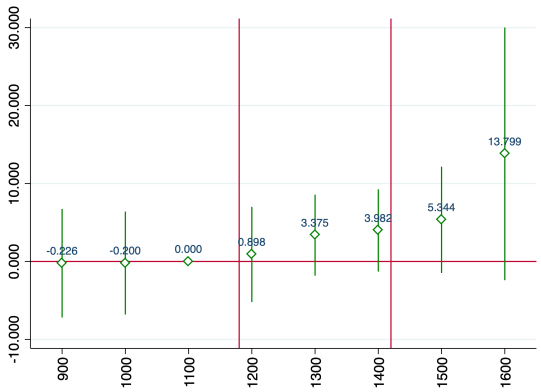


Main routes directed to Elblag controlling for the passage of the Preußenreisen and market integration. The red lines represent the borders of the Teutonic-Order state in the 13th century. **Source:** Holterman et al. (2021)

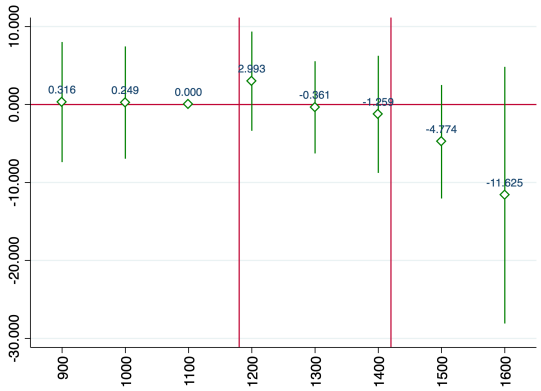
Figure 1.16: **The Teutonic Order and town charters on economic development**



(a) Teutonic Order coefficients



(b) Magdeburg-Law spread coefficients



(c) Teutonic Order × Magdeburg-Law coefficients

Event study according to eq. 1.2 with new buildings per century as the outcome. Where $TO_s \times Cen_t^j$, as before, measures the effect of the Teutonic Order over time (pic. (a)). $T.C._s \times Cen_t^j$ measures the spread of the Magdeburg law over time (pic. (b)); $TO_s \times TC_s \times Cen_t^j$ represents the triple interaction between centuries, town charters, and the Teutonic-Order state (pic. (c)). I restrict the sample to observations within 50km of the borders.

1.10 Tables

Table 1.1: **Descriptive statistics of the outcome variables**

Panel A. Year 1100

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.00	0.03	0.03	0.0	0.2	0.0	350
Civil Buildings	0.00	0.01	0.01	0.0	0.1	0.0	350
Religious Buildings	0.00	0.02	0.02	0.0	0.2	0.0	350
Military Buildings	0.00	0.00	0.00	0.0	0.0	0.0	350
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	350
Cities with Magdeburg Law	0.00	0.00	0.00	0.0	0.0	0.0	350
Number of Towns	0.00	0.00	0.00	0.0	0.0	0.0	350
N	350						

Panel B. Year 1200

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.67	0.19	-0.47*	2.7	0.6	0.2	350
Civil Buildings	0.23	0.07	-0.16	1.5	0.3	0.1	350
Religious Buildings	0.23	0.10	-0.13	0.8	0.4	0.1	350
Military Buildings	0.18	0.02	-0.16*	0.8	0.1	0.1	350
Palaces	0.01	0.00	-0.01	0.1	0.0	0.0	350
Cities with Magdeburg Law	0.09	0.04	-0.05	0.3	0.2	0.0	350
Number of Towns	0.11	0.08	-0.02	0.3	0.3	0.0	350
N	350						

Panel C. Year 1300

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	2.04	0.75	-1.29**	4.2	3.0	0.4	350
Civil Buildings	0.48	0.12	-0.37	2.6	0.8	0.2	350
Religious Buildings	1.10	0.41	-0.69***	1.7	1.3	0.2	350
Military Buildings	0.36	0.18	-0.18	0.9	1.0	0.1	350
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	350
Cities with Magdeburg Law	0.18	0.08	-0.10**	0.4	0.3	0.0	350
Number of Towns	0.25	0.25	0.00	0.5	0.6	0.1	350
N	350						

Summary statistics for the outcomes (total numbers of buildings, number of civil buildings, number of religious buildings, number of military buildings) in the 12th century (Panel A), 13th century (Panel B), and 14th century (Panel C), restricting the sample to the observations within 50km from the 13th century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control groups. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table 1.2: **Possible confounding variables: 50km from the 13th century borders**

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Archaeological Sites (Count)							
Stone Age	0.09	0.16	0.07	0.5	0.6	0.1	350
Prehistory	0.19	0.04	-0.15	1.1	0.2	0.1	350
Bronze Age	0.99	0.81	-0.18	1.5	1.3	0.1	350
Iron Age	0.32	0.73	0.41*	0.9	2.1	0.2	350
High Middle Ages (Before 13th cen.)	0.92	0.75	-0.17	1.3	1.1	0.1	350
Late Middle Ages (After 13th cen.)	0.26	0.13	-0.13*	0.6	0.4	0.1	350
Land Suitability (Mean)							
Barley	0.88	0.78	-0.10**	0.3	0.3	0.0	350
Rye	0.93	0.93	-0.00	0.2	0.2	0.0	350
Wheat	0.71	0.49	-0.22***	0.4	0.4	0.0	345
Luvisol Soil	0.16	0.15	-0.01	0.3	0.3	0.0	350
Luvisol × Barley Suitability	0.15	0.13	-0.02	0.3	0.3	0.0	350
Trade and Geographic Access							
Access to Trade Routes	0.63	0.58	-0.05	0.5	0.5	0.1	350
River Access	0.63	0.37	-0.26***	0.5	0.5	0.1	350
Dist. to Nearest Road (m)	1102.29	1064.97	-37.32	199.9	299.7	26.9	350
Dist. to Nearest River (m)	3170.23	3278.86	108.63	1000.8	913.3	103.3	350
Terrain (Mean)							
Altitude (m)	112.21	108.08	-4.14	53.6	35.8	5.0	350
Slope	0.14	0.13	-0.01	0.1	0.1	0.0	350
N	350						

Summary statistics for the possible confounding variables, restricting the sample to observations within 50km of the 13th century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control group. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table 1.3: **Teutonic Order territories in the 13th century on land onership (OLS regression)**

	(1) Crown Land	(2) Crown Land	(3) Crown Land	(4) Crown Land	(5) Crown Land	(6) Crown Land
TO (13th borders) = 1	0.16***	0.16**	0.16***	0.14**	0.16**	0.14*
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.06)
std. β	0.55***	0.54**	0.54***	0.49**	0.56**	0.50*
land suitability	No	Yes	No	No	No	Yes
morphology	No	No	Yes	No	No	Yes
access	No	No	No	Yes	No	Yes
# arch. sites	No	No	No	No	Yes	Yes
Observations	62	62	62	62	62	62

OLS coefficients: Impact of Teutonic Order presence on land owned by the ruler per size of the administrative unit (in hectares), controlling for land suitability, terrain morphology, trade access, archaeological sites, and all factors combined.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table 1.4: **RDD and TO interacted with northern and southern routes: all buildings**

Northern Routes

	Build.1000	Build.1100	Build.1200	Build.1300	Build.1400	Build.1500	Build.1600
Elblag-HRE (Northern) Route							
TO=1	-0.04	-0.09**	1.28*	3.60***	0.64	-0.56	-0.65
	(0.02)	(0.03)	(0.47)	(0.40)	(0.56)	(0.66)	(0.64)
NEAR DIST(100km)	0.00	0.00	-0.01	-0.01	-0.00	-0.03	0.03
	(0.00)	(0.00)	(0.02)	(0.04)	(0.03)	(0.07)	(0.07)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.02	-0.14***	0.02	0.05	0.05
	(0.00)	(0.00)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)
Elblag-Frankfurt (Northern) Route							
TO=1	-0.02	-0.26***	1.37	2.89***	1.06	-0.26	-0.10
	(0.01)	(0.06)	(0.68)	(0.47)	(0.88)	(0.33)	(0.61)
NEAR DIST(100km)	0.00	-0.00	-0.03**	-0.04	-0.05	-0.11	-0.04
	(.)	(0.00)	(0.01)	(0.04)	(0.04)	(0.08)	(0.07)
TO=1 × NEAR DIST(100km)	0.00	0.00**	-0.07	-0.28*	-0.11	0.03	-0.08
	(.)	(0.00)	(0.06)	(0.10)	(0.20)	(0.15)	(0.17)

Southern Routes

	Build.1000	Build.1100	Build.1200	Build.1300	Build.1400	Build.1500	Build.1600
Elblag-Frankfurt (Central) Route							
TO=1	-0.03	-0.08**	1.56*	3.31***	1.26	-0.35	-0.32
	(0.02)	(0.02)	(0.67)	(0.38)	(0.83)	(0.41)	(0.54)
NEAR DIST(100km)	-0.00	-0.00	-0.02	-0.02	-0.02	-0.03	-0.00
	(0.00)	(0.00)	(0.02)	(0.04)	(0.03)	(0.06)	(0.06)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.06	-0.15***	-0.05	0.05	0.02
	(0.00)	(0.00)	(0.05)	(0.04)	(0.05)	(0.03)	(0.03)
Elblag-Frankfurt (Southern) Route							
TO=1	-0.03	-0.08**	1.54*	3.29***	1.25	-0.38	-0.34
	(0.02)	(0.02)	(0.68)	(0.39)	(0.84)	(0.41)	(0.54)
NEAR DIST(100km)	-0.00	-0.00	-0.03	-0.04	-0.02	-0.06	-0.03
	(0.00)	(0.00)	(0.02)	(0.05)	(0.03)	(0.07)	(0.06)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.06	-0.15**	-0.05	0.05	0.03
	(0.00)	(0.00)	(0.05)	(0.04)	(0.05)	(0.04)	(0.03)
Elblag-HRE(South-Western) Route							
TO=1	-0.04*	-0.08**	1.47	3.16***	1.23	-0.54	-0.47
	(0.02)	(0.02)	(0.75)	(0.46)	(0.86)	(0.44)	(0.63)
NEAR DIST(100km)	-0.00	-0.00	-0.04*	-0.07***	-0.02	-0.08**	-0.06
	(0.00)	(0.00)	(0.02)	(0.01)	(0.01)	(0.02)	(0.04)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.06	-0.15**	-0.05	0.06	0.03
	(0.00)	(0.00)	(0.05)	(0.04)	(0.05)	(0.03)	(0.03)
Elblag-HRE (Southern) Route							
TO=1	-0.04*	-0.08**	1.47	3.14***	1.21	-0.55	-0.51
	(0.02)	(0.02)	(0.75)	(0.47)	(0.88)	(0.43)	(0.63)
NEAR DIST(100km)	-0.00*	-0.00	-0.04*	-0.08**	-0.03	-0.09**	-0.08*
	(0.00)	(0.00)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.06	-0.15**	-0.05	0.05	0.03
	(0.00)	(0.00)	(0.05)	(0.04)	(0.06)	(0.03)	(0.03)
Elblag-Goritz Route							
TO=1	-0.04*	-0.08**	1.47	3.14***	1.22	-0.57	-0.49
	(0.02)	(0.02)	(0.76)	(0.47)	(0.87)	(0.43)	(0.63)
NEAR DIST(100km)	-0.00	-0.00	-0.04*	-0.07***	-0.03*	-0.09**	-0.07
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.02)	(0.04)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.06	-0.15**	-0.05	0.06	0.03
	(0.00)	(0.00)	(0.05)	(0.04)	(0.05)	(0.03)	(0.03)

RDD coefficients according to eq. 1.1. *Build.#* is the number of buildings constructed in a century. NEAR DISTANCE (100km) indicates the distance (in 100 km units) from each of the trade routes originating in Elbląg and leading to different destinations (e.g., the Holy Roman Empire, Gorizia, Frankfurt, etc.). In each regression, distance is calculated with respect to a specific route. The term $1.TO_{s,t=\text{cen.}}\times$ NEAR DISTANCE (100km) represents the interaction between the Teutonic Order state and the distance from the respective Elbląg route. $X'_{s,t=cen.}$ is a set of control variables. Each column evaluates the RDD in a given century (from the 12th to 17th centuries).

***Significant at 0.1%; **significant at 1%; *significant at 5%

A First Appendix: Additional Tables

A.1 Data and Descriptive Tables

Table A.1: **Outcome variables: 20km from the 13th-century borders**

Panel A. 12th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.00	0.00	0.00	0.0	0.0	0.0	147
Civil Buildings	0.00	0.00	0.00	0.0	0.0	0.0	147
Religious Buildings	0.00	0.00	0.00	0.0	0.0	0.0	147
Military Buildings	0.00	0.00	0.00	0.0	0.0	0.0	147
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	147
Cities with Magdeburg Law	0.00	0.00	0.00	0.0	0.0	0.0	147
Number of Towns	0.00	0.00	0.00	0.0	0.0	0.0	147
N	147						

Panel B. 13th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	1.14	0.24	-0.89*	3.7	0.8	0.4	147
Civil Buildings	0.41	0.09	-0.32	2.1	0.3	0.2	147
Religious Buildings	0.37	0.11	-0.26*	1.0	0.5	0.1	147
Military Buildings	0.31	0.03	-0.28*	1.0	0.2	0.1	147
Palaces	0.01	0.00	-0.01	0.1	0.0	0.0	147
Cities with Magdeburg Law	0.12	0.05	-0.08	0.3	0.2	0.0	147
Number of Towns	0.17	0.08	-0.10	0.4	0.3	0.1	147
N	147						

Panel C. 14th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	2.54	1.27	-1.27	5.4	4.8	0.8	147
Civil Buildings	0.70	0.18	-0.52	3.5	1.2	0.4	147
Religious Buildings	1.25	0.70	-0.55	1.8	2.0	0.3	147
Military Buildings	0.42	0.32	-0.10	1.0	1.5	0.2	147
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	147
Cities with Magdeburg Law	0.19	0.09	-0.09	0.4	0.3	0.1	147
Number of Towns	0.27	0.23	-0.04	0.5	0.7	0.1	147
N	147						

Summary statistics for the outcomes (total number of buildings, number of civil buildings, religious buildings, and military buildings) from the 12th to 14th centuries, restricting the sample to observations within 20 km of the 13th-century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control group. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.2: **Outcome variables: 100km from the 13th-century borders**

Panel A. 12th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.00	0.05	0.05***	0.0	0.3	0.0	662
Civil Buildings	0.00	0.01	0.01*	0.0	0.1	0.0	662
Religious Buildings	0.00	0.04	0.04**	0.0	0.2	0.0	662
Military Buildings	0.00	0.00	0.00	0.0	0.0	0.0	662
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	662
Cities with Magdeburg Law	0.00	0.00	0.00	0.0	0.0	0.0	662
Number of Towns	0.00	0.00	0.00	0.0	0.0	0.0	662
N	662						

Panel B. 13th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.47	0.15	-0.33*	2.3	0.5	0.1	662
Civil Buildings	0.18	0.06	-0.12	1.2	0.2	0.1	662
Religious Buildings	0.15	0.07	-0.08	0.6	0.3	0.0	662
Military Buildings	0.12	0.01	-0.11**	0.6	0.1	0.0	662
Palaces	0.00	0.00	-0.00	0.1	0.0	0.0	662
Cities with Magdeburg Law	0.08	0.03	-0.05*	0.3	0.2	0.0	662
Number of Towns	0.09	0.08	-0.01	0.3	0.3	0.0	662
N	662						

Panel C. 14th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	2.01	0.49	-1.52***	3.7	2.1	0.3	662
Civil Buildings	0.44	0.09	-0.35*	2.1	0.6	0.1	662
Religious Buildings	1.08	0.25	-0.83***	1.6	0.9	0.1	662
Military Buildings	0.42	0.12	-0.31***	1.0	0.7	0.1	662
Palaces	0.00	0.01	0.01	0.0	0.1	0.0	662
Cities with Magdeburg Law	0.23	0.09	-0.14***	0.5	0.3	0.0	662
Number of Towns	0.26	0.26	-0.00	0.5	0.5	0.0	662
N	662						

Summary statistics for the outcomes (total number of buildings, number of civil buildings, religious buildings, and military buildings) from the 12th to 14th centuries, restricting the sample to observations within 100 km of the 13th-century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control group. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.3: **Outcome variables: 200km from the 13th-century borders**

Panel A. 12th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.00	0.04	0.04***	0.0	0.2	0.0	1151
Civil Buildings	0.00	0.01	0.01***	0.0	0.1	0.0	1151
Religious Buildings	0.00	0.03	0.03***	0.0	0.2	0.0	1151
Military Buildings	0.00	0.00	0.00	0.0	0.0	0.0	1151
Palaces	0.00	0.00	0.00	0.0	0.0	0.0	1151
Cities with Magdeburg Law	0.00	0.00	0.00	0.0	0.0	0.0	1151
Number of Towns	0.00	0.00	0.00	0.0	0.0	0.0	1151
N	1151						

Panel B. 13th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	0.46	0.18	-0.28	2.2	0.6	0.1	1151
Civil Buildings	0.17	0.08	-0.10	1.2	0.3	0.1	1151
Religious Buildings	0.15	0.09	-0.06	0.6	0.4	0.0	1151
Military Buildings	0.12	0.01	-0.11*	0.6	0.2	0.0	1151
Palaces	0.00	0.00	-0.00	0.1	0.0	0.0	1151
Cities with Magdeburg Law	0.07	0.05	-0.03	0.3	0.2	0.0	1151
Number of Towns	0.09	0.12	0.03	0.3	0.3	0.0	1151
N	1151						

Panel C. 14th century

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Total Buildings	1.97	0.47	-1.50***	3.7	1.6	0.2	1151
Civil Buildings	0.43	0.11	-0.33*	2.1	0.5	0.1	1151
Religious Buildings	1.06	0.23	-0.83***	1.5	0.8	0.1	1151
Military Buildings	0.41	0.11	-0.30***	1.0	0.6	0.1	1151
Palaces	0.00	0.00	0.00	0.0	0.1	0.0	1151
Cities with Magdeburg Law	0.22	0.11	-0.11***	0.5	0.3	0.0	1151
Number of Towns	0.26	0.30	0.04	0.5	0.5	0.0	1151
N	1151						

Summary statistics for the outcomes (total number of buildings, number of civil buildings, religious buildings, and military buildings) from the 12th to 14th centuries, restricting the sample to observations within 200 km of the 13th-century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control group. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.4: **Possible confounding variables: 20km from the 13th century borders**

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Archaeological Sites (Count)							
Stone Age	0.12	0.17	0.04	0.7	0.7	0.1	147
Prehistory	0.22	0.03	-0.19	1.5	0.2	0.2	147
Bronze Age	0.00	0.03	0.03	0.0	0.2	0.0	147
Iron Age	0.40	0.62	0.23	1.0	2.6	0.3	147
High Middle Ages (Before 13th cen.)	1.10	0.88	-0.22	1.5	1.2	0.2	147
Late Middle Ages (After 13th cen.)	0.41	0.18	-0.23*	0.7	0.5	0.1	147
Land Suitability (Mean)							
Barley	0.85	0.73	-0.12*	0.3	0.4	0.1	147
Rye	0.91	0.95	0.03	0.2	0.2	0.0	147
Wheat	0.63	0.44	-0.19*	0.4	0.5	0.1	144
Luvisol Soil	0.19	0.13	-0.05	0.4	0.3	0.1	147
Luvisol × Barley Suitability	0.17	0.07	-0.10*	0.3	0.2	0.0	147
Trade and Geographic Access							
Access to Trade Routes	0.64	0.52	-0.13	0.5	0.5	0.1	147
River Access	0.54	0.42	-0.12	0.5	0.5	0.1	147
Dist. to Nearest Road (m)	1037.06	1056.91	19.85	228.0	260.5	40.9	147
Dist. to Nearest River (m)	3237.99	3214.71	-23.28	1048.9	913.2	161.9	147
Terrain (Mean)							
Altitude (m)	98.11	100.39	2.28	53.8	42.2	7.9	147
Slope	0.12	0.12	0.00	0.1	0.1	0.0	147
N	147						

Summary statistics for the possible confounding variables, restricting the sample to the observations within 20km of the 13th century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In Column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control groups. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.5: **Possible confounding variables: 100km from the 13th century borders**

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Archaeological Sites (Count)							
Stone Age	0.07	0.15	0.09*	0.5	0.6	0.0	662
Prehistory	0.21	0.04	-0.17**	1.0	0.2	0.1	662
Bronze Age	0.01	0.12	0.11***	0.1	0.5	0.0	662
Iron Age	0.30	0.75	0.45***	0.8	1.9	0.1	662
High Middle Ages (Before 13th cen.)	0.88	0.84	-0.03	1.3	1.4	0.1	662
Late Middle Ages (After 13th cen.)	0.29	0.13	-0.16***	0.6	0.4	0.0	662
Land Suitability (Mean)							
Barley	0.91	0.77	-0.14***	0.2	0.3	0.0	662
Rye	0.94	0.95	0.00	0.2	0.2	0.0	662
Wheat	0.79	0.48	-0.31***	0.4	0.4	0.0	656
Luvisol Soil	0.16	0.22	0.06*	0.3	0.4	0.0	662
Luvisol × Barley Suitability	0.16	0.18	0.02	0.3	0.4	0.0	662
Trade and Geographic Access							
Access to Trade Routes	0.62	0.61	-0.00	0.5	0.5	0.0	662
River Access	0.54	0.40	-0.14***	0.5	0.5	0.0	662
Dist. to Nearest Road (m)	1125.20	1095.91	-29.29	170.1	386.0	21.7	662
Dist. to Nearest River (m)	3172.08	2958.36	-213.72*	971.4	1119.6	83.3	662
Terrain (Mean)							
Altitude (m)	112.10	110.56	-1.54	48.4	35.5	3.6	662
Slope	0.17	0.13	-0.04***	0.1	0.1	0.0	662
N	662						

Summary statistics for the possible confounding variables, restricting the sample to the observations within 100km of the 13th century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In Column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control groups. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.6: **Possible confounding variables: 200km from the 13th century borders**

	(1) Mean (Treatment)	(2) Mean (Control)	(3) Diff.	(4) Std. Dev. (Treatment)	(5) Std. Dev. (Control)	(6) Std. Err. (Diff.)	(7) Obs.
Archaeological Sites (Count)							
Stone Age	0.07	0.25	0.18***	0.4	1.3	0.1	1151
Prehistory	0.21	0.03	-0.19**	1.0	0.2	0.1	1151
Bronze Age	0.01	0.25	0.24***	0.1	1.0	0.0	1151
Iron Age	0.30	0.68	0.39***	0.8	2.0	0.1	1151
High Middle Ages (Before 13th cen.)	0.87	1.05	0.18	1.3	1.6	0.1	1151
Late Middle Ages (After 13th cen.)	0.28	0.20	-0.08	0.6	0.7	0.0	1151
Land Suitability (Mean)							
Barley	0.91	0.76	-0.15***	0.2	0.3	0.0	1151
Rye	0.95	0.95	0.01	0.2	0.2	0.0	1151
Wheat	0.79	0.47	-0.33***	0.4	0.4	0.0	1143
Luvisol Soil	0.16	0.26	0.10***	0.3	0.4	0.0	1151
Luvisol × Barley Suitability	0.15	0.21	0.05*	0.3	0.4	0.0	1151
Trade and Geographic Access							
Access to Trade Routes	0.63	0.64	0.01	0.5	0.5	0.0	1151
River Access	0.53	0.30	-0.22***	0.5	0.5	0.0	1151
Dist. to Nearest Road (m)	1126.23	1181.33	55.10*	168.1	587.2	22.3	1151
Dist. to Nearest River (m)	3186.83	2409.82	-777.02***	965.4	1335.8	76.2	1151
Terrain (Mean)							
Altitude (m)	110.86	113.80	2.94	48.5	41.9	3.4	1151
Slope	0.17	0.14	-0.03***	0.1	0.1	0.0	1151
N	1151						

Summary statistics for the possible confounding variables, restricting the sample to the observations within 200km of the 13th century borders. Columns (1) and (2) show the means for each control variable by the treatment and control group. In Column (3) I test that the "differences between the outcomes' means" of control and treatment groups are significantly different from 0 through a two-sided test. Columns (4) and (5) show the standard deviation for each control variable by the treatment and control groups. Column (6) shows the standard deviations difference. Column (7) shows the number of observations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.7: **RDD balance across Teutonic Order borders**

13th century borders

	(1)	(2)	(3)	(4)	(5)
Archeological sites presence					
VARIABLES	Stone Age Sites	PreHist. Age Sites	Bronze Age	Iron Age	High Middle Ages
RD Estimate	0.09	0.49*	−0.01	0.98*	0.51
	(0.18)	(0.22)	(0.01)	(0.45)	(0.45)
Land and Agriculture Suitability					
VARIABLES	Barley	Rye	Wheat	Luvisol	Luvisol × Barley
RD Estimate	−0.02	−0.07	0.10	0.19**	0.19***
	(0.08)	(0.09)	(0.11)	(0.07)	(0.04)
Access and Trade feasibility					
VARIABLES	Routes Access	Streets Distance	Rivers Access	Rivers Access	
RD Estimate	−0.23	27.95	−0.08	543.55	
	(0.12)	(26.17)	(0.29)	(439.42)	
Land Morphology					
VARIABLES	Height	Slope			
RD Estimate	−6.30	−0.03			
	(14.49)	(0.02)			

RDD coefficients with potential confounding variables as the outcome. I use a second order polynomial to account for the distance from the border as the cut-off. Row (1) measures the presence of socio-economic development coefficients across the 13th century borders prior to the Northern Crusades, as measured by the presence of archaeological sites in a 20x20km square. Row (2) shows the presence of jumps for land suitability. Row (3) shows the presence of jumps for the accessibility to the main land and water routes. Row (4) shows the presence of jumps for the morphology of the land.

***Significant at 0.1%; **significant at 1%; *significant at 5%

A.2 RDD: Results

Table A.8: **RDD by century on 13th-century borders**

Panel A. Number of new buildings

Century	(1) 1000	(2) 1100	(3) 1200	(4) 1300	(5) 1400	(6) 1500	(7) 1600
RD Estimate	−0.00	−0.03	1.41**	1.90**	3.54*	0.89	-0.51
	(0.01)	(0.03)	(0.53)	(0.62)	(1.73)	(1.12)	(1.05)
N. obs.	1151	1151	1151	1151	1151	1151	1151
Baseline controls	✓	✓	✓	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓	✓	✓	✓
Bandwidth	93.13	44.79	52.14	39.55	34.19	38.09	54.39
std. β^*	−0.03	−0.05	0.49	0.33	0.42	0.14	−0.04

Panel B. Number of town charters

Century	(1) 1000	(2) 1100	(3) 1200	(4) 1300	(5) 1400	(6) 1500	(7) 1600
RD Estimate	N.A.	N.A.	0.16**	0.36**	0.33	0.37*	0.35
	N.A.	N.A.	(0.06)	(0.13)	(0.18)	(0.37)	(0.35)
N. obs.	N.A.	N.A.	1,151	1151	1151	1151	1151
Baseline controls	✓	✓	✓	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓	✓	✓	✓
Bandwidth	N.A.	N.A.	33.85	21.25	25.50	29.03	26.75
std. β^*	N.A.	N.A.	0.28	0.40	0.33	0.37	0.34

RDD coefficients according to the specification in eq. 1.1, with the flow number of buildings (Panel A) and the number of town charters (Panel B) by century as the outcome. I employ the 13th-century borders as the cut-off. Columns (1)–(7) test the RDD in the 11th, 12th, 13th, 14th, 15th, 16th, and 17th centuries, respectively.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.9: **RDD with the number of buildings in the 13th-century 13th-century borders cut-off**

Panel A. Flow

	(1) 1200 Full	(2) 1200 Natural	(3) 1200 North	(4) 1200 Center-South
RD Estimate	1.41**	4.25***	1.15*	0.96**
	(0.53)	(0.40)	(0.55)	(0.30)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	0.180	0.211	0.209	0.129
Mean right	0.461	0.633	0.521	0.478
Bandwidth	52.14	199.6	70.85	18.59
Order polyn.	2	2	2	2

Panel B. Stock (cumulative)

	(1) 1200 Full	(2) 1200 Natural	(3) 1200 North	(4) 1200 Center-South
RD Estimate	1.39**	4.14***	1.04	1.15**
	(0.53)	(0.40)	(0.60)	(0.36)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	0.231	0.272	0.272	0.185
Mean right	0.461	0.633	0.521	0.478
Bandwidth	51.12	199.6	67.96	18.15
Order polyn.	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, with the flow (Panel A) and stock (Panel B) number of buildings in the 13th century as the outcome. Column (1) tests the RDD for the total 13th-century borders. Column (2) tests the RDD for the natural 13th-century borders. Column (3) tests the RDD for the northern 13th-century borders. Column (4) tests the RDD for the central-southern 13th-century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.10: **RDD with the number of buildings in the 14th-century 13th- and 14th-century borders cut-off**

Panel A. Flow

	(1) 1300 Full (1300 Borders)	(2) 1300 Full (1200 Borders)	(3) 1300 Natural	(4) 1300 North	(5) 1300 Center-South
RD Estimate	0.49	1.90**	4.86***	0.23	1.64***
	(0.55)	(0.62)	(0.44)	(0.99)	(0.48)
Observations	1173	1151	937	881	1151
Baseline controls	✓	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓	✓
Mean left	0.392	0.468	0.554	0.541	0.468
Mean right	1.680	1.967	2.480	2.214	1.967
Bandwidth	30.31	39.55	199.6	59.37	37.18
Order polyn.	2	2	2	2	2

Panel B. Stock (cumulative)

	(1) 1300 Full (1300 Borders)	(2) 1300 Full (1200 Borders)	(3) 1300 Natural	(4) 1300 North	(5) 1300 Center-South
RD Estimate	1.31	3.14***	9.01***	0.44	2.43***
	(0.74)	(0.94)	(0.79)	(0.78)	(0.61)
Observations	1173	1151	937	881	1151
Baseline controls	✓	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓	✓
Mean left	0.622	0.699	0.826	0.812	0.699
Mean right	2.079	2.428	3.113	2.735	2.428
Bandwidth	27.94	49.68	199.6	72.59	31.07
Order polyn.	2	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, with the flow (Panel A) and stock (Panel B) number of buildings in the 14th century as the outcome. Column (1) tests the RDD for the total 14th-century borders. Column (2) tests the RDD for the total 13th-century borders. Column (3) tests the RDD for the natural 13th-century borders. Column (4) tests the RDD for the northern 13th-century borders. Column (5) tests the RDD for the central-southern 13th-century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.11: **RDD with the number of buildings in the 15th-century 13th-century borders cut-off**

Panel A. Flow

	(1) 1400 Full	(2) 1400 Natural	(3) 1400 North	(4) 1400 Center-South
RD Estimate	3.54*	5.97***	−0.80	2.88***
	(1.73)	(0.66)	(1.34)	(0.84)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	0.573	0.657	0.601	0.573
Mean right	0.864	1.096	0.967	0.864
Bandwidth	34.19	199.6	76.77	44.27
Order polyn.	2	2	2	2

Panel B. Stock (cumulative)

	(1) 1400 Full	(2) 1400 Natural	(3) 1400 North	(4) 1400 Center-South
RD Estimate	5.52**	14.98***	0.07	5.62***
	(1.74)	(1.42)	(1.82)	(1.49)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	1.272	1.483	1.413	1.272
Mean right	3.292	4.209	3.702	3.292
Bandwidth	47.64	199.6	67.19	42.99
Order polyn.	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, with the flow (Panel A) and stock (Panel B) number of buildings in the 15th century as the outcome. Column (1) tests the RDD for the total 13th-century borders. Column (2) tests the RDD for the natural 13th-century borders. Column (3) tests the RDD for the northern 13th-century borders. Column (4) tests the RDD for the central-southern 13th-century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.12: **RDD with the number of buildings in the 16th-century 13th-century borders cut-off**

Panel A. Flow

	(1) 1500 Full	(2) 1500 Natural	(3) 1500 North	(4) 1500 Center-South
RD Estimate	0.89	1.40***	2.66	0.72***
	(1.12)	(0.36)	(1.39)	(0.19)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	0.597	0.650	0.574	0.597
Mean right	0.461	0.469	0.460	0.461
Bandwidth	38.09	199.6	39.14	29.50
Order polyn.	2	2	2	2

Panel B. Stock (cumulative)

	(1) 1500 Full	(2) 1500 Natural	(3) 1500 North	(4) 1500 Center-South
RD Estimate	6.74*	16.38***	0.95	6.22***
	(3.27)	(1.66)	(2.12)	(1.71)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	1.869	2.133	1.986	1.869
Mean right	3.753	4.678	4.163	3.753
Bandwidth	40.64	199.6	57	41.66
Order polyn.	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, with the flow (Panel A) and stock (Panel B) number of buildings in the 16th century as the outcome. Column (1) tests the RDD for the total 13th-century borders. Column (2) tests the RDD for the natural 13th-century borders. Column (3) tests the RDD for the northern 13th-century borders. Column (4) tests the RDD for the central-southern 13th-century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.13: **RDD with the number of buildings in the 17th-century 13th-century borders cut-off**

Panel A. Flow

	(1) 1600 Full	(2) 1600 Natural	(3) 1600 North	(4) 1600 Center-South
RD Estimate	−0.51	0.65	−1.36	−0.36
	(1.05)	(0.94)	(1.93)	(0.38)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	1.186	1.311	1.077	1.186
Mean right	0.691	0.774	0.749	0.691
Bandwidth	54.39	199.6	47.27	37.68
Order polyn.	2	2	2	2

Panel B. Stock (cumulative)

	(1) 1600 Full	(2) 1600 Natural	(3) 1600 North	(4) 1600 Center-South
RD Estimate	7.88	17.02***	0.28	6.21**
	(6.31)	(2.29)	(2.70)	(1.95)
Observations	1151	937	881	1151
Baseline controls	✓	✓	✓	✓
Zones FEs	✓	✓	✓	✓
Mean left	3.055	3.443	3.063	3.055
Mean right	4.444	5.452	4.912	4.444
Bandwidth	37.34	199.6	51.24	39.36
Order polyn.	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, with the flow (Panel A) and stock (Panel B) number of buildings in the 17th century as the outcome. Column (1) tests the RDD for the total 13th-century borders. Column (2) tests the RDD for the natural 13th-century borders. Column (3) tests the RDD for the northern 13th-century borders. Column (4) tests the RDD for the central-southern 13th-century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.14: **RDD on 13th century central-southern borders: confounding variables**

	(1)	(2)	(3)	(4)	(5)
Archeological sites presence					
VARIABLES	Stone Age Sites	PreHist. Age Sites	Bronze Age	Iron Age	High Middle Ages
RD Estimate	0.06**	0.69***	0.01*	0.46***	0.15
	(0.02)	(0.19)	(0.00)	(0.13)	(0.24)
Land and Agriculture Suitability					
VARIABLES	Barley	Rye	Wheat	Luvisol	Luvisol × Barley
RD Estimate	-0.03	-0.05	-0.07	0.19***	0.15
	(0.08)	(0.04)	(0.11)	(0.05)	(0.08)
Access and Trade feasibility					
VARIABLES	Routes Access	Streets Distance	Rivers Access	Rivers Access	
RD Estimate	−0.27***	6.33	−0.12	177.99	
	(0.07)	(5.65)	(0.17)	(300.09)	
Land Morphology					
VARIABLES	Height	Slope			
RD Estimate	−5.02	−0.04**			
	(5.16)	(0.01)			

RDD coefficients with potential confounding variables as the outcome. I use a second order polynomial to account for the distance from the border as the cut-off. Row (1) measures the presence of socio-economic development coefficients across the central-southern 13th century borders prior to the Northern Crusades, as measured by the presence of archaeological sites in a 20x20km square. Row (2) shows the presence of jumps for land suitability. Row (3) shows the presence of jumps for the accessibility to the main land and water routes. Row (3) shows the presence of jumps for the morphology of the land.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.15: **RDD on 13th century northern borders: confounding variables**

	(1)	(2)	(3)	(4)	(5)
Archeological sites presence					
VARIABLES	Stone Age Sites	PreHist. Age Sites	Bronze Age	Iron Age	High Middle Ages
RD Estimate	0.12	0.72***	−0.10***	−0.35	0.38
	(0.33)	(0.20)	(0.02)	(0.29)	(0.38)
Land and Agriculture Suitability					
VARIABLES	Barley	Rye	Wheat	Luvisol	Luvisol × Barley
RD Estimate	0.03	−0.13	0.47***	0.41***	0.20***
	(0.03)	(0.07)	(0.04)	(0.05)	(0.06)
Access and Trade feasibility					
VARIABLES	Routes Access	Streets Distance	Rivers Access	Rivers Access	
RD Estimate	−0.21***	85.62***	−0.01	1,481.78***	
	(0.05)	(20.18)	(0.10)	(378.80)	
Land Morphology					
VARIABLES	Height	Slope			
RD Estimate	−1.24	−0.02			
	(6.90)	(0.05)			

RDD coefficients with potential confounding variables as the outcome. I use a second order polynomial to account for the distance from the border as the cut-off. Row (1) measures the presence of socio-economic development coefficients across the northern 13th century borders prior to the Northern Crusades, as measured by the presence of archaeological sites in a 20x20km square. Row (2) shows the presence of jumps for land suitability. Row (3) shows the presence of jumps for the accessibility to the main land and water routes. Row (3) shows the presence of jumps for the morphology of the land.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.16: **Linear RDD, selection of control Variables**

Buildings, macro zones

Panel A. 13th century

	(1) Build.	(2) Build.	(3) Build.	(4) Build.	(5) Build.	(6) Build.	(7) Build.
TO=1	1.12*	0.92*	0.92*	0.94*	0.91*	1.00*	0.93*
	(0.42)	(0.39)	(0.39)	(0.39)	(0.40)	(0.37)	(0.39)
dist borderXIII(100km)	-0.21***	-0.03	-0.03	-0.05	-0.02	-0.08	-0.03
	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)	(0.06)	(0.04)
TO=1 × dist borderXIII(100km)	-1.17	-1.22	-1.20	-1.17	-1.22	-1.28*	-1.18
	(0.64)	(0.57)	(0.57)	(0.58)	(0.57)	(0.54)	(0.58)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.10	0.12	0.12	0.12	0.13	0.14	0.12

Panel B. 14th century

	(1) Build.	(2) Build.	(3) Build.	(4) Build.	(5) Build.	(6) Build.	(7) Build.
TO=1	2.49***	1.81**	1.81**	1.82**	1.73**	1.90***	1.82**
	(0.49)	(0.51)	(0.49)	(0.52)	(0.56)	(0.42)	(0.48)
dist borderXIII(100km)	-0.37***	0.11	0.10	0.06	0.14	0.08	0.09
	(0.09)	(0.24)	(0.22)	(0.19)	(0.22)	(0.26)	(0.21)
TO=1 × dist borderXIII(100km)	-0.64	-1.03	-0.93	-0.92	-0.85	-1.13	-0.89
	(0.77)	(0.59)	(0.59)	(0.58)	(0.56)	(0.67)	(0.58)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.18	0.23	0.23	0.26	0.24	0.24	0.23

RDD according to a linear specification with the flow number of buildings per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the macro regions (see Fig. B.3). Column (3) controls for the interaction between the macro regions and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the macro regions and barley suitability. Column (5) controls for rye suitability and the interaction between the macro regions and rye suitability. Column (6) controls for wheat suitability and the interaction between the macro regions and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the macro regions and the presence of luvisol and barley suitability.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.17: **Linear RDD, selection of control variables**

Buildings, coordinates

Panel A. 13th century

	(1) Build.	(2) Build.	(3) Build.	(4) Build.	(5) Build.	(6) Build.	(7) Build.
TO=1	1.12*	1.25**	1.23**	1.34**	0.91***	1.24***	1.20**
	(0.42)	(0.31)	(0.33)	(0.33)	(0.20)	(0.23)	(0.36)
dist borderXIII(100km)	-0.21***	-0.45***	-0.32	-0.58**	-0.07	-0.28	-0.29*
	(0.03)	(0.08)	(0.15)	(0.15)	(0.09)	(0.22)	(0.11)
TO=1 × dist borderXIII(100km)	-1.17	-0.42	-0.40	-0.14	-0.43	-0.33	-0.45
	(0.64)	(0.54)	(0.63)	(0.54)	(0.38)	(0.71)	(0.64)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.10	0.19	0.26	0.24	0.41	0.27	0.26

Panel B. 14th century

	(1) Build.	(2) Build.	(3) Build.	(4) Build.	(5) Build.	(6) Build.	(7) Build.
TO=1	2.49***	1.71*	1.84**	1.68*	1.37***	1.73**	1.80**
	(0.49)	(0.59)	(0.52)	(0.74)	(0.28)	(0.55)	(0.59)
dist borderXIII(100km)	-0.37***	-0.45	-0.54	-0.94	-0.16	-0.22	-0.46
	(0.09)	(0.63)	(0.50)	(0.63)	(0.65)	(0.66)	(0.49)
TO=1 × dist borderXIII(100km)	-0.64	-0.71	-0.67	-0.36	-0.63	-0.76	-0.72
	(0.77)	(1.25)	(1.29)	(1.33)	(1.47)	(1.28)	(1.26)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.18	0.30	0.33	0.41	0.59	0.37	0.33

RDD according to a linear specification with the flow number of buildings per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the square centroids' longitude and latitude. Column (3) controls for the interaction between the square centroids' longitude and latitude and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the square centroids' longitude and latitude and barley suitability. Column (5) controls for rye suitability and the interaction between the square centroids' longitude and latitude and rye suitability. Column (6) controls for wheat suitability and the interaction between the square centroids' longitude and latitude and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the square centroids' longitude and latitude, the presence of luvisol and barley suitability.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.18: **Linear RDD, selection of control variables**
Magdeburg-Law towns, macro zones

Panel A. 13th century

	(1) Magd City	(2) Magd City	(3) Magd City	(4) Magd City	(5) Magd City	(6) Magd City	(7) Magd City
TO=1	0.13**	0.11**	0.11**	0.11**	0.11**	0.10**	0.11**
	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
dist borderXIII(100km)	-0.05*	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
TO=1 × dist borderXIII(100km)	-0.05	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03
	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.06)	(0.07)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.08	0.09	0.09	0.09	0.09	0.10	0.09

Panel B. 14th century

	(1) Magd City	(2) Magd City	(3) Magd City	(4) Magd City	(5) Magd City	(6) Magd City	(7) Magd City
TO=1	0.13*	0.08	0.08	0.08	1.73**	0.07	0.08
	(0.06)	(0.04)	(0.04)	(0.04)	(0.56)	(0.04)	(0.04)
dist borderXIIIkm	-0.08*	-0.04	-0.05	-0.04	0.14	-0.04	-0.04
	(0.03)	(0.04)	(0.04)	(0.04)	(0.22)	(0.04)	(0.04)
TO=1 × dist borderXIIIkm	0.28*	0.27*	0.28*	0.26*	-0.85	0.31**	0.27*
	(0.10)	(0.10)	(0.10)	(0.09)	(0.56)	(0.09)	(0.09)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.17	0.19	0.19	0.19	0.24	0.20	0.19

RDD according to a linear specification with the number of Magdeburg-Law towns per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the macro regions (see Fig. B.3). Column (3) controls for the interaction between the macro regions and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the macro regions and barley suitability. Column (5) controls for rye suitability and the interaction between the macro regions and rye suitability. Column (6) controls for wheat suitability and the interaction between the macro regions and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the macro regions and the presence of luvisol and barley suitability. ***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.19: **Linear RDD, selection of control variables**

Magdeburg-Law towns, coordinates

Panel A. 13th century

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Magd City	Magd City	Magd City	Magd City	Magd City	Magd City	Magd City
TO=1	0.13**	0.09***	0.10**	0.09**	0.09***	0.08***	0.10**
	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
dist borderXIII(100km)	-0.05*	-0.02	0.02	0.02	0.01	0.03	0.01
	(0.02)	(0.05)	(0.05)	(0.03)	(0.05)	(0.05)	(0.05)
TO=1 × dist borderXIII(100km)	-0.05	-0.02	-0.03	-0.06	-0.06	-0.01	-0.03
	(0.08)	(0.09)	(0.09)	(0.10)	(0.11)	(0.12)	(0.09)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.08	0.15	0.20	0.21	0.18	0.21	0.21

Panel B. 14th century

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Magd City	Magd City	Magd City	Magd City	Magd City	Magd City	Magd City
TO=1	0.13*	0.07*	0.09*	0.05	0.06	0.06	0.09*
	(0.06)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
dist borderXIIIkm	-0.08*	-0.03	-0.02	0.04	0.02	-0.03	-0.01
	(0.03)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)
TO=1 × dist borderXIIIkm	0.28*	0.33*	0.28	0.27	0.29	0.32	0.29
	(0.10)	(0.15)	(0.16)	(0.17)	(0.17)	(0.20)	(0.16)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.17	0.23	0.28	0.27	0.26	0.29	0.29

RDD according to a linear specification with the number of Magdeburg-Law towns per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the square centroids' longitude and latitude. Column (3) controls for the interaction between the square centroids' longitude and latitude and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the square centroids' longitude and latitude and barley suitability. Column (5) controls for rye suitability and the interaction between the square centroids' longitude and latitude and rye suitability. Column (6) controls for wheat suitability and the interaction between the square centroids' longitude and latitude and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the square centroids' longitude and latitude, the presence of luvisol and barley suitability.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.20: **Linear RDD, selection of control variables**

Town Charters, macro zones

Panel A. 13th century

	(1) Number Miasto	(2) Number Miasto	(3) Number Miasto	(4) Number Miasto	(5) Number Miasto	(6) Number Miasto	(7) Number Miasto
TO=1	0.12**	0.09	0.09	0.09	0.09	0.10	0.09
	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.04)
dist borderXIII(100km)	-0.08**	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
TO=1 × dist borderXIII(100km)	0.02	0.01	0.01	0.01	0.02	0.00	0.01
	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.14	0.16	0.16	0.16	0.17	0.16	0.16

Panel B. 14th century

	(1) Number Miasto	(2) Number Miasto	(3) Number Miasto	(4) Number Miasto	(5) Number Miasto	(6) Number Miasto	(7) Number Miasto
TO=1	0.14*	0.03	0.04	0.02	1.73**	0.03	0.04
	(0.05)	(0.05)	(0.05)	(0.05)	(0.56)	(0.07)	(0.05)
dist borderXIIIkm	-0.12**	-0.03	-0.03	-0.02	0.14	-0.03	-0.03
	(0.04)	(0.02)	(0.02)	(0.02)	(0.22)	(0.03)	(0.02)
TO=1 × dist borderXIIIkm	0.20*	0.13	0.14	0.13	-0.85	0.18*	0.13
	(0.09)	(0.08)	(0.08)	(0.08)	(0.56)	(0.08)	(0.08)
Zones FE	No	Yes	No	No	No	No	No
Zones FE*Luv.	No	No	Yes	No	No	No	No
Zones FE*Barley	No	No	No	Yes	No	No	No
Zones FE*Rye	No	No	No	No	Yes	No	No
Zones FE*Wheat	No	No	No	No	No	Yes	No
Zones FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.21	0.25	0.25	0.26	0.24	0.26	0.25

RDD according to a linear specification with the number of towns having a town charter per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the macro regions (see Fig. B.3). Column (3) controls for the interaction between the macro regions and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the macro regions and barley suitability. Column (5) controls for rye suitability and the interaction between the macro regions and rye suitability. Column (6) controls for wheat suitability and the interaction between the macro regions and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the macro regions and the presence of luvisol and barley suitability.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.21: **Linear RDD, selection of control variables**

Town Charters, coordinates

Panel A. 13th century

	(1) Number Miasto	(2) Number Miasto	(3) Number Miasto	(4) Number Miasto	(5) Number Miasto	(6) Number Miasto	(7) Number Miasto
TO=1	0.12**	0.07	0.07*	0.07*	0.10*	0.07	0.07*
	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)
dist borderXIII(100km)	-0.08**	0.01	0.05	0.01	0.05	0.03	0.05
	(0.02)	(0.06)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)
TO=1 × dist borderXIII(100km)	0.02	-0.03	-0.02	-0.03	-0.08	0.04	-0.02
	(0.04)	(0.08)	(0.09)	(0.10)	(0.09)	(0.13)	(0.08)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.14	0.22	0.29	0.30	0.27	0.26	0.29

Panel B. 14th century

	(1) Number Miasto	(2) Number Miasto	(3) Number Miasto	(4) Number Miasto	(5) Number Miasto	(6) Number Miasto	(7) Number Miasto
TO=1	0.14*	0.02	0.09*	0.04	0.06	0.05	0.07
	(0.05)	(0.05)	(0.04)	(0.03)	(0.06)	(0.05)	(0.04)
dist borderXIIIkm	-0.12**	-0.01	-0.02	-0.06	-0.03	-0.09	0.00
	(0.04)	(0.04)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)
TO=1 × dist borderXIIIkm	0.20*	0.30*	0.28*	0.41**	0.35**	0.43*	0.27*
	(0.09)	(0.12)	(0.10)	(0.11)	(0.11)	(0.15)	(0.09)
Zones FE	No	No	No	No	No	No	No
Coord FE	No	Yes	No	No	No	No	No
Coord FE*Luv.	No	No	Yes	No	No	No	No
Coord FE*Barley	No	No	No	Yes	No	No	No
Coord FE*Rye	No	No	No	No	Yes	No	No
Coord FE*Wheat	No	No	No	No	No	Yes	No
Coord FE*LuvXBarley	No	No	No	No	No	No	Yes
Observations	1151.00	1151.00	1151.00	1151.00	1151.00	1143.00	1151.00
Adjusted R-squared	0.21	0.30	0.34	0.35	0.34	0.36	0.36

RDD according to a linear specification with the number of towns having a town charter per century as the main outcome. I use a first-degree polynomial to account for the distance from the border. Column (1) tests the specification without any further control variable. Column (2) controls for the square centroids' longitude and latitude. Column (3) controls for the interaction between the square centroids' longitude and latitude and the presence of luvisol. Column (4) controls for barley suitability and the interaction between the square centroids' longitude and latitude and barley suitability. Column (5) controls for rye suitability and the interaction between the square centroids' longitude and latitude and rye suitability. Column (6) controls for wheat suitability and the interaction between the square centroids' longitude and latitude and wheat suitability. Column (7) controls for the interaction between the presence of luvisol and barley suitability, measuring heavy plough suitability, and the interaction between the square centroids' longitude and latitude, the presence of luvisol and barley suitability.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.22: **RDD with the 13th century observations and 50 Km bandwidth 13th century borders**

	(1)	(2)	(3)
VARIABLES	1200 full	1200 North	1200 Center South
RD Estimate	1.35*	1.77	1.11***
	(0.53)	(1.12)	(0.29)
Observations	1151	881	1151
Covariates	YES	YES	YES
Mean left	0.180	0.209	0.180
Mean right	0.461	0.521	0.461
Bandwidth	50	50	50
Order polyn.	2	2	2

RDD coefficients according to the specification in eq. 1.1, where the flow number of buildings per century (13th century) represents the main outcome. I adopt a 50 km bandwidth from the 13th century borders. ***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.23: **RDD with the 14th century observations and 50 Km bandwidth 13th century borders**

	(1)	(2)	(3)	(4)
VARIABLES	1300 full (1300 borders)	1300 full (1200 borders)	1300 North	1300 Center-South
RD Estimate	1.06	1.78***	1.39	1.90**
	(0.71)	(0.48)	(0.83)	(0.67)
Observations	1173	1151	881	1151
Covariates	YES	YES	YES	YES
Mean left	0.392	0.468	0.541	0.468
Mean right	1.680	1.967	2.214	1.967
Bandwidth	50	50	50	50
Order polyn.	2	2	2	2

RDD coefficients according to the specification in eq. 1.1, where the flow number of buildings per century (14th century) represents the main outcome. I adopt a 50 km bandwidth from the 13th century borders. ***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.24: **Two-dimensional RDD with the 13th century observations**

	(1) Build.	(2) Build.	(3) Build.
TO XIII	0.77*	0.77*	0.77*
	(0.35)	(0.35)	(0.35)
x	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
y	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
x^2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
y^2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
$x * y$	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
x^3	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
y^3	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
$x^2 * y$	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
$x * y^2$	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
N	1972	1972	1966

Two-dimensional RDD with the 13th century observations as in eq. 1.1, where the flow number of buildings per century (13th century) represents the main outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.25: **Two-dimensional RDD with the 14th century observations**

	(1) Build.	(2) Build.	(3) Build.
TO XIII	1.43**	1.43**	1.40**
	(0.43)	(0.43)	(0.43)
x	-0.00**	-0.00**	-0.00**
	(0.00)	(0.00)	(0.00)
y	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
x^2	0.00**	0.00**	0.00**
	(0.00)	(0.00)	(0.00)
y^2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
$x * y$	0.00**	0.00**	0.00**
	(0.00)	(0.00)	(0.00)
x^3	-0.00	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)
y^3	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
$x^2 * y$	-0.00**	-0.00**	-0.00**
	(0.00)	(0.00)	(0.00)
$x * y^2$	-0.00*	-0.00*	-0.00*
	(0.00)	(0.00)	(0.00)
N	1972	1972	1966

Two-dimensional RDD with the 14th century observations as in eq. 1.1, where the flow number of buildings per century (14th century) represents the main outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.26: **Event study: different distance from the borders**

14th century borders

	(1)	(2)	(3)	(4)	(5)
	Number Monuments	Number Monuments	Number Monuments	Number Monuments	Number Monuments
lead3	-0.21	-0.12	-0.03	-0.01	0.00
	(0.96)	(0.51)	(0.38)	(0.44)	(0.39)
lead2	-0.18	-0.10	-0.03	-0.02	-0.01
	(0.99)	(0.51)	(0.40)	(0.40)	(0.37)
lag0	1.10	0.68	0.40	0.38	0.37
	(0.76)	(0.42)	(0.38)	(0.37)	(0.35)
lag1	1.46	1.17*	1.09**	0.99**	0.98**
	(0.75)	(0.48)	(0.34)	(0.37)	(0.33)
lag2	1.42*	0.97*	0.67	0.38	0.34
	(0.70)	(0.46)	(0.36)	(0.38)	(0.34)
lag3	1.45	1.01	0.53	0.18	0.17
	(0.91)	(0.57)	(0.43)	(0.44)	(0.40)
lag4	1.34	0.43	-0.27	-0.94*	-0.99**
	(1.05)	(0.59)	(0.38)	(0.43)	(0.38)
lag5	3.88	1.77	-0.49	-2.28	-2.33
	(3.05)	(1.71)	(1.13)	(1.42)	(1.27)
lag6	1.37	3.17*	2.78*	-0.19	0.30
	(1.97)	(1.47)	(1.29)	(1.31)	(1.22)
Spatial Clust.	Yes	Yes	Yes	Yes	Yes
ID FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Range	30Km	50Km	100Km	150Km	200Km
Observations	3300.00	5370.00	10095.00	13695.00	17430.00
Adjusted R-squared	0.01	0.01	0.01	0.00	0.00

Event study as in eq. 1.2 where the flow number of buildings represents the outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.27: **Event study: different distance from the borders**

14th century borders

	(1)	(2)	(3)	(4)	(5)
	Number Monuments	Number Monuments	Number Monuments	Number Monuments	Number Monuments
lead3	0.06	0.05	-0.02	0.00	0.00
	(0.30)	(0.34)	(0.38)	(0.40)	(0.38)
lead2	0.05	0.04	-0.03	-0.00	-0.00
	(0.31)	(0.35)	(0.39)	(0.38)	(0.37)
lag0	0.33	0.24	0.37	0.35	0.36
	(0.20)	(0.30)	(0.38)	(0.35)	(0.34)
lag1	0.75*	0.64	0.96**	0.96**	0.98**
	(0.30)	(0.33)	(0.35)	(0.34)	(0.33)
lag2	0.56	0.33	0.55	0.34	0.34
	(0.42)	(0.45)	(0.39)	(0.36)	(0.34)
lag3	0.20	0.15	0.45	0.21	0.17
	(0.25)	(0.34)	(0.45)	(0.42)	(0.40)
lag4	-0.47	-0.65*	-0.23	-0.83*	-1.03**
	(0.26)	(0.31)	(0.36)	(0.38)	(0.39)
lag5	-2.06**	-2.34**	-0.34	-1.99	-2.43
	(0.69)	(0.83)	(1.07)	(1.30)	(1.28)
lag6	0.60	1.76	3.77**	0.39	0.28
	(0.80)	(1.15)	(1.28)	(1.18)	(1.21)
Spatial Clust.	Yes	Yes	Yes	Yes	Yes
ID FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Range	30Km	50Km	100Km	150Km	200Km
Observations	4425.00	6990.00	11850.00	14955.00	17760.00
Adjusted R-squared	0.01	0.01	0.01	0.00	0.00

Event study as in eq. 1.2 where the flow number of buildings represents the outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.

***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.28: **Event study: different distances from the borders 13th or 14th centuries borders**

	(1)	(2)	(3)	(4)	(5)
	Number Monuments	Number Monuments	Number Monuments	Number Monuments	Number Monuments
lead3	-0.05	-0.04	-0.02	0.00	0.00
	(0.52)	(0.37)	(0.38)	(0.40)	(0.38)
lead2	-0.04	-0.03	-0.02	-0.00	-0.00
	(0.53)	(0.37)	(0.40)	(0.38)	(0.37)
lag0	0.65	0.44	0.37	0.35	0.36
	(0.36)	(0.29)	(0.38)	(0.35)	(0.34)
lag1	1.12**	0.89**	1.03**	0.96**	0.98**
	(0.42)	(0.34)	(0.35)	(0.34)	(0.33)
lag2	1.01*	0.69	0.56	0.34	0.34
	(0.44)	(0.37)	(0.38)	(0.36)	(0.34)
lag3	0.90	0.62	0.48	0.21	0.17
	(0.51)	(0.41)	(0.43)	(0.42)	(0.40)
lag4	0.49	-0.02	-0.20	-0.83*	-1.03**
	(0.54)	(0.40)	(0.36)	(0.38)	(0.39)
lag5	0.74	-0.16	-0.25	-1.99	-2.43
	(1.49)	(1.13)	(1.04)	(1.30)	(1.28)
lag6	1.72	2.90**	3.49**	0.39	0.28
	(1.18)	(1.03)	(1.31)	(1.18)	(1.21)
Spatial Clust.	Yes	Yes	Yes	Yes	Yes
ID FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Range	30Km	50Km	100Km	150Km	200Km
Observations	5190.00	7845.00	12195.00	14955.00	17760.00
Adjusted R-squared	0.00	0.01	0.01	0.00	0.00

Event study as in eq. 1.2 where the flow number of buildings represents the outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.29: **Event study: different distance from the natural borders**

	(1) Number Monuments	(2) Number Monuments	(3) Number Monuments	(4) Number Monuments	(5) Number Monuments
lead3	-0.51	-0.00	0.05	0.03	0.02
	(1.83)	(0.85)	(0.49)	(0.50)	(0.41)
lead2	-0.31	0.00	0.03	0.01	0.01
	(1.60)	(0.79)	(0.49)	(0.52)	(0.43)
lag0	1.52	1.08	0.50	0.42	0.38
	(1.32)	(0.65)	(0.37)	(0.47)	(0.40)
lag1	2.21	2.20**	1.47***	1.27**	1.09**
	(1.29)	(0.73)	(0.42)	(0.44)	(0.35)
lag2	2.47	2.66***	1.22**	0.71	0.47
	(1.45)	(0.74)	(0.39)	(0.44)	(0.37)
lag3	2.33	2.21*	0.75	0.46	0.30
	(1.95)	(0.96)	(0.47)	(0.51)	(0.44)
lag4	0.56	0.43	-0.67	-0.63	-0.83*
	(2.70)	(1.23)	(0.62)	(0.48)	(0.39)
lag5	0.39	0.69	-1.28	-1.47	-2.07
	(4.76)	(2.54)	(1.62)	(1.44)	(1.41)
lag6	-7.73	0.72	0.57	1.54	1.10
	(4.90)	(1.90)	(1.31)	(1.68)	(1.27)
Spatial Clust.	Yes	Yes	Yes	Yes	Yes
ID FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Range	30Km	50Km	100Km	150Km	200Km
Observations	1170.00	2115.00	5265.00	8970.00	13245.00
Adjusted R-squared	0.02	0.00	0.00	0.00	0.00

Event study as in eq. 1.2 where the flow number of buildings represents the outcome. In column (1) I restrict the sample to observations within 30 km of the cut-off. In column (2) I restrict the sample to observations within 50 km of the cut-off. In column (3) I restrict the sample to observations within 100 km of the cut-off. In column (4) I restrict the sample to observations within 150 km of the cut-off. In column (5) I restrict the sample to observations within 200 km of the cut-off.
***Significant at 0.1%; **significant at 1%; *significant at 5%

A.3 Mechanisms

Table A.30: **Teutonic Order territories in the 14th century on land ownership (OLS)**

	(1) Crown Land	(2) Crown Land	(3) Crown Land	(4) Crown Land	(5) Crown Land	(6) Crown Land
TO_14thadm	0.09*	0.09**	0.08*	0.06	0.09**	0.04
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
std. β	0.322*	0.322**	0.295*	0.221	0.328**	0.160
land suitability	No	Yes	No	No	No	Yes
morphology	No	No	Yes	No	No	Yes
access	No	No	No	Yes	No	Yes
# arch. sites	No	No	No	No	Yes	Yes
Observations	62	62	62	62	62	62

OLS coefficients: Impact of Teutonic Order presence on land owned by the ruler per size of the administrative unit (in hectares), controlling for land suitability, terrain morphology, trade access, archaeological sites, and all factors combined.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.31: **RDD and TO interacted with full routes network: all buildings**

	(1) Build. 1100	(2) Build. 1200	(3) Build. 1300	(4) Build. 1400	(5) Build. 1500
TO=1	0.38	0.37***	0.06*	0.03	-0.02
	(0.22)	(0.08)	(0.02)	(0.03)	(0.07)
NEAR DIST(100km)	-0.10	-0.33**	-0.06	-0.02	-0.21
	(0.09)	(0.10)	(0.05)	(0.10)	(0.12)
TO=1 × NEAR DIST(100km)	-0.59	-0.04	-0.12	0.05	0.18
	(0.60)	(0.36)	(0.14)	(0.10)	(0.18)
dist borderXIII(100km)	-20.44*	-52.35***	-23.26	-65.63**	-58.83***
	(7.05)	(9.55)	(12.25)	(17.34)	(9.35)
TO=1 × dist border(100km)	-344.41	100.17	45.61	99.97	54.38
	(212.96)	(95.85)	(48.41)	(58.85)	(28.87)
Observations	1875	1875	1875	1875	1875

RDD coefficients according to eq. 1.1. *Build.#* is the number of buildings completed in a century. *Distance_route* is the distance from the Elblag routes network and the $c.near\_route\_s \times 1.TO_{s,t=cen.}$ is the interaction between the Teutonic-Order state and the distance from the Elblag route; $X'_{s,t=cen.}$ is a set of control variables. Each column evaluates the RDD in a given century (from the 12th to 17th centuries)
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.32: **RDD and TO interacted with Elblag-NHRE route**

Civil, religious, military buildings

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.00	-0.02***	0.41**	0.58**	0.54	-0.38	-0.35
	(0.00)	(0.00)	(0.13)	(0.16)	(0.59)	(0.42)	(0.42)
NEAR DIST(100km)	-0.00	0.00	0.00	0.01	0.02	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.04)	(0.04)
TO=1 × NEAR DIST(100km)	0.00	0.00***	-0.01	-0.01	0.02	0.03	0.02
	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)
dist borderXIII(100km)	-3.77	0.28	-16.60	42.79	239.98	-65.50	-178.66
	(2.71)	(4.59)	(25.86)	(75.32)	(159.56)	(307.40)	(350.34)
TO=1 × dist borderXIII(100km)	5.62***	5.09	-419.74	-573.35*	-1797.96*	-248.25	28.29
	(1.32)	(6.02)	(202.17)	(228.28)	(679.63)	(198.65)	(179.00)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.04	-0.06**	0.41	2.35***	0.04	-0.27	-0.47
	(0.02)	(0.02)	(0.19)	(0.28)	(0.34)	(0.28)	(0.25)
NEAR DIST(100km)	0.00	0.00*	-0.01	-0.02	-0.02	-0.02	0.03
	(0.00)	(0.00)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.00	-0.11***	0.01	0.02	0.02
	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
dist borderXIII(100km)	9.47	30.52***	-233.62	-301.19	-395.73*	-228.23	-67.15
	(7.93)	(6.77)	(124.03)	(254.27)	(158.68)	(118.09)	(78.31)
TO=1 × dist borderXIII(100km)	-19.22	-21.00	-286.73	-242.79	695.71*	478.60*	129.22
	(15.76)	(28.04)	(204.48)	(358.71)	(254.06)	(163.08)	(323.45)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.39	0.55**	0.02	0.01	-0.05
	(.)	(0.01)	(0.18)	(0.15)	(0.05)	(0.02)	(0.07)
NEAR DIST(100km)	0.00	0.00	-0.00	-0.00	0.00	-0.00	0.00
	(.)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.02	0.00	0.00	0.01
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	1.25	-25.56	-70.14	-22.01	-85.16	-30.77
	(.)	(4.11)	(20.91)	(37.34)	(25.96)	(49.91)	(36.57)
TO=1 × dist borderXIII(100km)	0.00	-0.31	-358.56	65.37	50.18	101.67	67.27
	(.)	(4.60)	(200.00)	(73.32)	(42.08)	(56.16)	(35.34)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century borders. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from the Holy Roman Empire-Elblag northern route. $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.33: **RDD: TO interacted with Elblag-Frankfurt(north) route Civil, religious, military buildings**

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.00	-0.05**	0.50*	0.78*	1.07	-0.21	-0.13
	(0.00)	(0.01)	(0.23)	(0.30)	(0.87)	(0.35)	(0.31)
NEAR DIST(100km)	0.00	-0.00	-0.00**	0.02	0.02	-0.04	-0.02
	(.)	(0.00)	(0.00)	(0.01)	(0.03)	(0.05)	(0.06)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.03	-0.09	-0.14	0.03	0.00
	(.)	(0.00)	(0.02)	(0.05)	(0.16)	(0.11)	(0.09)
dist borderXIII(100km)	-2.97	-2.05	-20.23	-8.51	103.56	-1.28	-186.90
	(1.51)	(2.57)	(11.27)	(31.12)	(91.09)	(80.19)	(107.86)
TO=1 × dist borderXIII(100km)	5.05**	-8.56	-394.98*	-682.43*	-2056.01*	-362.27	-57.07
	(1.37)	(8.02)	(177.59)	(295.64)	(919.34)	(184.67)	(230.42)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.02	-0.17***	0.37	1.49***	-0.12	-0.14	-0.11
	(0.01)	(0.04)	(0.22)	(0.35)	(0.18)	(0.16)	(0.14)
NEAR DIST(100km)	0.00	-0.00	-0.02**	-0.03	-0.06*	-0.04	0.02
	(.)	(0.00)	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)
TO=1 × NEAR DIST(100km)	0.00	0.00**	-0.01	-0.13*	0.05	-0.00	-0.04
	(.)	(0.00)	(0.02)	(0.05)	(0.04)	(0.03)	(0.05)
dist borderXIII(100km)	5.89	17.77***	-115.75**	-137.45**	-200.11**	-73.06	-256.08**
	(4.22)	(3.15)	(36.06)	(38.67)	(52.04)	(39.99)	(72.67)
TO=1 × dist borderXIII(100km)	-22.56	-58.43*	-325.87	-417.60	595.87*	310.15*	52.93
	(16.14)	(20.79)	(174.40)	(394.74)	(253.56)	(137.63)	(285.30)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.04*	0.42	0.45***	0.03	-0.02	-0.04
	(.)	(0.02)	(0.21)	(0.08)	(0.02)	(0.01)	(0.07)
NEAR DIST(100km)	0.00	-0.00	-0.00	-0.02	-0.01	-0.02	-0.01
	(.)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.03	-0.05**	0.00	0.02	0.01
	(.)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
dist borderXIII(100km)	0.00	1.18	-15.38*	-32.75	-20.78*	-59.57***	-57.61***
	(.)	(3.37)	(5.66)	(21.61)	(7.84)	(10.62)	(10.51)
TO=1 × dist borderXIII(100km)	0.00	-13.83	-324.38	-67.14	25.56	83.35*	33.58
	(.)	(6.48)	(168.72)	(101.00)	(33.79)	(37.99)	(27.43)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century borders. The flow number of buildings per century represents the main outcome. $NEARDISTANCE$ is the distance from the Frankfurt-Elblag northern route. $1.TO \times NEARDISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.34: **RDD: TO interacted with Elblag-Frankfurt(center) routes Civil, religious, military buildings**

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.00	-0.01***	0.54*	0.76*	1.20	-0.23	-0.21
	(0.00)	(0.00)	(0.23)	(0.27)	(0.87)	(0.33)	(0.32)
NEAR DIST(100km)	-0.00	-0.00	-0.00	0.00	0.01	-0.01	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.03)	(0.04)
TO=1 × NEAR DIST(100km)	0.00**	0.00***	-0.03	-0.04*	-0.07	0.02	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.05)	(0.02)	(0.01)
dist borderXIII(100km)	-3.78**	-7.44*	-43.15	14.88	163.72	-76.74	-207.65
	(1.01)	(2.87)	(24.32)	(61.57)	(116.69)	(227.71)	(235.82)
TO=1 × dist borderXIII(100km)	4.64*	3.01	-346.99*	-499.89*	-1734.60*	-308.51	-40.30
	(1.60)	(5.06)	(151.78)	(172.63)	(586.07)	(249.31)	(203.98)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.03	-0.06*	0.48*	1.88***	-0.06	-0.25	-0.34
	(0.02)	(0.02)	(0.22)	(0.21)	(0.19)	(0.15)	(0.19)
NEAR DIST(100km)	-0.00	-0.00	-0.01	-0.02	-0.03	-0.02	0.01
	(0.00)	(0.00)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.09***	0.02	0.03	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
dist borderXIII(100km)	0.11	-3.54	-204.47	-298.60	-395.96*	-199.33	-222.53*
	(4.85)	(11.54)	(130.11)	(240.60)	(158.48)	(111.74)	(85.54)
TO=1 × dist borderXIII(100km)	-23.22	-19.14	-210.70	230.26	745.41**	451.52*	11.03
	(13.86)	(27.26)	(195.94)	(353.20)	(236.03)	(157.33)	(262.57)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.46*	0.49***	0.03	0.02	-0.00
	(.)	(0.01)	(0.21)	(0.10)	(0.03)	(0.02)	(0.06)
NEAR DIST(100km)	0.00	0.00	-0.00	-0.00	0.00	-0.00	0.00
	(.)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.02	-0.02*	0.00	0.00	0.00
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	2.28	-23.28	-59.65	-12.34	-74.52*	-49.89*
	(.)	(2.42)	(17.07)	(32.79)	(20.81)	(34.10)	(18.01)
TO=1 × dist borderXIII(100km)	0.00	-3.45	-292.16	138.91	36.66	98.95	42.52
	(.)	(4.43)	(146.30)	(79.88)	(46.99)	(63.52)	(27.88)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from the Frankfurt-Elblag central route. $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.35: **RDD: TO interacted with Elblag-Frankfurt(south) routes**
Civil, religious, military buildings

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.00	-0.01***	0.53*	0.77*	1.20	-0.24	-0.22
	(0.00)	(0.00)	(0.23)	(0.27)	(0.87)	(0.33)	(0.32)
NEAR DIST(100km)	-0.00	-0.00	-0.01	0.00	0.01	-0.02	-0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.04)
TO=1 × NEAR DIST(100km)	0.00*	0.00***	-0.03	-0.04*	-0.07	0.02	0.02
	(0.00)	(0.00)	(0.01)	(0.01)	(0.05)	(0.02)	(0.01)
dist borderXIII(100km)	-5.45***	-6.63	-48.65	24.69	193.08	-131.79	-282.76
	(0.75)	(3.45)	(23.68)	(65.91)	(127.96)	(257.00)	(244.88)
TO=1 × dist borderXIII(100km)	5.35***	2.52	-345.33*	-504.04*	-1746.49**	-285.70	-7.33
	(1.24)	(5.30)	(153.52)	(171.23)	(576.80)	(253.78)	(199.03)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.03	-0.06*	0.47	1.86***	-0.07	-0.26	-0.34
	(0.02)	(0.02)	(0.23)	(0.19)	(0.18)	(0.14)	(0.19)
NEAR DIST(100km)	-0.00	-0.00	-0.02	-0.04	-0.03	-0.02	0.00
	(0.00)	(0.00)	(0.02)	(0.04)	(0.02)	(0.02)	(0.01)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.09***	0.02	0.03	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
dist borderXIII(100km)	1.60	1.61	-244.21	-402.29	-443.22*	-246.04	-232.88**
	(5.05)	(11.65)	(143.75)	(268.07)	(171.63)	(120.21)	(63.21)
TO=1 × dist borderXIII(100km)	-24.03	-21.95	-195.79	271.29	761.45**	469.24**	16.76
	(14.05)	(27.23)	(203.62)	(342.56)	(233.28)	(151.95)	(265.33)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.46*	0.49***	0.03	0.02	-0.00
	(.)	(0.01)	(0.21)	(0.11)	(0.03)	(0.02)	(0.06)
NEAR DIST(100km)	0.00	0.00	-0.00	-0.00	0.00	-0.01	0.00
	(.)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00*	-0.02	-0.02*	0.00	0.00	0.00
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	1.50	-28.54	-66.26*	-25.76	-100.52*	-58.52**
	(.)	(3.32)	(19.56)	(30.42)	(25.91)	(40.51)	(15.56)
TO=1 × dist borderXIII(100km)	0.00	-3.05	-290.16	141.57	43.02	110.20	46.80
	(.)	(4.61)	(147.27)	(78.48)	(48.78)	(68.10)	(28.75)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEARDISTANCE$ is the distance from the Frankfurt-Elblag southern route. $1.TO \times NEARDISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.36: **RDD: TO interacted with Elblag-HRE(southwest) routes**

Civil, religious, military buildings

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.01	-0.02***	0.53*	0.79*	1.27	-0.28	-0.23
	(0.00)	(0.00)	(0.24)	(0.26)	(0.84)	(0.35)	(0.37)
NEAR DIST(100km)	-0.00*	-0.00	-0.01***	0.01	0.02	-0.02	-0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.03)
TO=1 × NEAR DIST(100km)	0.00*	0.00***	-0.03	-0.04*	-0.07	0.02	0.02
	(0.00)	(0.00)	(0.02)	(0.01)	(0.05)	(0.02)	(0.02)
dist borderXIII(100km)	-7.47***	-8.44*	-48.28**	33.61	217.86	-125.86	-257.55
	(1.33)	(2.98)	(12.85)	(66.87)	(157.19)	(108.22)	(163.80)
TO=1 × dist borderXIII(100km)	5.57***	2.49	-348.65*	-501.37**	-1737.14**	-302.38	-26.23
	(1.24)	(4.96)	(153.47)	(159.94)	(555.12)	(199.69)	(160.69)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.03	-0.06*	0.41	1.73***	-0.14	-0.34**	-0.37
	(0.02)	(0.02)	(0.27)	(0.13)	(0.14)	(0.09)	(0.19)
NEAR DIST(100km)	-0.00	-0.00	-0.03	-0.06**	-0.04	-0.04**	-0.01
	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.08***	0.02	0.03*	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
dist borderXIII(100km)	0.44	8.57	-249.05*	-422.87**	-406.76**	-265.71***	-318.13*
	(8.72)	(12.24)	(93.73)	(134.24)	(117.69)	(51.99)	(139.87)
TO=1 × dist borderXIII(100km)	-24.24	-25.80	-213.75	237.05	719.50**	453.19**	45.42
	(14.08)	(26.41)	(181.24)	(266.25)	(208.88)	(115.07)	(270.30)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.45	0.47**	0.01	-0.01	-0.02
	(.)	(0.01)	(0.22)	(0.11)	(0.02)	(0.04)	(0.09)
NEAR DIST(100km)	0.00	-0.00	-0.00	-0.01***	-0.01*	-0.01**	-0.01
	(.)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00**	-0.02	-0.02*	0.00	0.00	0.00
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	0.36	-25.49	-90.52***	-60.05*	-122.46***	-105.07***
	(.)	(2.74)	(12.40)	(11.58)	(25.16)	(28.95)	(19.03)
TO=1 × dist borderXIII(100km)	0.00	-2.60	-293.27	146.58	53.01	111.28	61.10
	(.)	(4.28)	(146.24)	(70.55)	(46.29)	(64.65)	(29.11)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from the Holy Roman Empire-Elblag South-Western route. $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.37: **RDD: TO interacted with Elblag-HRE(south) routes**

Civil, religious, military buildings

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.01	-0.02***	0.53*	0.77*	1.25	-0.29	-0.28
	(0.00)	(0.00)	(0.24)	(0.27)	(0.86)	(0.35)	(0.36)
NEAR DIST(100km)	-0.00*	-0.00	-0.01**	0.00	0.01	-0.03	-0.03
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.01)	(0.02)
TO=1 × NEAR DIST(100km)	0.00*	0.00***	-0.03	-0.04*	-0.07	0.02	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)
dist borderXIII(100km)	-5.77**	-7.87*	-39.88*	11.55	182.39	-134.67	-313.59*
	(1.62)	(2.95)	(15.25)	(46.92)	(120.39)	(78.78)	(127.80)
TO=1 × dist borderXIII(100km)	4.73***	1.68	-354.03*	-494.86**	-1720.01**	-314.44	-25.79
	(0.98)	(4.80)	(153.22)	(163.66)	(563.27)	(192.69)	(156.70)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.03	-0.06*	0.41	1.72***	-0.14	-0.33**	-0.37
	(0.02)	(0.02)	(0.28)	(0.13)	(0.14)	(0.10)	(0.19)
NEAR DIST(100km)	-0.00	-0.00	-0.03	-0.07*	-0.04	-0.03**	-0.01
	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.09***	0.02	0.03*	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
dist borderXIII(100km)	-0.39	10.90	-235.79*	-396.75**	-382.75**	-228.51***	-299.79*
	(7.04)	(11.06)	(81.70)	(112.71)	(105.04)	(42.07)	(122.77)
TO=1 × dist borderXIII(100km)	-24.75	-26.83	-233.38	195.33	693.35**	425.91**	34.69
	(13.10)	(25.60)	(177.85)	(254.57)	(202.43)	(111.81)	(269.03)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.45	0.47**	0.01	-0.01	-0.02
	(.)	(0.01)	(0.21)	(0.11)	(0.02)	(0.04)	(0.08)
NEAR DIST(100km)	0.00	-0.00	-0.00	-0.01**	-0.01*	-0.01**	-0.01
	(.)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00**	-0.02	-0.02*	0.00	0.00	0.00
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	-0.12	-21.34	-87.44***	-51.61*	-115.16***	-94.76***
	(.)	(2.33)	(10.90)	(12.50)	(18.72)	(23.82)	(16.34)
TO=1 × dist borderXIII(100km)	0.00	-2.59	-295.65	140.77	47.10	102.61	54.05
	(.)	(4.01)	(145.50)	(69.50)	(44.49)	(63.61)	(28.11)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from the Holy Roman Empire-Elblag southern route. $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.38: **RDD: TO interacted with Elblag-Göritz routes**
Civil, religious, military buildings

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.01	-0.02***	0.53*	0.78*	1.26	-0.29	-0.26
	(0.00)	(0.00)	(0.24)	(0.27)	(0.85)	(0.35)	(0.36)
NEAR DIST(100km)	-0.00*	-0.00	-0.01**	0.00	0.02	-0.03	-0.02
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.01)	(0.02)
TO=1 × NEAR DIST(100km)	0.00*	0.00***	-0.03	-0.04*	-0.07	0.02	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)
dist borderXIII(100km)	-6.11**	-7.83*	-44.14**	21.80	199.44	-144.18	-287.32
	(1.56)	(2.96)	(13.39)	(54.42)	(133.72)	(91.90)	(143.62)
TO=1 × dist borderXIII(100km)	4.93***	1.92	-352.04*	-496.99**	-1726.08**	-307.01	-25.13
	(1.02)	(4.95)	(153.43)	(162.01)	(560.67)	(193.73)	(157.32)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	-0.03	-0.06*	0.40	1.72***	-0.14	-0.34**	-0.37
	(0.02)	(0.02)	(0.28)	(0.13)	(0.14)	(0.09)	(0.20)
NEAR DIST(100km)	-0.00	-0.00	-0.03	-0.07*	-0.04	-0.03**	-0.01
	(0.00)	(0.00)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
TO=1 × NEAR DIST(100km)	0.00	0.00	-0.01	-0.09***	0.02	0.03*	0.02
	(0.00)	(0.00)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
dist borderXIII(100km)	0.19	10.41	-245.65*	-410.75**	-394.20**	-247.52***	-301.65*
	(7.68)	(11.49)	(86.47)	(116.47)	(106.63)	(43.27)	(131.18)
TO=1 × dist borderXIII(100km)	-24.58	-26.59	-225.39	211.16	702.98**	436.05**	37.16
	(13.54)	(25.93)	(177.88)	(257.01)	(203.56)	(111.37)	(270.88)
Observations	1875	1875	1875	1875	1875	1875	1875

	(1) Build. 1000	(2) Build. 1100	(3) Build. 1200	(4) Build. 1300	(5) Build. 1400	(6) Build. 1500	(7) Build. 1600
TO=1	0.00	-0.01	0.45	0.47**	0.01	-0.01	-0.02
	(.)	(0.01)	(0.22)	(0.11)	(0.02)	(0.04)	(0.08)
NEAR DIST(100km)	0.00	-0.00	-0.00	-0.01***	-0.01*	-0.01**	-0.01
	(.)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
TO=1 × NEAR DIST(100km)	0.00	0.00**	-0.02	-0.02*	0.00	0.00	0.00
	(.)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
dist borderXIII(100km)	0.00	-0.20	-23.53	-89.46***	-53.63*	-118.58***	-97.51***
	(.)	(2.60)	(11.05)	(12.00)	(19.36)	(24.14)	(16.85)
TO=1 × dist borderXIII(100km)	0.00	-2.52	-294.76	143.05	48.84	105.80	56.17
	(.)	(4.05)	(145.82)	(69.89)	(44.58)	(63.17)	(28.12)
Observations	1875	1875	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from Goritz-Elblag southern route. $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.39: **RDD: TO interacted with full routes network Civil, religious, military buildings**

	(1) Build. 1100	(2) Build. 1200	(3) Build. 1300	(4) Build. 1400	(5) Build. 1500
TO=1	0.38	0.37***	0.06*	0.03	-0.02
	(0.22)	(0.08)	(0.02)	(0.03)	(0.07)
NEAR DIST(100km)	-0.10	-0.33**	-0.06	-0.02	-0.21
	(0.09)	(0.10)	(0.05)	(0.10)	(0.12)
TO=1 × NEAR DIST(100km)	-0.59	-0.04	-0.12	0.05	0.18
	(0.60)	(0.36)	(0.14)	(0.10)	(0.18)
dist borderXIII(100km)	-20.44*	-52.35***	-23.26	-65.63**	-58.83***
	(7.05)	(9.55)	(12.25)	(17.34)	(9.35)
TO=1 × dist borderXIII(100km)	-344.41	100.17	45.61	99.97	54.38
	(212.96)	(95.85)	(48.41)	(58.85)	(28.87)
Observations	1875	1875	1875	1875	1875

	(1) Build. 1100	(2) Build. 1200	(3) Build. 1300	(4) Build. 1400	(5) Build. 1500
TO=1	0.38	0.37***	0.06*	0.03	-0.02
	(0.22)	(0.08)	(0.02)	(0.03)	(0.07)
NEAR DIST(100km)	-0.10	-0.33**	-0.06	-0.02	-0.21
	(0.09)	(0.10)	(0.05)	(0.10)	(0.12)
TO=1 × NEAR DIST(100km)	-0.59	-0.04	-0.12	0.05	0.18
	(0.60)	(0.36)	(0.14)	(0.10)	(0.18)
dist borderXIII(100km)	-20.44*	-52.35***	-23.26	-65.63**	-58.83***
	(7.05)	(9.55)	(12.25)	(17.34)	(9.35)
TO=1 × dist borderXIII(100km)	-344.41	100.17	45.61	99.97	54.38
	(212.96)	(95.85)	(48.41)	(58.85)	(28.87)
Observations	1875	1875	1875	1875	1875

	(1) Build. 1100	(2) Build. 1200	(3) Build. 1300	(4) Build. 1400	(5) Build. 1500
TO=1	0.38	0.37***	0.06*	0.03	-0.02
	(0.22)	(0.08)	(0.02)	(0.03)	(0.07)
NEAR DIST(100km)	-0.10	-0.33**	-0.06	-0.02	-0.21
	(0.09)	(0.10)	(0.05)	(0.10)	(0.12)
TO=1 × NEAR DIST(100km)	-0.59	-0.04	-0.12	0.05	0.18
	(0.60)	(0.36)	(0.14)	(0.10)	(0.18)
dist borderXIII(100km)	-20.44*	-52.35***	-23.26	-65.63**	-58.83***
	(7.05)	(9.55)	(12.25)	(17.34)	(9.35)
TO=1 × dist borderXIII(100km)	-344.41	100.17	45.61	99.97	54.38
	(212.96)	(95.85)	(48.41)	(58.85)	(28.87)
Observations	1875	1875	1875	1875	1875

RDD coefficients according to a linear specification. I use a first degree polynomial to account for the distance from the 13th century border. The flow number of buildings per century represents the main outcome. $NEAR\,DISTANCE$ is the distance from the entire network of router (lv.7 is the importance index according to 1.15, where 7 are the most important streets). $1.TO \times NEAR\,DISTANCE$ is the interaction between $NEAR\,DISTANCE$ and the Teutonic-Order territories. Each column evaluates the RDD in a given century (from the 12th to the 17th centuries).
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.41: **RDD by century controlling for the number of Prussian villages**

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1100	1200	1300	1400	1500	1600
TO = 1	-0.04	1.48***	2.05**	3.77*	0.22	0.00
	(0.04)	(0.40)	(0.79)	(1.54)	(0.71)	(1.27)
Observations	1074	1074	1074	1074	1074	1074
Covariates	YES	YES	YES	YES	YES	YES
Mean left	0.544	0.544	0.544	0.544	0.544	0.544
Mean right	0.460	0.460	0.460	0.460	0.460	0.460
Bandwidth	50.72	49.24	38.33	32.18	49.45	52.68
Order polyn.	2	2	2	2	2	2

RDD coefficients by century according to eq. 1.1, controlling for the number of Prussian villages from Erlen (1992). The 13th century borders represent the cut-off.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Table A.40: **Event study: different distance from the 13th century borders**

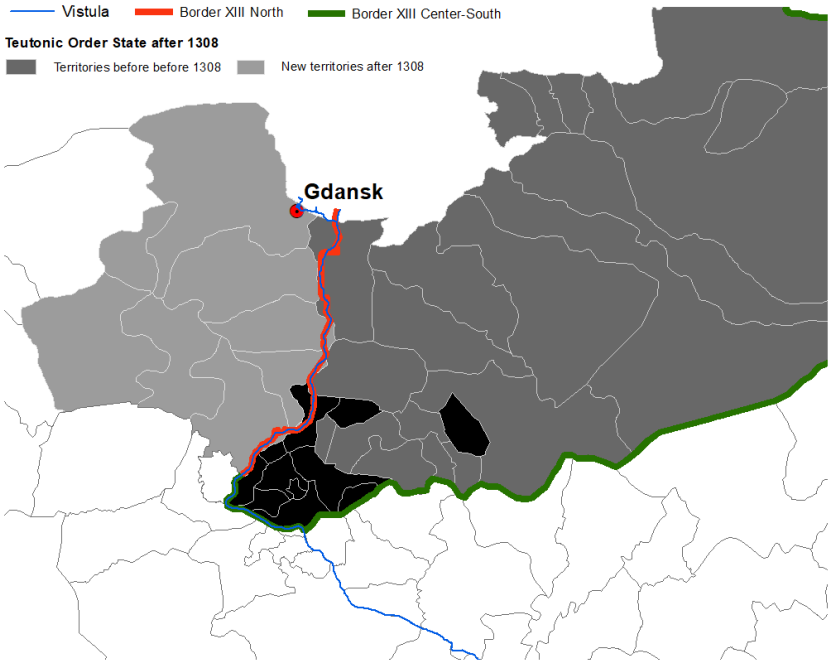
	(1)	(2)	(3)	(4)	(5)	(6)
	Build.	Build.	Build.	Build.	Build.	Build.
lead2 TO	-0.21	-0.13	-0.05	-0.03	-0.03	-0.00
	(0.35)	(0.23)	(0.14)	(0.13)	(0.13)	(0.14)
lag0 TO	0.80**	0.47**	0.20	0.19	0.18	0.10
	(0.25)	(0.17)	(0.12)	(0.12)	(0.12)	(0.13)
lead1 TO	1.18***	0.92***	0.79***	0.74***	0.72***	0.60**
	(0.27)	(0.22)	(0.21)	(0.22)	(0.22)	(0.21)
lag2 TO	1.29**	0.84**	0.53**	0.33*	0.26	0.03
	(0.41)	(0.29)	(0.18)	(0.15)	(0.15)	(0.16)
lag3 TO	1.65	1.15	0.57	0.36	0.29	-0.16
	(0.96)	(0.64)	(0.37)	(0.32)	(0.32)	(0.31)
lag4 TO	1.61*	0.75	0.00	-0.43	-0.66*	-1.39***
	(0.69)	(0.50)	(0.28)	(0.25)	(0.30)	(0.36)
lead2 TOxTS	0.41	0.25	0.20	0.17	0.18	0.26
	(4.68)	(3.67)	(1.98)	(1.60)	(1.01)	(0.62)
lag0 TOxTS	3.56	2.99	2.65	2.36	2.37**	2.02***
	(4.40)	(3.25)	(1.77)	(1.41)	(0.91)	(0.57)
lead1 TOxTS	-0.83	-0.36	-0.08	-0.43	0.02	-0.23
	(3.89)	(3.02)	(1.68)	(1.35)	(0.97)	(0.78)
lag2 TOxTS	-2.07	-1.26	-0.74	-1.24	-0.46	-0.89
	(4.96)	(3.83)	(2.03)	(1.70)	(1.39)	(1.23)
lag3 TOxTS	-7.42	-4.77	-2.16	-3.35	-2.01	-3.03***
	(5.03)	(3.71)	(1.98)	(1.79)	(1.12)	(0.73)
lag4 TOxTS	-18.68	-11.63	-4.10	-7.16	-4.38	-3.55*
	(11.40)	(8.40)	(4.74)	(4.92)	(3.07)	(1.63)
lead2 TS	-0.37	-0.20	-0.18	-0.16	-0.16	-0.22
	(4.59)	(3.37)	(1.83)	(1.50)	(0.88)	(0.44)
lag0 TS	0.77	0.90	0.50	0.80	0.80	1.15**
	(4.25)	(3.12)	(1.71)	(1.32)	(0.79)	(0.43)
lead1 TS	4.76	3.37	2.04	2.35*	1.89**	2.19***
	(3.62)	(2.65)	(1.48)	(1.11)	(0.65)	(0.34)
lag2 TS	6.00	3.98	2.21	2.71*	1.94**	2.38***
	(3.72)	(2.69)	(1.45)	(1.10)	(0.65)	(0.42)
lag3 TS	8.14	5.34	3.05	4.36*	3.08**	4.21***
	(4.85)	(3.48)	(1.85)	(1.78)	(1.12)	(0.65)
lag4 TS	20.25	13.80	7.53	10.54*	7.75*	6.92***
	(11.32)	(8.27)	(4.49)	(5.03)	(3.11)	(1.18)
ID FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2640.00	4296.00	8076.00	10956.00	13944.00	23796.00
Adjusted R-squared	0.17	0.11	0.08	0.05	0.04	0.07

Event study according to the specification in eq. 1.3. In column (1) I restrict the sample to the observations within 30km from the borders. In column (2) I restrict the sample to the observations within 50km from the borders. In column (3) I restrict the sample to the observations within 100km from the borders. In column (4) I restrict the sample to the observations within 150km from the borders. In column (5) I restrict the sample to the observations within 50km from the borders. In column (6) I employ for the full sample, and I control for the distance from the 13th century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

B Second Appendix: Additional Figures

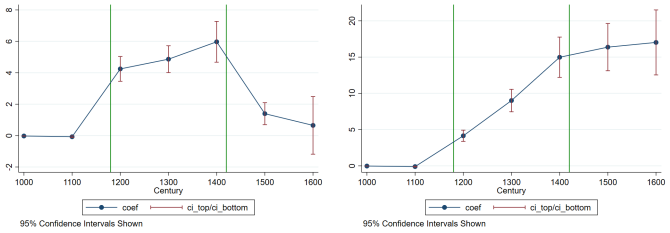
B.1 Results

Figure B.1: **Partial borders considered in the RDD analysis**



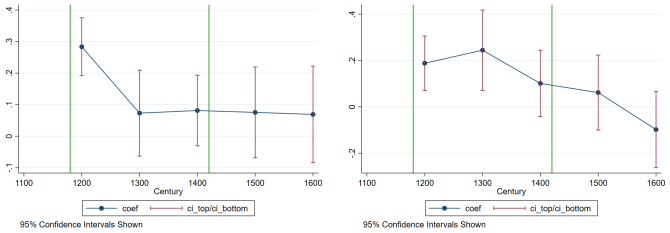
Borders considered in the RDD analysis. The 13th century borders of the Teutonic-Order state are light green and they includes the other borders. The central-southern borders are in dark green. The blue borders represent the northern borders, which ceased to exist after the conquest of Gdansk and Pomerelia in 1308. The natural borders are in red. They remained constant in both the 13th and 14th centuries and they were delimited by the Vistula river. **Source:** see text

Figure B.2: **RDD: effects of the Teutonic Order on the economic development Natural 13th century borders**



(a) Flow number of buildings

(b) Stock number of buildings

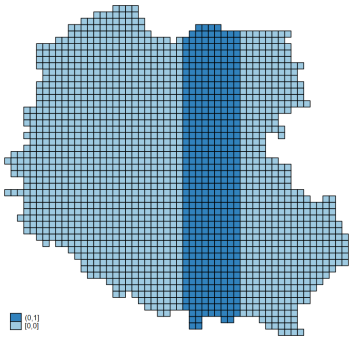


(c) Number of towns receiving a Magdeburg Law charter

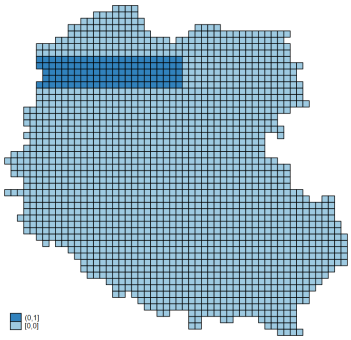
(d) Number of towns with a town charter

RDD coefficients and standard errors according to the specification in eq. 1.1. Each coefficient and standard error is calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the natural 13th century borders. Figure (a) evaluates the RDD for the 13th century border, using the flow buildings as the outcome. Figure (b) evaluates the RDD, using the stock buildings as the outcome. Figure (c) evaluates the RDD, using the Magdeburg-Law towns as the outcome. Figure (d) evaluates the RDD, using the towns adopting a town charter as the outcome. The green vertical lines signed the beginning of the treatment (1200) and the period after the treatment (mid-1400).

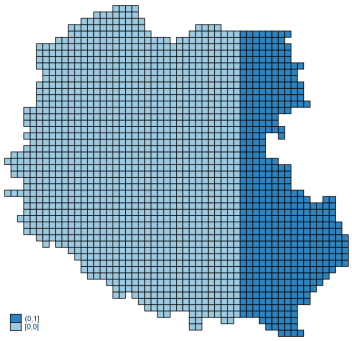
Figure B.3: **Macro-geographic zones in Poland**



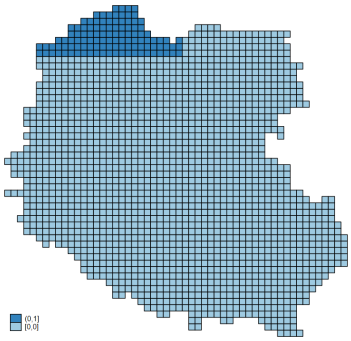
(a) Central Zone
Source: see text



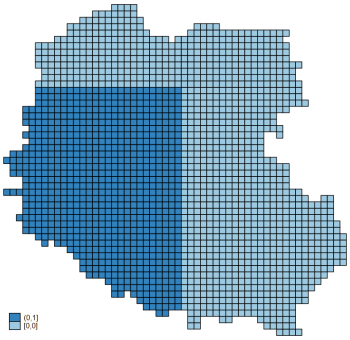
(b) Center-Eastern Zone
Source: see text



(c) Eastern Zone
Source: see text



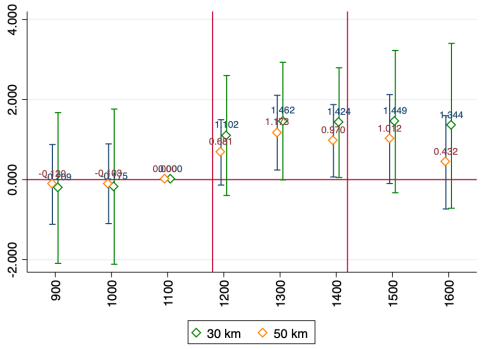
(d) Northern Zone
Source: see text



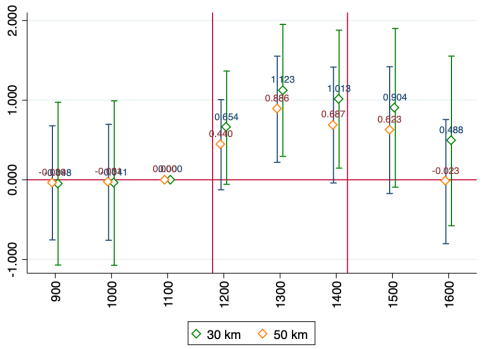
(e) South-Western Zone
Source: Personal elaboration

Macro regions of Poland controlling for unobserved heterogeneity. The direction from West to East controls for the different timing of the Teutonic Order's conquest of Prussia ((a) and (c)), but also the distance from the Holy Roman Empire, which should positively affect trade and development. The direction from North to South controls for the closeness to the coast on one side, and on the other side for closeness to Silesia, Greater Poland, and Lesser Poland, which were the main political and economic centers of Poland. **Source:** Personal elaboration.

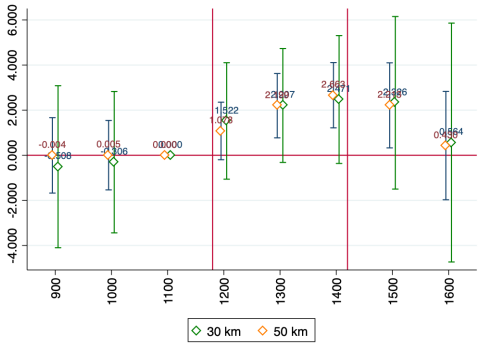
Figure B.4: **Event study across different borders**



(a) Event Study: 13th century borders



(b) Event Study: 13th or 14th centuries borders

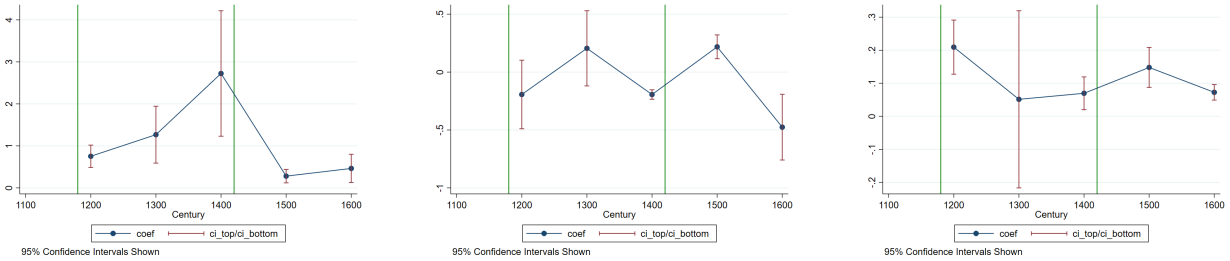


(c) Event Study: natural borders

Event-study analysis showing the evolution of the coefficients interacting the treatment with each century and their standard deviation. In Fig. B.4a the green coefficients represent the specification with a sample restriction to observations within 30 km of the 13th century borders. The yellow coefficients represent the specification with a sample restriction to observations within 50 km of the 13th century borders. In Fig. B.4b The green coefficients represent the specification with a sample restriction to observations within 30 km of the 13th or 14th century borders. The yellow coefficients represent the specification with a sample restriction to observations within 50 km of the 13th or 14th centuries borders. In Fig. B.4c The green coefficients represent the specification with a sample restriction to observations within 30 km of the natural borders. The yellow coefficients represent the specification with a sample restriction to the observation within 50 km of the natural borders.

B.2 Mechanisms

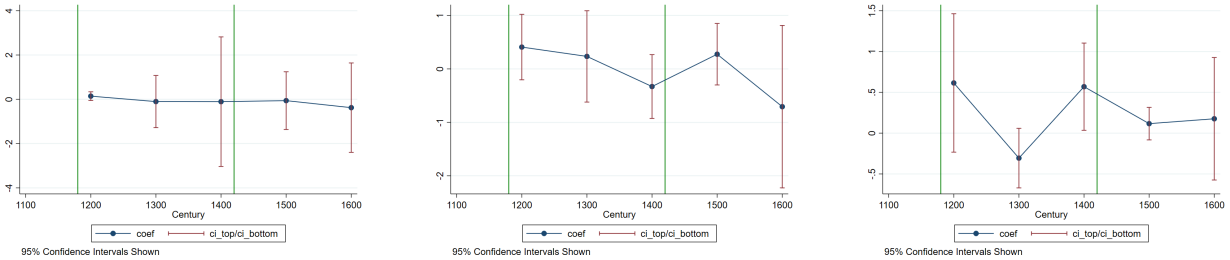
Figure B.5: **RDDs over time on the central-southern 13th century borders**



(a) Civil Buildings (b) Religious Buildings (c) Military Buildings

RDD coefficients and standard errors according to the specification in 1.1. Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the northern 13th century borders. Figure (a) evaluates the RDD considering civil buildings as the outcome. Figure (b) evaluates the RDD for religious buildings. Figure (c) evaluates the RDD for military buildings. In this specification I use the distance from the central-southern 13th century borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Figure B.6: **RDDs over time on the northern 13th century borders**



(a) Civil Buildings (b) Religious Buildings (c) Military Buildings

RDD coefficients and standard errors according to the specification in 1.1. Each coefficient and standard errors are calculated for a given century and plotted chronologically to give the temporal evolution of the coefficient and of the standard error. I use the northern 13th century borders. Figure (a) evaluates the RDD considering civil buildings as the outcome. Figure (b) evaluates the RDD for religious buildings. Figure (c) evaluates the RDD for military buildings. In this specification I use the distance from the northern 13th century AD borders.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Figure B.7: **Intensity of damage from aerial bombing in Poland**

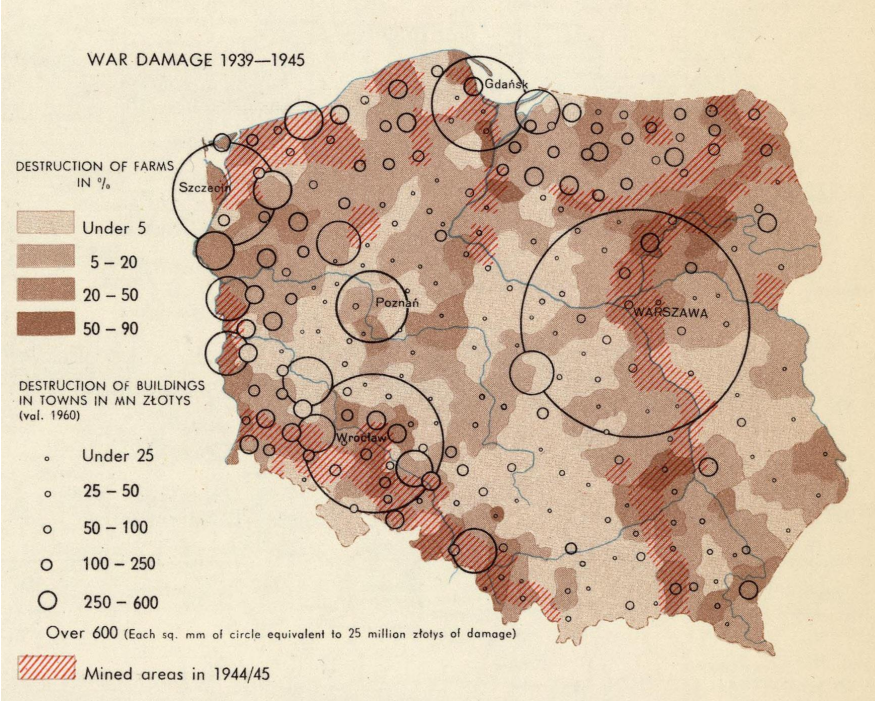
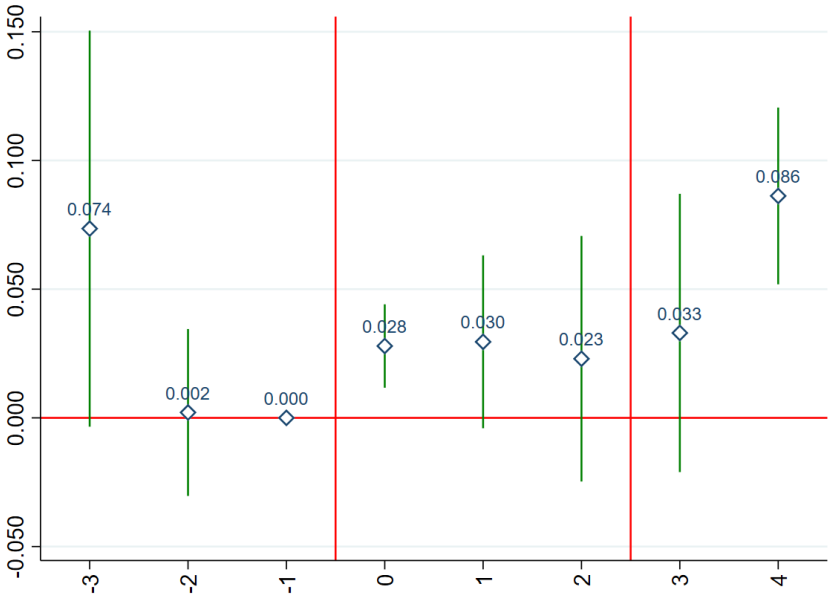


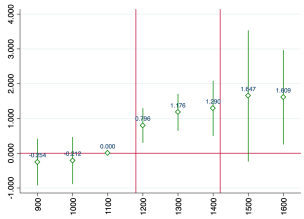
Figure B.8: Intensity of damage from aerial bombing during WWII in Poland. **Source:** Pergamon world atlas (1968)

Figure B.9: **Event study analysis using urbanization as outcome**

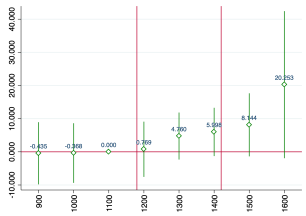


Event study coefficients and standard errors are calculated according to the specification in 1.1. The outcome variable is urbanization, based on HYDE 3.2 estimations.
***Significant at 0.1%; **significant at 1%; *significant at 5%

Figure B.10: **DDD using Teutonic Order and town charters as treatments**



(a) Teutonic Order × Century



(b) Town charters × Century

(c) Teutonic Order × Town charters × Century

Teutonic Order, town charters, and their interaction on economic development (30km sample)

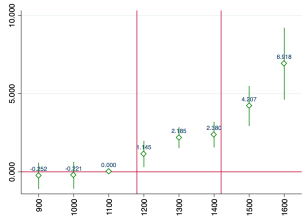
(a) Teutonic Order × Century

(b) Town charters × Century

(c) Teutonic Order × Town charters × Century

Teutonic Order, town charters, and their interaction on economic development(100km sample).

(a) Teutonic Order × Century

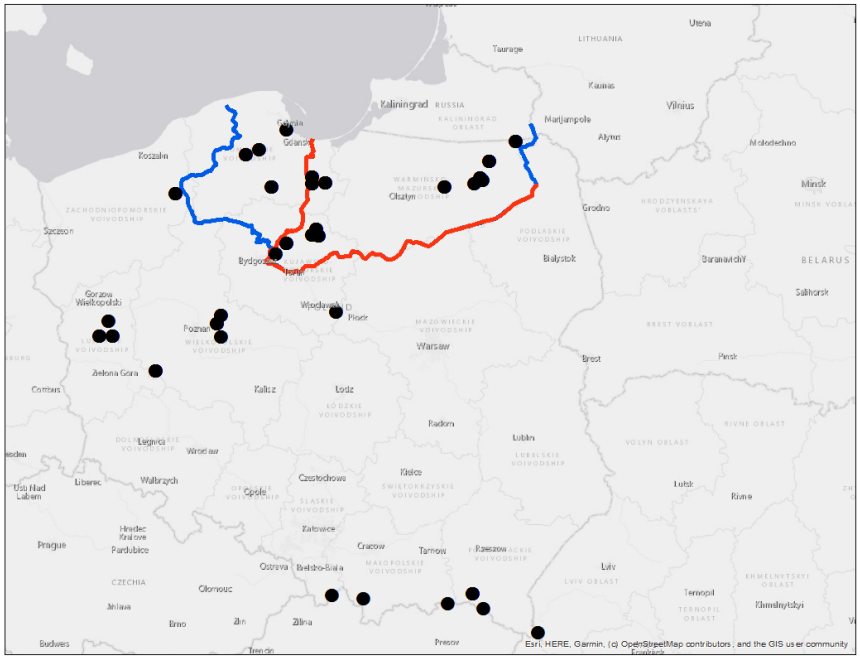


(b) Town charters × Century

(c) Teutonic Order × Town charters × Century

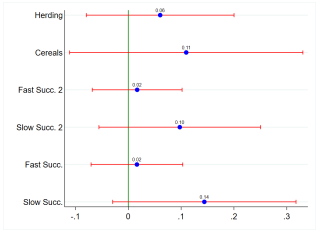
Teutonic Order, town charters, and their interaction on economic development(full sample).

Figure B.13: **Location of pollen-analysed sediment cores in Poland**

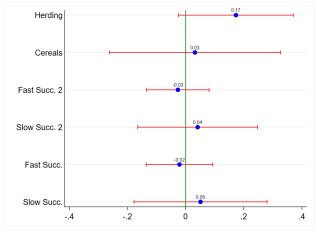


Locations of pollen-analyzed sediment cores in Poland, based on Izdebski et al. (2022). The 13th-century borders of the Teutonic Order's state are marked in red, and the 14th-century borders are marked in blue.

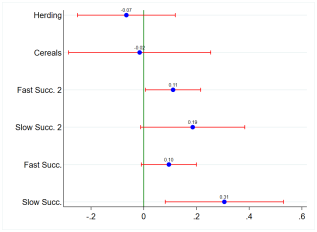
Figure B.14: **Pastureland, agriculture, and land abandonment Order vs Polish territories (13th cen. borders)**



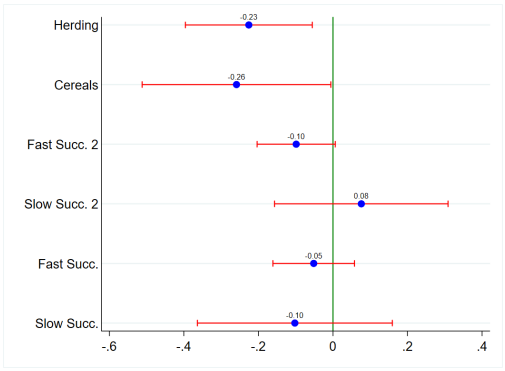
(a) 1300 Century (full)



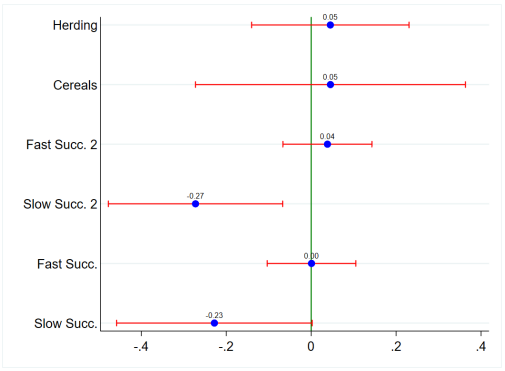
(b) 1300-1350



(c) 1350-1400



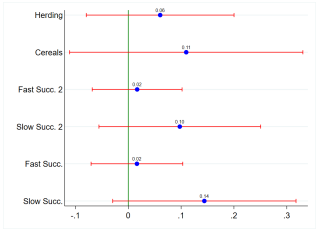
(d) 1250-1300



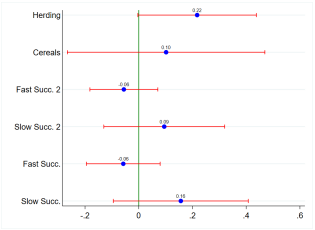
(e) 1400-1450

Comparison of pastureland (herding), agriculture (cereals), and land abandonment (slow and fast succession) between the Order's state and Polish territories, using palaeoecological data. I use the 13th century border for the division between Order state territories and Polish territories. The sample is restricted to four 50-year intervals from 1250 to 1450, allowing for t-test comparisons over these distinct periods. A positive coefficient indicates a higher average in Polish territories during a given interval, while a negative coefficient indicates a higher average in the Teutonic Order's territories.
Source: data from Izdebski et al. (2022)

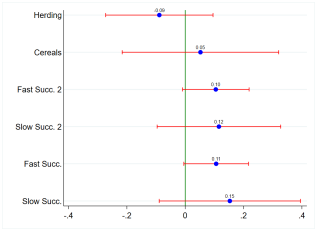
Figure B.15: **Pastureland, agriculture, and land abandonment Order vs Polish territories (14th cen. borders)**



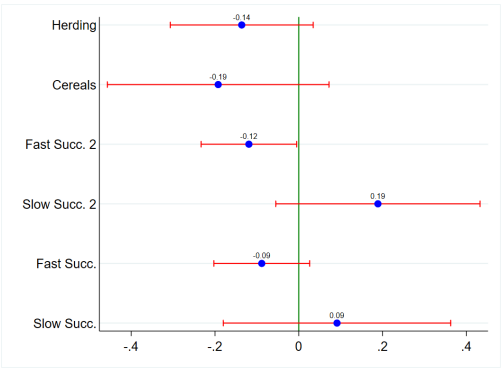
(a) 1300 Century (full)



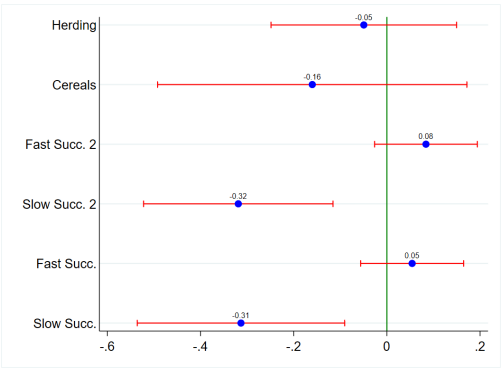
(b) 1300-1350



(c) 1350-1400



(d) 1250-1300



(e) 1400-1450

Comparison of pastureland (herding), agriculture (cereals), and land abandonment (slow and fast succession) between the Order's state and Polish territories, using palaeoecological data. I use the 14th century border for the division between Order state territories and Polish territories. The sample is restricted to four 50-year intervals from 1250 to 1450, allowing for t-test comparisons over these distinct periods. A positive coefficient indicates a higher average in Polish territories during a given interval, while a negative coefficient indicates a higher average in the Teutonic Order's territories.
Source: data from Izdebski et al. (2022)

C Third Appendix: List of Variables Used in the Paper

C.1 Main Outcomes

Number of Buildings: This variable counts the number of building (stock and flow) activities per century in 20x20 km grid-cells. It measures economic development by century (from the 11th to the 17th century), as a proxy for public capital formation. For a more in-depth analysis, buildings are further classified into categories: religious, military, civil, cultural, and palace/residence. Due to data scarcity in the latter two categories, the study is limited to the first three categories.
Source: Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage] (2020b) `https://dane.gov.pl/pl/dataset/1130,rejestr-zabytkow-nieruchomych/resource/61341/table?page=1&per_page=20&q=&sort=` (updated: 2020).
Number of town Charters: This variable accounts for the number of town charters in 20x20 km grid-cells across modern Poland. It is an indicator of early development, measuring the dissemination of pro-market institutions.
Source:
IHPAN (2021): `https://data.atlasfontium.pl/` (updated: 2021);
Cantoni et al. (2018) (updated: 2021); `http://www.davidecantoni.net/data.html`;
Najgrakowski (2009).
Number of Magdeburg Law's cities: This variable represents the number of town charters based on Magdeburg Law within 20x20 km grid cells across modern Poland, serving as an indicator of early development through the spread of pro-market institutions. Cities under Magdeburg Law benefited from a particularly robust form of town charter, as the political, economic, and judicial autonomy of townspeople was solidified by customary law modeled after Magdeburg and German-Saxon law, with the Magdeburg court overseeing its correct application. Additionally, since Magdeburg Law was specifically tied to German-Saxon legal traditions, it spread primarily in areas with established communities of German settlers and merchants, making this charter type also a proxy for the presence of German communities in the region.
Source:
Cantoni et al. (2018): `http://www.davidecantoni.net/data.html` (updated: 2021);
Zentrum Für Mittelalterausstellungen Am Kulturhistorischen Museum Magdeburg [Center for Medieval Exhibitions at the Cultural History Museum in Magdeburg] (2020): `https://magdeburg-law.com/historic-city/` (updated: 2021).

C.2 Main Independent Variables

Presence of the Teutonic Order: Indicator variable set to 1 if the 20x20 km grid square was conquered by the Teutonic Order in the century under analysis, and 0 otherwise. As I am adopting a RDD as baseline specification, the main cut-off is represented by the 13th century border.
Source: Erlen (1992), pg.105, Pluskowski (2024), Czaja and Radziminski (2016), Pluskowski

(2012), and Christiansen (1980).

C.3 Main Control Variables

Archaeological Sites - Prehistory: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square.
Archaeological Sites - Stone Age: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square.
Archaeological Sites - Bronze Age: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square.
Archaeological Sites - Iron Age: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square.
Archaeological Sites - High Middle Age: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square. The High Middle Ages end in the 13th century, according to dating by the Polish National Institute of Cultural Heritage.
Archaeological Sites - Low Middle Age: Number of archaeological sites dating back to prehistory within each 20kmx20km grid square. According to the Polish National Institute of Cultural Heritage, the Low Middle Ages begin in the 13th century.[18]
Source: Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage] (2020a) `https://dane.gov.pl/pl/dataset/210,rejestr-zabytkow-archeologicznych` (updated: 2020).

Barley Suitability: measure of land suitability for barley obtained by averaging the pixel values within each 20x20 km grid square from a raster dataset. Pixels are assigned a value of 1 if land suitability for barley is above 0.55 ("good suitability") and 0 otherwise.
Wheat Suitability: measure of land suitability for wheat obtained by averaging the pixel values within each 20x20 km grid square from a raster dataset. Pixels are assigned a value of 1 if land suitability for wheat is above 0.55 ("good suitability") and 0 otherwise.
Rye Suitability: measure of land suitability for rye obtained by averaging the pixel values within each 20x20 km grid square from a raster dataset. Pixels are assigned a value of 1 if land suitability for rye is above 0.55 ("good suitability") and 0 otherwise.[19]
Source: Food and Agriculture Organization (FAO), and International Institute for Applied Systems Analysis (IIASA) (2021); `https://gaez.fao.org/pages/data-viewer` (updated: 2021).
Luvisol: measure of the presence of luvisol soil obtained by averaging the pixel values within each 20x20 km grid square from a raster dataset. Pixels are assigned a value of 1 if the terrain is classified as luvisol and 0 otherwise.
Source: European Soil Database v2.0 (Panagos et al., 2012);`https://esdac.jrc.ec.europa.eu/content/european-soil-database-v20-vector-and-attribute-data` (up-

[18]the classification of archeological sites by age is based on the original classification made by Polish National Institute of Cultural Heritage and present in the original dataset.

[19]for the 0.55 threshold see Andersen et al. (2016), Alesina et al. (2013) and GAEZ Data Portal (`https://experience.arcgis.com/experience/8f925fc730534cceb2b5155e354769d6/page/Theme-4%3A-Suitability-and-Attainable-Yield/`).

dated: 2021)
Luvisol × Barley Suitability: measure of the presence of luvisol soil and barley suitability obtained by averaging the pixel values within each 20kmx20km grid square from the product of the luvisol- and the barley-suitability raster dataset.

Routes access: Indicator variable set to 1 if each 20kmx20km grid square is crossed by a route, 0 otherwise.
Routes distance: Geographical distance from the centroid of each 20kmx20km grid square to the nearest route.
Source: Viabundus Project (Holterman et al., 2021); `https://www.landesgeschichte.uni-goettingen.de/handelsstrassen/index.php#download` (updated: 2022)[20].
Rivers access: Indicator variable set to 1 if each 20kmx20km grid square is crossed by a river, 0 otherwise.
Rivers distance: Geographical distance from the centroid of each 20kmx20km grid square to the nearest river.
Source: European Environment Agency (EEA), and Copernicus Land Monitoring Service (2019b); `https://land.copernicus.eu/imagery-in-situ/eu-hydro`.

Elevation: Average elevation within each 20kmx20km grid square.
Slope: Average slope within each 20kmx20km grid square.
Source: European Environment Agency (EEA), and Copernicus Land Monitoring Service (2019a); `https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-dem-v1.1`.

Latitude and Longitude: Coordinates of each grid Square.

C.4 Fixed Effects

Zone Est: Indicator function set to 1 if the longitude of each grid square is higher than 2195151.48922.
Zone Center: Indicator function set to 1 if the longitude of each grid square is higher than 2195151.48922 and smaller than 2375151.48922.
Zone South Est: Indicator function set to 1 if the longitude of each grid square is smaller than 2195151.48922 and the longitude is smaller than 7078838.6147.
Zone Center west: Indicator function set to 1 if the longitude of each grid square is smaller than 2195151.48922 and the latitude is higher than 7078838.6147 and smaller than 7178838.6147.
Zone North Est: Indicator function set to 1 if the longitude of each grid square is smaller than 2195151.48922 and the longitude is higher than 7178838.6147.

Dioceses (11th century): Indicator variable set to 1 if a 20kmx20km grid square belongs to a diocese.
Polish Principalities (12th century): Indicator variable set to 1 if a 20kmx20km grid square

[20]For my analysis, I selected only routes classified with levels 1 or 2 in terms of importance.

belongs to one of the Polish Principalities during the feudal fragmentation of the Piast Kingdom in the 11th century.
Prussian Tribes (12th century): Indicator variable set to 1 if a 20kmx20km grid square belongs to one of the main Prussian tribes.
Division of Poland (13th century): Indicator variable set to 1 if a 20kmx20km grid square belongs to one of the Polish Principalities during the feudal fragmentation of the Piast Kingdom in the 12th century.
Administrative division of Poland and the Order state (14th century): ndicator variable set to 1 if a 20kmx20km grid square belongs to one of the commanderies in the Order state, or one of the castellanies in the Kingdom of Poland.
Source: Friedrich Bruns (1875).

C.5 Additional Variables

Urbanization Estimate: Number of people living in an urban area within each 20kmx20km grid-square over total population in the same square.
Source: HYDE 3.2 database (Klein Goldewijk et al. (2017)); `https://landuse.sites.uu.nl/hyde-project/` *Pollen Data*: Pollen data measuring the extent to which a given site was used for cereal production, herding, or was left abandoned (distinguishing between short-term and long-term abandonment).
Source: Izdebski et al. (2022).
Land Ownership: Number of hectares owned by the main ruler - the Order in Prussia and the Polish Crown in the Polish Kingdom - per size of the administrative unit in hectares (Commanderies in the Order, Castellanies in the Polish Kingdom).
Sources: Sarnowsky (1993) for the Teutonic Order State.
Instytut Historii im. Tadeusza Manteuffla PAN (2021), pg.7 for Poland.
Subordinate Turnover: Duration of service for Teutonic Order commanders and Polish castellans within an administrative unit (Commanderies for the Order and Castellanies for the Polish Kingdom). This variable measures the ruler's ability to control their subordinates. A higher turnover indicates a greater capacity to replace subordinates within the administrative unit.
Sources: Czaja and Radziminski (2016) for Teutonic Order commanders.
Series IHPAN (2014) "Urzednicy dawnej Rzeczypospolitej XII-XVIII wieku [Officials of the former Republic of Poland XII-XVIII centuries]" for Polish castellans: Vol. I/1, II/2, IV/3, VI/1, VI/2.
Number of Prussian Villages: Number of Prussian villages within each 20x20 km grid square. This variable measures the presence of native Prussian villages, which operated under a serfdom regime, unlike the Germanic settlers who were considered freemen. Consequently, this serves as an indirect measure of extraction and extractive institutions imposed on native ethnic groups.
Source: Erlen (1992), pg.111.

Chapter 2

Fast Car to Boom and Bust

Transportation Technology and its Causal Effects on Rural Economic Development

2.1 Introduction

It is widely recognized that horses, ships, trains, cars, and airplanes carry not only people and goods, but also ideas, hope, and economic change. Means of transportation alter regional accessibility, thereby shaping economic activity and expectations about the future. Most studies on the effects of shifts in regional accessibility focus on large infrastructure expansions, including the expansion of train networks (Donaldson, 2018; Hornung, 2015; Donaldson and Hornbeck, 2016), and road construction (Asher and Novosad, 2020), or improved accessibility by land, water, or air following the gradual introduction of new technologies (Eli et al., 2022, 2025; Campante and Yanagizawa-Drott, 2018; Pascali, 2017). Surprisingly, the economic effects of the most transformative transportation technology of the twentieth century - automobiles and motor vehicles in general - are largely understudied (Eli et al., 2022). To date, little is known about the spatial economic effects triggered by automobiles, whether these effects are uniformly distributed across space or highly concentrated in certain places. Empirically, identifying the causal effect of car accessibility is challenging because both the diffusion of automobiles and their economic utility have evolved gradually over time. It is thus complicated to estimate their direct impacts on economic outcomes, spatial patterns, and shifts in individual and entrepreneurial behavior.

In this paper, we exploit the economic effects of lifting one of the most unique and long-lasting technology bans in recent history: the automobile ban in the Swiss canton of Grisons from 1901 to 1925. Grisons' authorities initially banned automobiles after some accidents with horse-drawn carriages. The ban was implemented at a time when automobiles were largely considered primarily sports vehicles for the rich, with no direct economic value. However, while the rest of the world steadily adopted automobiles, motorcycles, and trucks, Grisons' automobile ban remained in effect until 1925. By the summer of 1925, a narrow majority of Grisons' voters decided in a popular vote to remove the ban completely. We use the unexpected and abrupt removal of this long-standing ban on automobiles as a unique quasi-natural experiment that shocked actual and perceived accessibility of places within the canton, broadly speaking, from one day to the next, while local infrastructure remained constant. This episode marks sudden and largely unexpected access to one of the most transformative transportation technologies of the twentieth century. It allows us to document and quantify the economic effects of access to automobiles, their spatial economic impact, and shifts in entrepreneurial expectations.

We use event-study and difference-in-differences designs to compare regional economic activity in the canton of Grisons compared to neighboring regions that were never under a car ban. The main analysis focuses on the years from 1920 to 1930, the years before and after the repeal of the automobile ban. We use different hand-collected data to measure shifts in local economic activity at the yearly level. Our main measures of economic development are the number of newly registered firms, firm survival, and firm closures per year in each municipality. These measures capture, on the one hand, new economic activity on the entrepreneurial side at the onset of the automobile's introduction. On the other hand, new firm registration may indicate an expectation of future economic activity, which can materialize as local accessibility increases. We also classify firms by main industrial sectors - advanced services,

manufacturing, construction, hospitality, retail, and primary/waste sector - to assess whether the observed effects are driven by specific types of economic activity and to shed light on how the automobile affected the local economic structure. Beyond firm dynamics, we compare Grisons and neighboring municipalities using a broader set of indicators of local economic development drawn from demographic and business censuses, including the stock of firms and farms, population, the number of houses and households, and residents' birthplaces, to capture migration patterns. Finally, we analyze local taxable income, using the same event-study and difference-in-differences designs. Shifts in local taxable income measure the net economic effect of increased local accessibility. This helps us uncover the local characteristics for which automobiles truly spur sustainable economic growth, i.e., identifying places that benefit in real terms, as opposed to those with characteristics for which the new technology is less effective and less sustainable.

We show that the introduction of automobiles following the repeal of the ban in 1925 had a positive effect on economic activity, relative to neighboring municipalities, as measured by the number of new firms registered each year in a given municipality. We find that Grisons' entrepreneurs registered about 0.5 more firms per 1,000 inhabitants per year after the repeal of the ban than in the control regions. The effect is statistically significant and economically meaningful, corresponding to about 36% of the unconditional mean of the dependent variable and roughly 46% of the pre-1925 average level of firm registration. In other words, the number of newly-registered firms in Grisons' municipalities grew by almost 50 percentage points in the short run, compared to the control sample. Moreover, we also document a parallel trend between Grisons and the control sample in firm registration prior to the lifting of the ban. This evidence hints at a causal effect of automobiles on (regional) economic activity. However, the initial boom in Grisons lasted only the first two years after the end of the ban, before the number of new firm registrations returned close to pre-ban levels, followed by a new spike in Grisons in the late 1920s. When focusing only on firms that survived until 1937, the estimated impact of the repeal of the car ban becomes smaller, indicating some over-optimistic perception about the future of the initial firm registration activities in Grisons. This evidence suggests that the response of economic actors was immediate but only partially persistent over time. Looking at firm registrations by main industrial sectors, we find that the effects are mainly driven by retail and manufacturing. This result is consistent with a process of modernization of local productive activities following the expansion of market access and flows of motorists driving through Grisons.

To understand how these effects varied across space, we examine heterogeneity along three dimensions of municipal centrality: railway connectivity, altitude, and population. These measures correlate with the initial development trajectories of localities and with residents' (tacit) knowledge of how to interact in a more connected world. The results provide a mixed picture of how the benefits of the automobile were distributed across municipalities. Total firm registrations do not show systematic differences between more and less central municipalities; if anything, in the first two years they increase more in lower-population and higher-altitude municipalities. However, in the later years (1929 and 1930), and when we focus on surviving firms, higher-population and railway-connected municipalities drive the results. We then assess whether these differences translate into broader, longer-run economic outcomes by analyzing taxable income. Consistent with the evidence on surviving firms,

income increases are concentrated in larger municipalities that were better connected in 1925. Taken together, the findings suggest that, in the short run, entrepreneurial activity was relatively more spurred in rural and peripheral municipalities. This aligns with Faber (2014), who documents that peripheral places were not disadvantaged by centralizing forces related to economies of scale and spillovers. Over time, however, these forces appear to re-emerge when considering firm survival and income. This pattern is consistent with a period of experimentation and trial and error by entrepreneurs following the introduction of the automobile and the associated expansion of market access. The initial rise in activity in more peripheral municipalities appears to reflect entry in response to new opportunities, but it does not fully translate into persistent firm survival or sustained income growth, as economic gains remain concentrated in ex-ante larger and better-connected municipalities. The findings also suggest that automobiles serve as a complement to pre-existing infrastructure, such as train access. We conclude that underdeveloped and peripheral places hold an overly optimistic view of the benefits of automobiles, leading to a boom-and-bust cycle in firm activity without any long-run improvement in local taxable income. In contrast, already ex-ante well-developed localities benefit relatively more in the long run, with automobile accessibility increasing regional economic disparities over time due to automobile accessibility.

2.2 Literature Review

We contribute to several strands of literature. First, we add to the literature that studies the effects of transportation technologies and infrastructure on market access, economic development, and the spatial distribution of economic activity, often using empirical and quasi-natural experimental approaches (Neubert and Nikolić, 2026; Andersson et al., 2023; Asher and Novosad, 2020; Campante and Yanagizawa-Drott, 2018; Donaldson and Hornbeck, 2016; Jedwab and Moradi, 2016; Hornung, 2015). A large part of this work finds that transportation infrastructure supports economic development by improving market access, fostering specialization, and generating spillovers and agglomeration effects. For example, Andersson et al. (2023) show that railways in Sweden boosted local development by reducing the cost of transmitting new ideas and expanding markets for innovation. Hornung (2015) documents that railway construction in the Prussian Kingdom between 1840 and 1871 increased city growth through industrial expansion and the attraction of workers to newly connected urban centers. Donaldson and Hornbeck (2016) show that the rapid expansion of railroads in colonial India (1870–1930) reduced trade costs and inter-regional price gaps, thereby increasing real income in the long run. Campante and Yanagizawa-Drott (2018) find that improvements in long-distance flight connectivity raise local economic activity, measured by the density of night-time lighting, by strengthening business links and facilitating mobility of people and capital, especially between high- and middle-income countries. However, they also note that these benefits do not extend to low-income countries, and contribute to widening of both local and global inequalities.

Evidence within this same literature also shows that transportation technologies and their supporting infrastructure can entail limits and, at times, substantial costs. Asher and Novosad (2020) show that rural road construction in India has limited short-run effects (over four

years). They find a large shift of workers out of agriculture, but limited mobility across villages, implying weak spillovers and agglomeration, and "no major changes in agricultural outcomes, income, or assets" (Asher and Novosad, 2020, p. 1). Their results suggest that infrastructure alone may be insufficient for sustained local development in peripheral areas. Similarly, Faber (2014) exploits the quasi-natural experiment of China's National Trunk Highway System and documents GDP losses in peripheral counties connected to the network, driven by trade integration that favored core metropolitan areas. Neubert and Nikolić (2026) show that, under Habsburg rule in Bosnia and Herzegovina, the transition to normal-gauge railways harmed local industries by exposing them to competition from imperial centers. They also find that the benefits of narrow-gauge railways were small and short-lived unless towns had supportive human capital and law enforcement, measured respectively by access to public elementary schools and the presence of armed forces.

Our paper differs from this literature in two ways. First, we study a quasi-natural experiment where a major transportation technology - the car - is introduced almost overnight, following the repeal of a long-standing ban. This shock affected the entire territory of Grisons without requiring new infrastructure, long construction periods, or large individual or public investment. Second, while most existing papers focus on the impact of transportation infrastructure without separating the effects of the technology from its infrastructure, we begin by estimating the direct effect of the car on economic development across the region. Then, in a second step, we examine how this effect varies with existing infrastructure, such as the road network that facilitates car use, and the railway system that complements or competes with it.

We also contribute to the recent work that studies technology, its adoption, and its economic and social effects. As highlighted in the 2025 Economics Nobel Prize award, technological change can have transformative and creative-destructive impacts on both production and society (Royal Swedish Academy of Sciences, 2025; Aghion and Howitt, 1992, 1998). Recent studies show that the challenges of technological progress stem not only from invention itself but also from uncertain and uneven adoption processes (Comin and Hobijn, 2004; Comin and Mestieri, 2018). This process reflects the interaction between the transformative nature of new technologies and the trial-and-error dynamics that accompany their diffusion (Eli et al., 2025, 2022; Juhász et al., 2024; Mokyr et al., 2022). Eli et al. (2025, 2022) argue that the Model T expanded the U.S. automobile market much as the iPhone transformed the smartphone from a niche device into a mass-market product. Yet, unlike the iPhone, the Model T spread slowly in Europe, mainly due to higher costs driven by trade frictions and technological constraints. Mokyr et al. (2022) links the timing of adoption to path dependency, showing that the distribution of watermills in the Domesday Book (1086) persisted in the 18th-century locations of millwrights, key craftsmen in the English Industrial Revolution. He explains path dependence through the transmission of human capital, which facilitates technological adoption and intergenerational learning. Juhász et al. (2024) complement this explanation, emphasizing that adoption requires a process of "trial and error" in reorganizing production, which can generate long-run dispersion in productivity. Together, this literature highlights the difficulty of disentangling the process of adoption from its effects on economic and social outcomes. In this paper, we examine whether adoption of transportation technologies follows a similar process of "creative destruction" and "trial and error" at a broader regional and

social level, using a causal empirical framework given by the repeal of the car ban in Grisons. To our knowledge, no study has examined how the adoption of a transformative technology - such as the automobile - has affected not only the sector where it was first introduced (transportation) but also the wider productive structure, regional economy, and society as a whole.

Finally, we contribute to the literature on boom-and-bust dynamics by studying economic fluctuations following a sudden increase in market access. The development literature typically associates local booms and busts with resource discoveries and Dutch disease. Jacobsen and Parker (2016), and Caselli and Michaels (2013) show that oil and extractive shocks generate local expansions followed by persistent downturns. Allcott and Keniston (2017) find that oil and gas booms in the United States raise local wages and contract tradable manufacturing, though without reducing manufacturing productivity. Faber and Gaubert (2019) study tourism development and its interaction with local industries and geography. Our setting differs from resource-driven booms. In our paper, the temporary effect of the automobile shock on economic activity, especially in remote areas, is not determined by the resource curse, the volatility of international resource prices, or resource exhaustibility. Rather, it is driven by the interaction between the limits and opportunities associated with market access - even when expanded by cars - and the expectations of economic agents, particularly firms and entrepreneurs.

This mechanism naturally relates to a large literature that studies expectation formation when agents must learn from observed outcomes (Evans and Honkapohja, 2001, 2011; Cogley and Sargent, 2005). Rather than holding fully rational expectations, agents update beliefs using past realizations. This problem is particularly relevant for entrepreneurial entry after the opening of new markets. When demand is uncertain, firms may enter a market based on optimistic expectations and revise their beliefs as information accumulates. Related work documents informational herding and systematic over-extrapolation in belief formation (Devenow and Welch, 1996; Bordalo et al., 2018, 2020). These mechanisms can generate temporary entry booms followed by exit once realized demand becomes known.

Empirical evidence on firm behavior under new market opportunities remains limited, especially after large changes in market access or new technologies. Existing contributions show that firms adjust product scope, exporting, innovation, and market participation as they learn about profitability and demand conditions (Bernard et al., 2010; Moser et al., 2014; Atkin et al., 2017; Doraszelski et al., 2018). The abolition of the automobile ban created a sharp and unanticipated expansion in market access. We document a boom-bust-boom pattern in firm entry consistent with initially optimistic expectations about tourism demand and transit motorists, followed by learning and some number of firm closures. The results suggest a process of entrepreneurial experimentation and adjustment in response to the new technology.

2.3 Historical Background

In this section, we document the history of the car ban and its repeal in 1925 in Grisons. We show how the car ban history relates to the broader diffusion of cars and motorized vehicles

across Europe, as well as to the evolving perception of cars and drivers among the inhabitants of Grisons.

2.3.1 Automobile Ban in Grisons, 1900-1925

On 17 August 1900, following several incidents and accidents in which postal and general road traffic was endangered by the use of *motor vehicles* (automobiles), the Small Council - the cantonal government of Grisons - decreed a ban on driving automobiles on all roads in the canton.[1] A few years later, in October 1907, the Grand Council - the cantonal parliament - decided to ease the existing car ban, introducing a system of concessions for trade, commerce, and transport, and opening four roads to motor traffic. This decree was subject to a popular vote for approval, and was - in a surprise to the local political elite - decisively rejected with 11,184 "No" and only 2074 "Yes" votes (approximately 16%).

These two acts, a legislative measure and a political action by the populace, marked the beginning of car ban in Grisons, which defined the region for nearly twenty years until 1925. It stands as a unique case in the history of car bans, notable not only for its duration and nearly continuous enforcement, but also for the tension it revealed between government and the people. Moreover, as debated by contemporaries, it frames and summarizes the broader discourse and prevailing attitudes regarding automobiles, their drivers, and their regulation.

Figure 2.1 shows the timeline of the car ban in Grisons. It was enforced almost continuously, with only minor exceptions, until 1925. From a political perspective, the 1911 popular vote, triggered by the so-called "Zizers Initiative",[2] prevented any further attempt by the government to introduce a license system, affirming support for a total ban. As a consequence, few legislative initiatives followed until 1920. However, shortages of traditional means of transport during World War I led to exceptions for a limited number of trucks, medical and ambulance vehicles, and eventually postal automobiles and buses. Although temporary, these exceptions laid the groundwork for future developments.

The reasons behind the car ban and its popular support in Grisons can be traced back to two main factors: one related to the broader diffusion of automobiles across Europe (or indeed the world), and one local, rooted in the specific socio-economic conditions and attitudes of population living in Grisons toward cars. From a European perspective, up to the 1920s, cars were not yet considered a primary means of transportation due to their high acquisition and maintenance costs. Instead, they were primarily regarded as luxury or sporting vehicles.

[1]The official decree reads as follows: *Da Fälle vorgekommen sind, in denen durch das Befahren von Strassen mit Automobilen der Post- und der Fahrverkehr überhaupt gefährdet wurde und da solche Fälle sich wiederholen und zu eigentlichen Katastrophen führen könnten, beschliesst der Kleine Rat: [...] Das Fahren mit Automobilen auf sämtlichen Strassen des Kantons Graubünden ist verboten. [Since cases have occurred in which the use of automobiles on roads has endangered postal services and traffic more generally, and since such incidents may recur and could lead to actual catastrophes, the Small Council resolves: ... The use of automobiles on all roads in the Canton of Graubünden is prohibited.]* (Amtsblatt des Kantons [Official Gazette of the Canton] GR 1900, S. 393, as reported in (Hollinger, 2018, pg. 48))

[2]Named after a petition from the municipality of Zizers, which called for a return to a complete ban in opposition to the government's legislative proposal. The proposal aimed to allow limited car use for transportation on specific roads, under registration requirements.

With few models in circulation[3] the profile of car owners largely overlapped with the social elite, which reinforced the image of motorists as "gentleman drivers" and "car show-offs" (Hollinger, 2018). Consequently, the car quickly came to symbolize both social class division between the upper and lower classes and spatial inequality between urban centers and the periphery.

From a local perspective, the early reputation of cars and their drivers intersected with unique social structure in Grisons. As a canton with a strong agricultural tradition, mountainous terrain, and relative isolation compared to other Swiss regions, its residents viewed motorists as "reckless speeders who endanger the health and safety of humans and animals" (Hollinger, 2018, pg. 59). On a more practical and material level cars were perceived as economic threats to traditional transport providers, such as horse-drawn carriages and stagecoaches, as well as to the regional railway system. Competition with the railway was a specific concern as, unlike in other cantons, Grisons received no federal subsidies, and by 1920, the construction debt was still a heavy burden for locals.

Moreover, the extensive road network,[4] combined with low population density, made road maintenance expensive. These costs often fell on local municipalities and became a heavy burden for communities. Cars, especially those coming from outside the canton, were seen as damaging the roads and reducing their lifespan. In addition, by raising dust, creating noise, and crowding out other road users, including pedestrians and children, cars were seen as taking over what had traditionally been a shared public good and social space. Drivers were thus often viewed as free-riders by the local population (Merki, 1998; Hollinger, 2018).

Finally, it is worth noting that, during this period, local opinions about tourists, and those of the lodging and tourist sectors were divided. Some viewed the car as a potential asset, capable of improving accessibility to Grisons municipalities and boosting tourist numbers. Others saw it as incompatible with spa and health-resort tourism, fearing that cars would disturb the tranquility and natural environment of Grisons (Hollinger, 2018).

In addition to these considerations, other political factors should not be overlooked. First, Switzerland has a strong tradition of direct representation and grassroots-level politics (Stutzer and Frey, 2006; Feld and Matsusaka, 2003; Hollinger, 2018). Thus, the perception among Grisons residents that the Small and Grand Council ignored popular sentiment fueled resistance. Second, while not tied to a specific issue, the weakness of the car supporters in the popular vote can also be explained by their difficulty in clearly presenting the benefits of automobiles, which were still vague and uncertain at the time. In contrast, the disadvantages, including financial costs, were more visible and tangible.

[Figure 2.1 about here]

[3] In 1920, the two European countries with the highest car density, France and the UK, had only 6 and 8.5 cars per 1,000 inhabitants, respectively (Mitchell, 1998).

[4] Hollinger (2018) reports that in 1870, Grisons had 7 km of roads per 1,000 inhabitants, compared to the national average of 2.4 km.

2.3.2 The End of the Car Ban and the Street Network in 1925

Several factors help to explain the shift in popular perception of cars in Grisons and the growing political and institutional activity around their regulation. First, the exceptions introduced during WWI, though mainly limited to vehicles with military and public utility, convinced the government of the need to maintain these exemptions at the legislative level even after the war ended.

Second, the period immediately after WWI witnessed a rapid increase in the use of automobiles for both public and private transportation in Switzerland (except in Grisons), in Europe, and worldwide. Figure B.1 shows that car use increased almost fivefold in the UK and France, which already had relatively high auto diffusion rates. Other European countries experienced even stronger growth, although they started from and converged to lower levels. Switzerland showed a similar growth trend, falling between the higher levels of the UK and France and the lower levels of other continental European countries. Nevertheless, the years after WWI and the early 1920s were a period of rapid adoption of this new technology in Switzerland. Within the postal services, for example, the number of horses used was halved between 1914 and 1919, while the number of motor vehicles in the postal services increased from 6 in 1918 to 341 in 1926 (Hollinger, 2018, pg. 28). Registered private cars in Switzerland increased two or threefold in the years after WWI. By contrast, Grisons had almost no registered private cars before the repeal of the automobile ban, and only 5.11 cars per 1,000 inhabitants by 1928. In other Swiss cantons, the numbers were around two (St. Gallen) to eight times (Geneva) larger.[5] This trend illustrates that the automobile was gradually becoming accessible to a broader share of the population, as a means of transportation for people and goods. For the canton of Grisons, however, potential economic benefits immediately after repeal of the car ban may stem mainly from increased accessibility by non-Grisons motorists rather than from direct ownership within the canton.

Third, by 1923, the tourism sector faced a severe crisis due to the lingering effects of WWI, which led to a sharp decline in tourist flows. This decline also created economic and fiscal concerns, as the 18 main tourist municipalities and Grisons' capital Chur generated more than 55% of the canton's tax revenue (Hollinger, 2018).[6] Finally, the possibility that legislative competencies around motor vehicles would shift from the cantonal to the federal level became more concrete. Although the first federal motor vehicle law only came into force in 1933, the 1921 federal automobile referendum had already granted the federal government the authority to designate roads as necessary for public transit. Though Grisons voted against this centralization, the bill passed at the national level.

Despite the growing shift in attitudes toward cars and drivers, every attempt by the government to introduce legislative exceptions to the total ban encountered popular resistance in five votes, held in 1920, 1921, 1923, 1924, and January 1925, up to June 1925 (see Figure 2.1). Government initiatives were still seen as attempts to circumvent the popular will.

[5]The canton of Geneva increased private cars from 17.43 per 1,000 inhabitants in 1924 to 40.78 in 1928; Zurich from 6.37 to 20.20; and St. Gallen from 4.47 to 10.40 (see Table B.1).

[6]The main tourist municipalities, as indicated by Hollinger (2018), are: Davos, St. Moritz, Arosa, Pontresina, Klosters, Flims, Lenzerheide, Scuol, Tarasp-Vulpera, Sils im Engadin, Celerina, San Bernardino, Chur, Silvaplana, Maloja, Bergün, Samedan, and Churwalden.

Furthermore, as in the previous decade, cars were still viewed as a potential threat to the social system of Grisons and tourism and the arrival of outsiders were seen as potentially corrupting influences. As a result, from both a social and political perspective, the popular vote often reflected a divide between the lodging and tourism sectors, which supported the introduction of cars, and farmers or traditional transport providers, who opposed them (Hollinger, 2018). An extreme example of this polarized environment was the 1922 legislative initiative, introduced at the grassroots level by doctors. It proposed limited exceptions only for medical vehicles, but was rejected by a narrow majority. For this reason, even though it is reasonable to assume that by the early 1920s the population in Grisons anticipated the eventual introduction of automobiles over the following decade or beyond, the specific timing of the ban's repeal in 1925 was not known in advance. Nevertheless, in June 1925, a narrow majority of voters in Grisons, by a margin of around 2%, voted in favor of automobiles, thereby repealing the ban. This decision ended one of the world's longest and most distinctive technology bans, allowing cars and motor vehicles to circulate freely on the roads of Grisons.

2.4 Data and Descriptives

In this section, we introduce our sample of municipalities in Grisons and adjacent Swiss valleys and describe the self-compiled data used in our analysis.

2.4.1 Sample

Our main analysis compares the evolution of economic variables before and after the repeal of the car ban in the canton of Grisons with those of neighboring Swiss regions that were never subject to a car ban. Figure 2.2 illustrates the location of the canton of Grisons (dark gray) and the control sample consisting of municipalities in the cantons of St. Gallen, Uri, Glarus, and Ticino (light gray). We construct the control sample based on geographic features of neighboring places. In particular, we include adjacent major valleys adjacent to Grisons as the control group. Adjacent valleys include the entire cantons of Glarus and Uri, and parts of the cantons of St. Gallen and Ticino. In total, our dataset consists of 349 municipalities, of which 218 observations belong to the canton of Grisons. The rest belongs to the southern parts of the canton of St. Gallen (20 municipalities), Uri (20 municipalities), Glarus (28 municipalities), and the main northwestern valley of Ticino (63 municipalities).[7] Between 1883 and the late 1930s, various territorial and administrative changes occurred, primarily due to municipal mergers and splits. To account for these, we adopt the 1920 administrative territorial division as our reference unit. Where necessary, municipalities are merged to construct a balanced panel. We will add population figures for the border regions of Italy and Austria to our data to construct shifts in market access with the newly introduced cars.

[Figure 2.2 about here]

[7]Records from the enterprise register for the district of Blenio (neighboring Grisons) and the municipalities of Personico, Prato-Fiesso, Gnosca, Anzonico, Robasacco, Sobrio, Rossura, Cavagnago, and Campello were lost. Consequently, information on firm registrations is unavailable. In specifications that include firm registrations as an outcome, we exclude this district and these municipalities from the sample.

2.4.2 Variables

Our dataset combines hand-collected archival sources with data retrieved from the Swiss Federal Statistical Office and the Cantonal Archives of Grisons, St. Gallen, Uri, Glarus, and Ticino. Our primary measure of economic activity is the number of newly-registered enterprises between 1883 and 1937 in Grisons, and between 1920 and 1937 in the other cantons. The structure of the registers also allows us to associate each enterprise with the owner's name, legal status, business type, the associated sector of operation, and whether it had closed by each endpoint of the registers (1910, 1923, and 1937). This provides us with a dataset of the universe of newly registered firms by year and by municipality. Because the canton of Glarus introduced preferential corporate tax treatment unusually early (Brülhart et al., 2023), its firm-registration series exhibits a discontinuity in 1924 due to the relisting of already registered firms. We cleaned this spike in the data for the canton of Glarus by replacing the 1924 values with the average of the adjacent years (1923 and 1925). Section 2.7 shows that our results are robust to alternative treatments, including using the unadjusted firm data for the canton of Glarus, excluding Glarus, and allowing for canton-specific linear time-trends.

We also collect data on socio-economic and socio-demographic variables at the municipality level. We use demographic census data from the Federal Statistical Office to gather information on population levels and composition by age, sex, and language. Similarly, we draw on the economic census for data on occupations and the stock of firms and farms. We also collect information about taxable income at the municipality level from the respective Cantonal Archives to obtain a measure of aggregate income. To measure accessibility and market access, we use GIS software to reconstruct the 1920 route network, by comparing historical maps from 1920 with the present-day street and railway networks. We also traced the development of the railway system over the second half of the 19^{th} and the first half of the 20^{th} century. Appendix A provides further details on data sources, data accessibility, digitization, and describes the construction of the dataset.

Table B.2 presents descriptive statistics for the full sample. The study area is primarily mountainous. While most inhabitants speak German, a significant portion - particularly in Ticino and the southern Grisons - speak Italian or Romansh, both Romance languages. Approximately 50% of municipalities were connected to the railway network in the 1920s, when rail remained primary means of mechanical transportation in Europe. Based on the 1920 population census, municipalities were sparsely populated, with an average of 790 inhabitants. The economy was predominantly agricultural, reflecting a rural society: more than half the population (59% on average in 1920) worked in agriculture. These figures align more closely with countries like Italy, Austria, and Czechoslovakia at the time, rather than with more industrialized nations such as France, Germany, or the UK (Grigg, 1975). Firms were also small in size, employing on average just 2.5 workers per firm in 1905.

2.4.3 Descriptive Evidence: Main Outcome Variable

Our main variable of interest is regional economic activity measured as newly registered firms. The main advantage of this variable compared to official census data is that we can measure it on a yearly basis, allowing us to observe sudden shifts in regional economic activity. We start with the description of the raw data by geographical region and over time. First, Figure 2.3 plots the number of new firm registrations per 1,000 inhabitants in each municipality of Grisons and the control sample separately. Figure 2.3a shows the sum of new firm registrations in 1923 and 1924, i.e., one year and two years before the repeal of the car ban. Figure 2.3b displays the sums in registrations in 1925 and 1926, i.e., the year of the repeal and the following year. A visual comparison shows a general increase in new firm registrations across Grisons following the repeal of the car ban, and also in comparison with municipalities in the control sample.

[Figure 2.3 about here]

Second, Figure 2.4 plots the number of newly registered firms from 1920 to 1930 per year for Grisons and the control sample. The bars also show the sector compositions of newly registered firms. The bars indicate that, prior to 1925, firm registration was stable over these years with around 0.5 newly registered firms per year, with limited differences between Grisons and the control sample. By 1925, however, we document a massive increase in newly registered firms in Grisons, while the numbers in the control sample remain more or less at pre-1925 levels. The increase in firm registration in Grisons is particularly pronounced in the first two years after the repeal of the ban, followed by a normalization in 1927 and 1928, before Grisons numbers spike again. The shifts from 1924 to 1925 are large: while during the last year of the car ban, Grisons entrepreneurs registered around 0.5 firms per 1,000 inhabitants, while the numbers doubled in the years after the repeal of the ban. To sum up, these figures provide a descriptive analysis pointing to an increase in regional economic activity after the repeal of the car ban in Grisons.

[Figure 2.4 about here]

2.4.4 Descriptive Evidence: Further Outcomes and Covariates

We next compare Grisons with the control sample to provide descriptive evidence of the respective economic trajectory and socio-economic differences. Table B.3 presents the differences between Grisons and the control sample, consisting of the canton of Glarus and Uri, and parts of the cantons of St. Gallen and Ticino. Columns (2) and (3) report descriptive statistics separately for Grisons and the other cantons, while column (4) presents a series of t-tests to assess the difference and its statistical significance. Municipalities in Grisons are, on average, located at higher altitudes and are less connected to the railway network, making access more difficult compared to neighboring cantons. Grisons also has a lower share of Italian and German speakers and a higher share of Romansh speakers.

Religiously, the canton is nearly evenly split between Catholic and Protestant affiliations, whereas the neighboring cantons show a Catholic majority (75%).

From a demographic perspective, municipalities in Grisons are smaller and less populous. Grisons municipalities are, on average, less than half the size of those in the control sample in terms of population, and they host an older population. However, there is no significant difference in the working-age population (defined as individuals aged 14 to 59) between Grisons and the control sample. Economically, agriculture is the dominant sector in Grisons, while the industrial sector is less developed compared to its neighbors. By contrast, the share of employment in services - specifically trade and transportation - does not differ significantly across regions. The average firm size, as well as the number of firms and farms, is significantly smaller in Grisons than in the control sample. The lagging economic of Grisons in the 1920s could introduce challenges when we compare the cantons with the control cantons to analyze the impact of repealing the ban. However, with the exception of altitude, which we address explicitly by including it as a control in section 2.8.1, these differences may themselves be shaped by the presence of the car ban. Therefore, they can also be interpreted as alternative outcome variables to be analyzed before and after the repeal of the car ban. However, our analysis will rely on shifts in trends in economic activity, allowing for differences in stocks in other economic or demographic variables.

2.5 Empirical Identification Strategy

This section presents the main empirical strategy for identifying the effect of the repeal of the car ban in Grisons on economic activity. It also provides empirical support for the validity of the key identifying assumptions behind the models. To estimate the economic impact of the repeal, we employ a difference-in-differences and event-study design, comparing the economic activity of Grisons' municipalities with that of the control sample before and after 1925, the year the ban was repealed.

2.5.1 Event-study Design and Difference-in-Differences

Our empirical strategy employs both an event study design and a difference-in-differences approach. We exploit the fact that Grisons strictly enforced the car ban across its entire territory until 1925 (with some exceptions as discussed above), while neighboring cantons, including the valleys directly bordering Grisons, were never subject to such restrictions. As a result, only Grisons experienced a sudden shift in access to this new transportation technology, which increased regional accessibility following the repeal of the ban in 1925. To estimate the effect, we compare changes in economic activity in Grisons with those in control municipalities. We focus mainly on the decade from 1920 to 1930 in which this major policy change occurred. We use the years 1920–1924 as the pre-treatment period and 1925–1930 as the post-treatment period, applying both the difference-in-differences and event-study frameworks.

We estimate a two-way fixed effects (TWFE) model following Angrist and Pischke (2009) and Imbens and Wooldridge (2009), leveraging the fact that treatment is not staggered, as

all treated units receive the shock simultaneously in 1925. Our baseline specification is as follows:

$$Y_{it} = \beta(GR_i \times Post\,1925_t) + \gamma_k \left(X_{i,1920} \times \delta_{t=k}\right) + \theta_i + \eta_t + \lambda_{c,t} + \epsilon_{it} \tag{2.1}$$

Y_{it} denotes a measure of economic activity. Our primary outcomes include the number of new firm registrations per 1,000 inhabitants in year t and municipality i. In addition to newly registered firms, we also employ other outcomes. These include firm closures through 1937 by year of registration in t, firms' survival through 1937 and beyond by year of registration, and a variety of other measures, including local taxable income and demographic shifts. These measures are intended to proxy for the regional economic development in the productive system and overall economic activity from the production side. We also analyze sector-specific effects by using the same outcome measures, i.e., the number of new firm registrations, closures, and survival by industrial sector (retail, lodging and hospitality, construction, manufacturing, and advanced services (comprising finance, insurance, and real estate). All outcomes are standardized by the municipality's population.

Our coefficient of interest is β, which measures shifts in regional economic activity in Grisons compared to the control sample before and after 1925. GR_i is a dummy variable equal to one if municipality i belongs to Grisons, and zero otherwise. $Post1925_t$ is a dummy variable equal to one for years $t \geq 1925$, and zero before. In the event study specification, GR_i is interacted with dummies for each year, $\mathbf{1}(Year_{it} = k)$, which equal 1 when $t = k$. θ_i and η_t represent municipality and year fixed effects, respectively. In some specifications, we also control for a canton-specific linear time trend, denoted by $\lambda_{c,t}$. In alternative specifications, we additionally include pre-treatment time-variant and time-invariant covariates interacted with year fixed effects, $X_{i,1920} \times \delta_{t=k}$. We use the population from the most recent year available at or before the first observation. Accordingly, when firm registrations are the outcome, we use the municipality population from 1920; when taxable income is the outcome, we use the population from 1910. Finally, ϵ_{it} is the error term. Standard errors are heteroskedasticity-robust, and we will also conduct inference based on spatially clustered standard errors.

2.5.2 Identifying Assumptions

Difference-in-differences and event-study designs rely on two key assumptions: (i) exogeneity of the treatment, and (ii) parallel trends. Our main argument for exogeneity is the timing of the treatment. We note that opposition to cars steadily declined after WWI. From a 1920 perspective, it can thus be assumed that over the next decade or beyond, the ban would likely be repealed by Grisons' voters. However, the exact timing of this event - whether it would be 1923, 1925, 1927, or even later - was not known ex ante. Anecdotally, two main elements supports the argument that the year of repeal was neither known nor predictable. First, the final popular vote in June 1925 repealed the ban by only a narrow margin of around 2%. Second, the government in Grisons pursued a gradual strategy, proposing limited exceptions for specific types of vehicles (e.g., commercial or medical) or for certain routes, rather than full liberalization of motor vehicles. These government proposals always failed to win a clear majority until the popular vote in June 1925. Regarding the parallel-trend

assumption, Figure 2.4 has already shown similar absolute numbers of newly registered firms (per 1,000 inhabitants) in Grisons and in the control sample before the repeal of the car ban in 1925. This graphical inspection will be confirmed by the event-study plots in the next sections. To sum up, both main identification assumptions for a causal interpretation of difference-in-differences estimates hold in our setting.

2.6 Main Results

This section links the repeal of the car ban in Grisons to municipal economic activity relative to neighboring municipalities in other cantons without any ban. Our main measure of economic activity is the number of new firm registrations by municipality and year, which captures the immediate supply-side response of entrepreneurs and economic actors to the policy change. Using the event-study and difference-in-differences framework described in Section 2.5, we present the results and assess their robustness. We also examine whether the firms opened in each year closed or survived by 1937, and we disaggregate the effects by industrial sector to assess whether specific sectors drive the results. Finally, we examine the effects of the repeal of the car ban on social and demographic outcomes to capture dimensions beyond firm activity and to evaluate potential confounding factors.

2.6.1 New Firm Registration

We first graphically analyze the impact of the repeal of the car ban in Grisons in 1925 on shifts of firm registrations per 1,000 inhabitants, using an event-study design. Figures 2.5 and 2.6 show the event-study plots at the yearly level and pooled by two subsequent years, respectively. The analysis window spans from 1920 to 1930, covering five years before and after the repeal. To trace the evolution of firm registrations around the policy change, we interact year dummies with an indicator for whether a municipality belongs to Grisons. We normalize the coefficient for 1924, the year immediately preceding the repeal of the ban. Figure 2.5 shows no significant differences in firm registrations prior to 1925. The absence of pre-treatment differences is consistent with the raw data on firm registration shown in Figure 2.4, which confirms parallel trends in the treated and control groups. In contrast, in 1925 and in the following year, we observe a sharp increase in new firm registrations in Grisons relative to those in neighboring municipalities, with positive and statistically significant coefficients. This initial boom in Grisons appears to have ended in 1927 and 1928, with the coefficients on registrations returning to magnitudes similar to their pre-treatment values. We observe a partial recovery in the final two years of the sample in 1929 and 1930. Pooling the coefficients into two-year intervals, with 1924 as the reference year, confirms the pattern and makes it more evident (Figure 2.6). We conclude that, before the repeal of the automobile ban, there were no significant differences in firm registrations between Grisons and neighboring municipalities. The repeal of the car ban then caused a shift in entrepreneurial activity lasting for around two years before the numbers returned to normality, followed by another boom period in the late 1920s. The effect size is substantial, with around 0.5 more newly registered firms in Grisons in 1925 and 1926, representing a relative increase in entrepreneurial activity

of around 100%.

[Figure 2.5 about here]

[Figure 2.6 about here]

We now turn to the regression results in Table B.4, which reports the coefficients from different specifications of Equation 2.1, using pooled data on firm registrations before and after the repeal. Columns (1) and (2) present results for the full sample of municipalities from Grisons and neighboring cantons. Column (1) uses a binary specification that pools all post-repeal years and compares them with the pre-repeal period, while column (2) groups post-repeal years into two-year intervals to assess the effects over time. Column (1) confirms the event-study results, showing a significant increase in firm registrations following the repeal. We find that the repeal increased new firm registrations by 0.26 firms per 1,000 inhabitants in Grisons relative to those in neighboring municipalities in the post-1925 period. This effect corresponds to roughly 36% of the unconditional mean of the dependent variable (0.71) and about 46% of the pre-1925 average level (0.56), indicating a large effect size. Column (2) also supports the trend observed in the event study after the repeal. Firm registrations increased sharply in 1925 and 1926, then slowed down in 1927 and 1928, returning to pre-repeal levels. In the final two years, 1929–1930, the effect becomes positive and significant once again, but with a lower magnitude compared to 1925-1926.

2.6.2 Firm Closures and Survivals

In Figure 2.7 and Columns (1) and (2) of Tables 2.1 and B.5, we analyze the closure and survival of firms registered before and after the repeal of the car ban. The aim is to assess whether newly registered firms and, indirectly, the associated economic activity were durable over time following the policy change, or whether the increase in firm creation was accompanied by a proportional rise in firm closures by 1937. We exploit the fact that firms that closed by the end of the register, that is by 1937, are marked with a strike-through. Following Equation 2.1, Figure 2.7a, and Table B.5 focus directly on the closure rates of firms newly registered in each year between 1920 and 1930. This allows us to assess how the probability of closure for firms registered in year t evolved after the repeal. In parallel, Figure 2.7b and Table 2.1 use the number of firms that remained active after 1937 as the outcome, computed as the total number of firms registered in municipality i in year t minus the number of firms that closed by 1937. We find an increase in firm closures for newly registered firms in 1925 and 1926, although the estimates are not statistically significant. Based on the difference-in-differences estimates reported in Table B.5, the difference in closure rates is equivalent to approximately 36% for the additional firms founded in 1925–1926 in Grisons, and rises to around 59% for those founded in 1929–1930. This implies that approximately half of the additional firms registered in connection with the repeal had exited the market by 1937. Part of this pattern may be mechanical, as higher entry naturally generates more exits. However, the closure rates are economically meaningful because they are large enough to substantially attenuate the net effect when economic activity is measured by surviving firms.

Consistent with this interpretation, Figure 2.7b shows that the coefficients for 1925–1926 are positive and statistically significant for Grisons, although their magnitude is smaller. However, a similarly large and significant coefficient also appears in 1922, before the repeal. The effect of the repeal is less clear and less persistent when measured using surviving firms alone. A similar pattern emerges in the difference-in-differences setting. These findings point to some boom-and-bust patterns; it seems that entrepreneurs in Grisons were somewhat overoptimistic about the future due to increased accessibility in their area, and that registered firms are slightly more likely to close soon. We investigate these patterns in more detail below.

[Figure 2.7 about here]

2.6.3 Firm Registration by Industrial Sector

As in Section 2.6.1, we employ the Difference-in-Differences specification in Equation 2.1, estimating the effect in the years following the repeal of the car ban in two-year intervals. We now focus on disaggregated newly registered firms by the main industrial sectors, which are retail, lodging, advanced services, construction, manufacturing, and primary sector/waste.[8] Figures 2.8a to 2.8c show that the manufacturing, retail, and primary/waste sectors are the main drivers of the overall pattern in firm registrations, closely mirroring the aggregate trend: no effect in the years before the repeal of the car ban in 1925, and an immediate positive response in 1925 and in 1926. Firm registrations by these sectors then declined thereafter, before rising again in the late 1920s. In line with economic actors' expectations before the repeal, the effects in manufacturing and retail may suggest a development consistent with the expansion of local production and sales services following the introduction of the car. One can assume that the manufacturing sector benefits from increased accessibility and can thus penetrate markets further away. The retail sector might benefit from increased tourist flows and transit traffic, selling products and gasoline to them. The "primary/waste" category, which includes energy production, also reflects the contribution of energy power plants, mainly hydro-power plants, which might have facilitated due to increased and cheaper accessibility with automobiles. By contrast, the lodging sector - covering hotels and restaurants - shows no significant difference from neighboring municipalities after 1925, contrary to the hopes of tourism actors who had expected a boom from improved car access.

[Figure 2.8 about here]

2.6.4 Additional Outcomes

We investigate whether the repeal of the car ban influenced the social, demographic, and broader economic structure of the canton. In particular, we examine whether changes in firm registrations were accompanied by shifts in other dimensions, including the birthplaces

[8]For further details on how we reclassify business types into sectors and main industrial sectors, and their correspondence with NACE codes, see Section A.1 and Table B.7.

of municipal residents, the numbers of houses and households, and the stock of firms and farms within each municipality. Note that most of these data stems from decennial census data. Given the limited number of years observed, it is difficult to establish causality from the repeal because a general time trend might affect the outcome. For most variables, data are available for 1920, 1930, and 1941. The only exceptions are firms and farms, for which data exist for 1905, 1929, and 1939. Nonetheless, comparing demographic changes between Grisons and other cantons, and changes in the stock of firms helps us to assess whether contemporaneous social dynamics could confound our estimated effects of the ban's repeal.

We follow Equation 2.1 and standardize all outcome variables by the municipal population in the year preceding the first observation.[9] Figures 2.11a to 2.11c present the DiD coefficients and the respective confidence intervals for each outcome. In each graph, we compare the coefficients from the full sample with those obtained after splitting the sample by measures of potential municipal centrality. The measures of municipal centrality include railway connectivity (2.11a), altitude 2.11b, and population size 2.11c. The sample splits according to the latter two variables are based on median splits by the treatment and control groups separately. Looking at the full sample, we find a significant increase after the repeal in the number of residents in Grisons' municipalities who were born in their municipality of actual residence. This likely implies that the migration outflow, which had historically affected Grisons, slowed somewhat during the 1920s relative to the control sample. For the other variables, including residents from other municipalities, cantons, and countries, we find no clear differences between Grisons and neighboring cantons, either before or after the repeal, nor across the examined dimensions of local centrality. The figures also show that municipalities without railway connections, at higher altitudes, and with lower populations have higher coefficients for the number of residents born in the same municipality, and a significant increase in the stock of houses and households. This evidence is consistent with an increase in population following the repeal, particularly in peripheral municipalities. At the same time, we find no clear evidence that other socio-demographic trends differentially affected Grisons during the 1920s in ways that could confound the estimated effect. In particular, the repeal of the car ban does not appear to have systematically increased intercantonal or intermunicipal migration within Grisons, despite the shift in access to the new transportation technology. This also indicates that the spike in newly registered firms after the repeal of the car ban, as discussed above, stems from local residents in Grisons. At the same time, other cantons do not appear to have been affected, either positively or negatively, in terms of intercantonal or intermunicipal migration, following the repeal of the car ban in Grisons. Finally, the lack of significant differences in the stock of firms and farms in 1929 and 1939 compared to 1905, the only years with available data, suggests that the economic effects of the repeal were only partially persistent, indicating a boom-and-bust cycle as discussed in 2.6.2.

[Figure 2.11 about here]

[9] 1920 for birthplace, houses, and households; 1900 for firms and farms.

2.7 Robustness Checks

Our results on firm registrations hold across several robustness exercises. We discuss them below and show all related tables in Online Appendix B.

First, we verify that our findings on firm registrations reflect actual business creation and economic activity rather than administrative or accounting factors. Some firm registrations may not correspond to new business activity but instead reflect an administrative change following a transfer of ownership - either through a sale or intergenerational succession. To address this issue, we combine business and owner names to identify cases in which a registration merely reflects a change in ownership, while the underlying activity remains unchanged. Using Equation 2.1, Figure B.2a compares the baseline results with specifications that exclude these administrative transfers. Removing such cases slightly reduces the estimated coefficients but leaves their statistical significance unchanged.

Second, we further test the robustness of the baseline results using two alternative specifications. The results are shown in Figure B.2b. We include the municipal population in 1920, the first year of the sample, interacted with year fixed effects to account for time-varying demographic heterogeneity. We further add canton-specific linear time trends to capture potential differential cantonal dynamics. In both cases, the overall pattern remains similar to the baseline. The specification that includes cantonal-specific time trends exhibits larger standard errors, which may reflect overlapping between cantonal trends, the treatment effect, and year fixed effects.

Third, we rule out that the canton of Glarus affects our estimates because it introduced an early preferential corporate tax treatment (Brülhart et al., 2023), which led to a large number of newly registered firms in 1924 (see Section 2.4.2). In the baseline specification, we replace the 1924 observations for Glarus with the average of the 1923 and 1925 values. Figure B.3 examines robustness using the original dataset: one specification excludes Glarus from the control group, and another retains the full sample but introduces canton-specific linear trends. Excluding Glarus produces only minor changes relative to the baseline results. Introducing cantonal trends increases the estimated coefficients, but also increases the standard errors. Overall, the baseline pattern is preserved: an early increase, followed by a short slowdown and a subsequent recovery.

Finally, we test whether our industrial-sector results depend on how firms are classified by sector. Many firms operate in more than one line of business, making it difficult to assign them to a single industrial sector. For example, a firm engaged in processing and selling wood could plausibly belong to more than one sector, i.e., it belongs to both the manufacturing sector (processing wood) and the retail sector (selling wood). Our main analyses by industrial sector have so far focused on the primary industry as classified from the register entries. To account for firms engaged in multiple business activities, we create a second category to record an additional line of business when a second activity is mentioned or can be inferred from the original firm registration records. Figure B.4 compares sectoral coefficients from our baseline specification (which considers only the first line of business) with an alternative specification that counts newly registered firms by sector based on both first and second lines of business. Firms may therefore be counted twice, but in different industrial sectors. To address this

concern, we define a new outcome as the total number of firms in each sector, regardless of whether the sector is recorded as a first or second activity. This specification increases the standard errors but does not change the baseline results. In particular, manufacturing and retail drive the effects, although retail is only weakly significant.

We conclude that our main findings in shifts in newly registered firms after the repeal of Grisons' car ban are robust to various concerns related to measurement errors, data quality and cleaning, different empirical specifications, and coding of the industrial sector.

2.8 Mechanism

We have shown that the repeal of the car ban had positive effects on firm registrations and on economic activity, particularly in the first two years following the policy change. This pattern is confirmed by our analysis of firm closures and survival by 1937, which shows that exits of firms that opened after the repeal attenuate the net effect on economic activity (Section 2.6.2). It is also consistent with the sectoral evidence, in which only manufacturing and retail drive the results, while other sectors show mixed outcomes, including the lodging sector, which played a prominent role in the political campaign for the repeal of the ban (Section 2.6.3).

In this section, we explore the mechanisms underlying this heterogeneity. We assess whether differences in the economic response can be explained by the relationship between more central and more peripheral municipalities, measured along morphological, infrastructural, and demographic dimensions. We also examine whether the dynamics observed can be interpreted as a boom-and-bust pattern, or at least as an episode of over-expectation regarding the economic effects of the repeal. To this end, we mainly focus on shifts in taxable income at the municipality level as a proxy for the *real* economic effects, i.e., whether increased accessibility of places following the introduction of cars in Grisons materializes in real economic outcomes, and not merely through entrepreneurial activity. These dimensions of analysis allow us to evaluate how expectations and adjustment processes interact with the center–periphery dimension in shaping the overall economic impact of the policy change.

2.8.1 Center vs Periphery

We study heterogeneous effects to see whether the repeal of the car ban affected some municipalities more than others. We focus on characteristics that capture a municipality's relative centrality: transport connectivity, geography, and population before the ban was removed. The goal is to understand how increased mobility changed the spatial distribution of economic activity. In particular, we ask whether the policy improved access mainly for smaller and less-connected places, or whether it reinforced the position of already larger and better-connected municipalities. Although opinions about the car ban did not follow a strict central-peripheral divide, the issue was central in the political and economic debate in Grisons. There was uncertainty about how mobility would affect local economies: would the car compete with the railway or complement it? Would activity concentrate in larger towns or spread toward smaller ones? Could altitude, previously a constraint, become an

advantage through better access and tourism? By examining heterogeneous effects along these dimensions, we provide empirical evidence on these questions.

Figure 2.9 reports event-study estimates using Equation 2.1. We classify municipalities by railway connectivity in 1920 (Figure 2.9a), by altitude relative to the treatment and control group medians (Figure 2.9b), and by population relative to the median (Figure 2.9c). Columns (3) to (14) of Table B.4 present the same analysis in a difference-in-differences framework. Across all the dimensions, the general pattern remains similar to the baseline results: a strong increase in firm registrations in 1925 and 1926, followed by a slowdown and a partial recovery thereafter. Looking at all newly registered firms, a clear divide between center-periphery is not evident across all the dimensions studied. However, some differences appear when we distinguish between total firm entry and firms surviving after 1937. Figure 2.9a shows that railway-connected municipalities do not have larger effects in 1925 and 1926, but they display stronger and statistically significant increases in 1926 and 1930 relative to unconnected municipalities. This suggests that automobiles complemented, rather than replaced, the railway network, contrary to concerns expressed by railway operators (Hollinger, 2018). Population patterns are similar (Figure 2.9c). Less-populated municipalities show slightly higher initial entry, but by 1930, only larger municipalities retain statistically significant effects. Differences by altitude are smaller (Figure 2.9b); higher-altitude municipalities tend to have somewhat larger coefficients, but the magnitudes are comparable. The difference-in-differences results in Table B.4 provide a consistent picture and make these differences clearer. In Columns (3) to (6), both railway-connected and unconnected municipalities show significant effects in 1925 and 1926 and again in 1929 and 1930, with slightly larger coefficients for connected areas, driven by the years 1926 and 1930. In Columns (7) and (10), municipalities above the mean altitude display larger pooled post-treatment effects than lower-altitude municipalities. Finally, Columns (11) to (14) show that municipalities with larger and smaller populations have similar coefficients in 1925 and 1926, while larger municipalities drive the results in 1929 and 1930.

When we focus on firms that survived beyond 1937 (Figures B.7a–B.7c and Tables B.5), the differences become clearer. Railway-connected and more populous municipalities remain significant, whereas less-connected and smaller municipalities generally do not. Higher-altitude municipalities remain significant mainly in the early years. Figures B.8a to B.10c report the DiD coefficients for each main industrial sector, pooling the entire post-car ban period and applying sample splits by railway connectivity, altitude, and population. The results are broadly consistent with those obtained for total firm registrations. Manufacturing, retail, and the primary/waste sectors drive the effects across these dimensions. Differences across more and less central municipalities are less pronounced for total new firm registrations and, if anything, tend to favor lower-population or higher-altitude municipalities. However, the pattern differs when we focus on firms that survived beyond 1937, with the results mainly driven by railway-connected municipalities and those with larger populations.

Taken together, the results suggest that improved regional accessibility after the repeal of the car ban initially increased entrepreneurial activity in a broad set of municipalities, including more peripheral ones. This pattern is consistent with decentralization mechanisms discussed in Baum-Snow (2007) and Baum-Snow et al. (2017), in which improved transport allows activity to expand outside main centers. However, after 1929 - and especially when considering

surviving firms - stronger effects appear in railway-connected and larger municipalities. This indicates that many early entries in peripheral areas were not durable. Rather, they likely reflected initial experimentation and optimistic expectations about the opportunities created by the automobile. Over time, market integration and selection favored municipalities with better connectivity and larger scale, consistent with the evidence in Faber (2014), while the periphery experienced, to some extent, a boom-and-bust cycle in entrepreneurial activity.

[Figure 2.9 about here]

2.8.2 Entrepreneurial Expectations vs Shifts in Income

We now turn to the net economic effect of repealing the car ban in *real* terms by examining aggregated taxable income at the municipality level. This analysis investigates whether the increase in firm registrations and business activity observed after the introduction of the automobile in Grisons was accompanied by changes in overall income and thus affected the well-being of local residents. We replicate the specification in Equation 2.1 in both event-study and difference-in-differences form, using aggregate municipal income per capita as the main outcome variable. The analysis is restricted to the years for which income data are available: 1913, 1918, 1920, 1923, 1928, 1930, and 1933. Figure 2.10 shows that the repeal had a positive effect on aggregate income in Grisons' municipalities relative to neighboring municipalities, consistent with the evidence from firm registrations. In contrast to the firm registration results, however, the event-study estimates suggest that the income effect is more persistent, as the coefficient for 1933 is similar in magnitude to that for 1928. Column (1) of Table B.6 confirms these findings when we pool all post-1925 years. On average, the repeal is associated with an increase of about 155 Swiss francs per person, corresponding to a 75% rise relative to the unconditional mean. The year-by-year difference-in-differences estimates in Column (2) further confirm the persistence of the income response.

Figure 2.10 also explores heterogeneous effects by distinguishing municipalities along three dimensions: railway connection status (Figure 2.10a), altitude (Figure 2.10b), and population size (Figure 2.10c). We replicate this analysis in a difference-in-differences framework in Table B.6, where Columns (3) to (6) correspond to railway access, Columns (7) to (10) to altitude, and Columns (11) to (14) to population. Municipalities connected to the railway network and those with larger populations appear to drive the income results in terms of both magnitude and statistical significance. High-altitude municipalities also display significant and relatively larger effects than their lower-altitude counterparts. These results are consistent with the firm-registration patterns, especially in the later years (1929–1930) and when we focus on firms surviving beyond 1937.

Taken together, our findings suggest that firm creation was initially strongest in smaller, more peripheral municipalities, whereas income gains were concentrated in larger ones. In line with Section 2.8.1, this difference can be explained by two mechanisms. In more populous municipalities, entry is more constrained by existing firms and stronger competition, but income remains more persistent due to agglomeration and scale effects, so established activity generates durable income growth even without large increases in new firm formation. Furthermore, the strong entry response in smaller municipalities may reflect initial over-optimism

about the opportunities created by the repeal. Improved regional accessibility encouraged experimentation and the creation of new businesses, but many entrants, particularly those in more peripheral municipalities, were not viable in the longer run. As a result, the initial increase in registrations in peripheral areas did not translate into sustained income gains. This is consistent with the finding that the rise in firm registrations in less populous places is short-lived when firm closures by 1937 are taken into account.[10]

[Figure 2.10 about here]

2.8.3 North-South Routes

We test whether the increase in economic activity following the repeal of the car ban was driven by greater exposure to other countries and cantons. In particular, places that rely relatively more on external consumers (tourists and transit passengers) along the main north-south transit routes might face different expectations and benefits after the repeal of the car ban. As shown in Figure B.11, we digitize the major routes connecting Grisons and the neighboring municipalities with other countries - Italy to the south, Germany to the north - as well as with the rest of Switzerland.[11] While the municipalities in the control group had already benefited from the increased connectivity provided by the automobile before 1925, Grisons could fully exploit its strategic position only after the repeal of the car ban. We then reclassify the municipalities based on whether and how they are crossed by the north-south routes. Specifically, we assign: 1 to municipalities where the north-south routes cross directly through the main town; 2 to municipalities through which the routes pass and where the main town is easily reachable from the main route; 3 to municipalities through which the routes pass, but where the main town is difficult to reach due to natural barriers such as rivers or higher altitude relative to the main route; and 4 to municipalities not crossed by the main routes at all.

We replicate the event study described in Equation 2.1, conditioning on each category of municipality according to their position relative to the north-south routes. Categories 2 and 3

[10]The baseline estimates for municipal income in Figures 2.10a to 2.10c and Table B.6 rely on an unbalanced dataset, as information for Ticino and Uri is incomplete. To address this empirical limitation, Figure B.5 reports event study coefficients and standard errors in a balanced panel by restricting the sample to Glarus and St. Gallen. To improve comparability between Grisons and the control sample, we implement two alternative subsamples. First, we restrict the sample of municipalities in Grisons to the 1920 districts within the Rhine watershed. The districts are: *Unterlandquart*, *Imboden*, *Glenner*, *Vorderrhein*, *Unterlandquart*, *Oberlandquart*, *Plessur*, *Heinzenberg*, *Hinterrhein*, and *Albula*. The districts excluded are: *Bernina*, *Inn*, *Maloja/Maloggia*, *Moësa*, and *Münstertal*. Second, we restrict the sample of Grisons to municipalities whose centroids lie within 30 km of the Glarus–St. Gallen border. In both cases, the restrictions reduce the size of the coefficients but do not alter the overall patterns, which continue to show an increase in municipal income in Grisons following the repeal of the car ban and the accessibility of Grisons' localities with motor vehicles.

[11]The main access route from Switzerland to Italy enters Ticino through Chiasso. From Bellinzona the road divides into two main branches. The first passes through the St. Gotthard Pass, crossing Ticino and Uri before reaching Lucerne and continuing toward western Switzerland. The second branch, passing through the San Bernardino Pass, runs across western Grisons and Chur, connecting further north through the canton of St. Gallen to Zurich on one side, and to Germany via Konstanz on the other. We also consider the routes linking Italy and Grisons through Castasegna. This branch runs northward, passes St. Moritz, and reconnects with the routes leading to Zurich or Germany in Chur.

are aggregated so as to emphasize the distinction between municipalities classified as category 1, whose main towns are directly crossed by the north-south routes, and those classified as categories 2 and 3, where the routes only traverse the municipal territory without passing through the main town, irrespective of its accessibility from the route. Figures 2.12a and 2.12b plot the coefficients from each event study, comparing the results for the full sample with those obtained from the subsamples conditioned on the municipality categories (1–4), for both firm registrations and income from taxation.

We find that the results appear to be driven by the municipalities not connected to the main north-south routes. For firm registrations, following the lifting of the car ban, the coefficients for municipalities not connected to these routes are even higher than those of the full sample. Among the municipalities directly crossed by the north-south routes, positive effects remain, though they are smaller than the coefficients for the full sample. By contrast, municipalities whose main towns are not directly crossed exhibit negative coefficients after the car ban was repealed, lower than those of the other groups. This evidence suggests that the effects of the repeal were concentrated less in municipalities that were already connected and more in those that were previously peripheral relative to the main routes. In this sense, the car contributed to integrating these peripheral municipalities that are located in the main transit valleys into the main transport network and economic nodes. Conversely, the most penalized municipalities appear to be those situated midway along the connected-unconnected divide: towns where the routes crossed municipal territory but did not directly connect to the main town. These municipalities were both less directly affected by the north-south flows and less economically impacted by the increased accessibility following the lifting of the car ban.[12]

[Figure 2.12 about here]

2.9 Conclusion

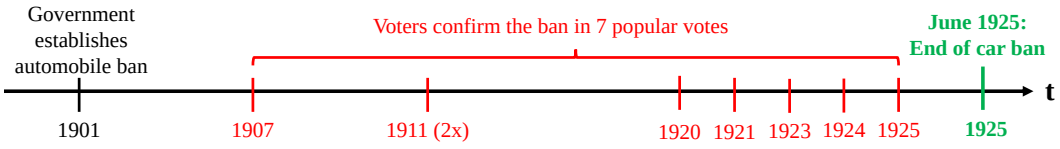
What are the economic effects of automobiles, as a means of transportation technology, across space and over time? To address this question, we exploit the natural experiment created by the unexpected repeal in 1925 of an automobile ban that had been in place for more than twenty years in the Swiss canton of Grisons. Using archival and historical sources, we digitize new firm registrations from 1920 to 1930 as our main measure of economic activity. We also collect additional social, demographic, economic, and geographic information for Grisons and neighboring municipalities in bordering cantons to capture other economic dimensions. Through an event-study and a difference-in-differences design, we compare yearly economic activity in municipalities of Grisons with that of neighboring municipalities before and after an abrupt and unanticipated repeal of a car ban in 1925. New firm registrations display an immediate, positive, and statistically significant response in the first two years after the repeal, followed by a slowdown and a subsequent re-emergence. When we focus only on firms that survived beyond 1937, the estimated effects become smaller and less significant. Heterogeneity

[12]The results may also be influenced by the fact that the main north-south routes in Grisons were already heavily frequented by stagecoaches, resulting in increased economic activity in directly connected places prior to the automobile ban repeal.

analysis along railway connectivity, population, and altitude, together with the analysis of taxable income as a broader measure of economic activity, complements these results. Initial effects in terms of firm registrations appear to be evenly distributed across municipalities, regardless of railway connectivity, population size, or altitude. However, when firm closures are taken into account, using the number of firms that survived beyond 1937 as the outcome, more populous and better-connected municipalities show more significant and persistent effects than less populous and non-connected municipalities. Income increases are concentrated in more populous and better-connected municipalities. These findings suggest that entrepreneurs in more peripheral municipalities faced an over-optimistic perception associated with increased connectivity. However, over time, centralizing forces appear to prevail, and inhabitants of more connected municipalities earn the real benefits of increased accessibility measured as taxable income. This pattern is consistent with a period of entrepreneurial experimentation in response to the new transportation technology and expanded market access, which does not always translate into persistent economic gains or sustained economic activity.

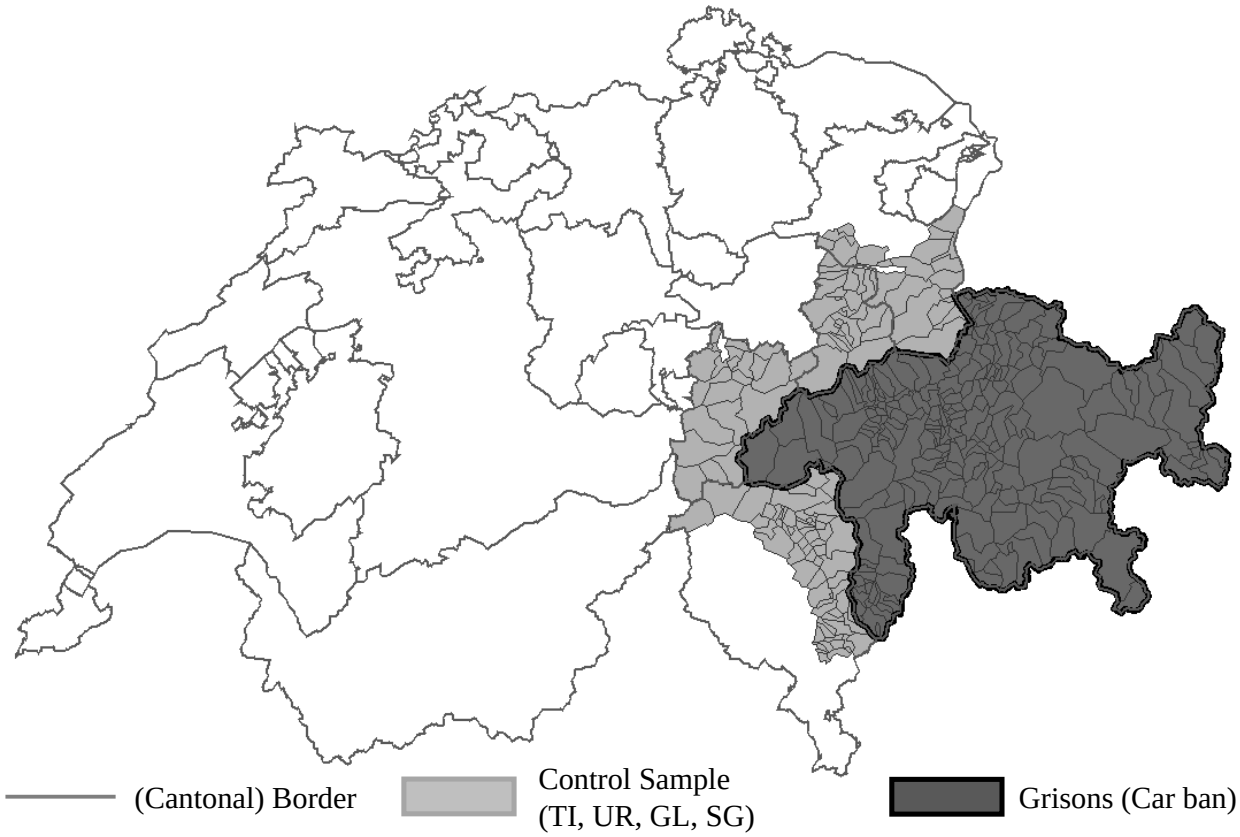
2.10 Figures of the Main Text

Figure 2.1: The timeline of Grisons' car ban until its repeal



Notes: The figure shows the timeline of the car ban, including legislative initiatives and popular votes, which confirm that the ban remained in place until 1925. *Source:* Personal Elaboration.

Figure 2.2: Grisons, and the control sample in Switzerland

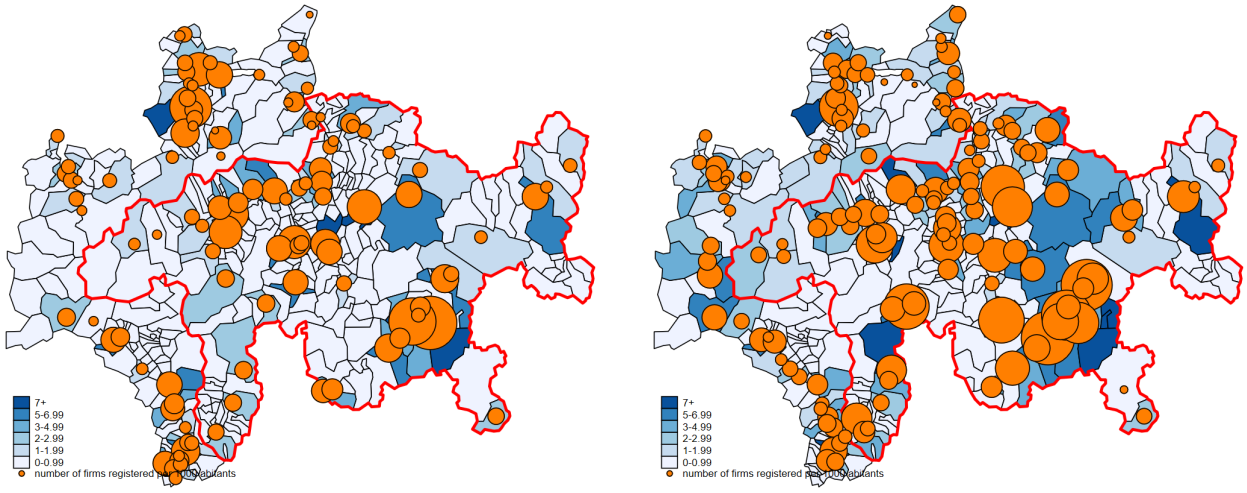


Notes: The figure shows the canton of Grisons and neighboring districts and municipalities and with the rest of Switzerland. Dark gray represents the municipalities in Grisons, that were affected by the automobile ban and its repeal in 1925. Light gray represents municipalities in neighboring cantons or directly adjacent valleys of other cantons that did not implement the automobile ban and serve as the control group in our analysis. These neighboring areas include Uri, Glarus, St. Gallen (districts of Werdenberg, Sargans, and Gaster), and Ticino (districts of Bellinzona, Blenio, Leventina, and Riviera).

Figure 2.3: Regional pattern of newly registered firms before and after the repeal of the ban

(a) New firm registration per municipality (per 1,000 inhabitants), 1923/24

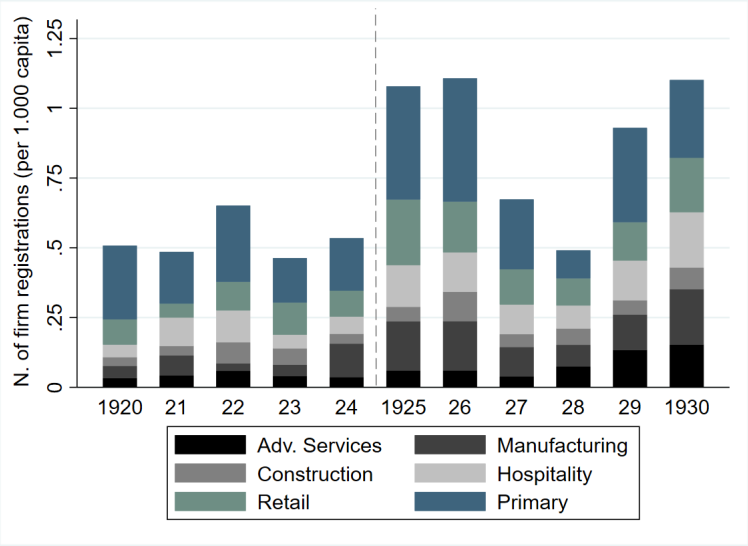
(b) New firm registration per municipality (per 1,000 inhabitants), 1925/26



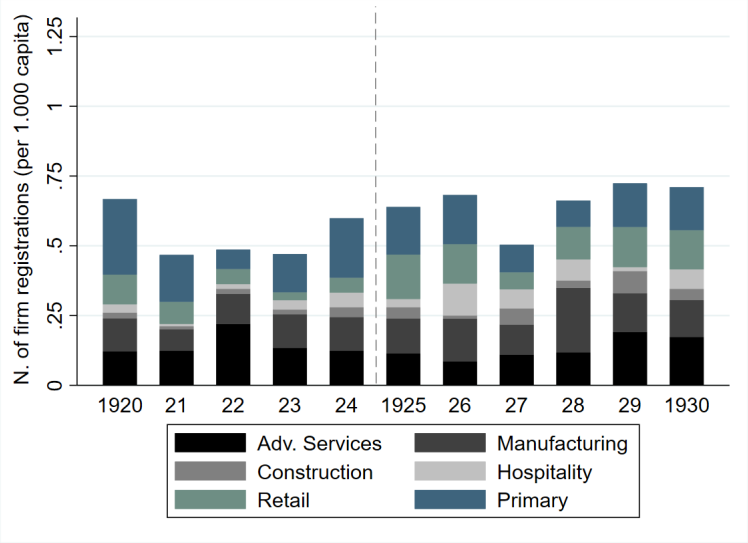
Notes: The figure compares newly-registered firms per 1,000 inhabitants in the canton of Grisons and in neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino before and after the repeal of the car ban. Figure (a) shows newly registered firms per 1,000 inhabitants by municipality in 1923/1924, the two years immediately preceding the repeal of the ban, with the yearly counts summed. Figure (b) shows newly-registered firms per 1,000 inhabitants by municipality in 1925/1926, the two years following the repeal, again summing the yearly counts. In both figures, bubble size and the shading of each municipality represent the number of newly registered firms: the larger the bubble, the higher the number of registrations; likewise, darker shading indicates more new firms.

Figure 2.4: New firm registration by sector in Grisons and control sample, 1920–1930

(a) Canton of Grisons

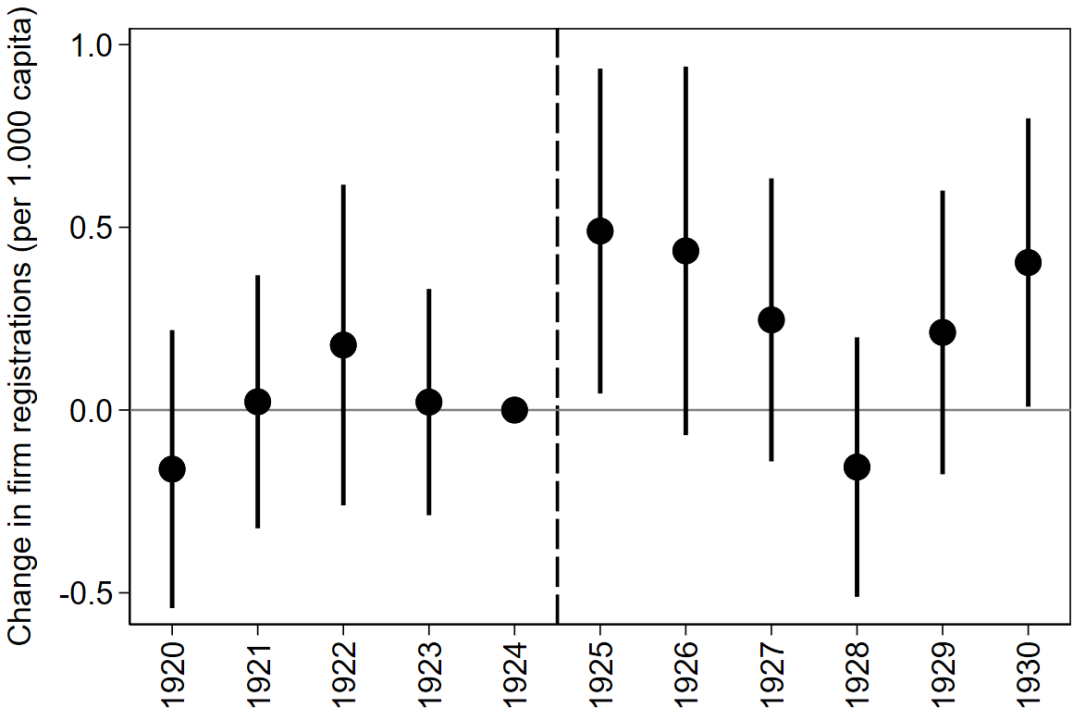


(b) Control sample



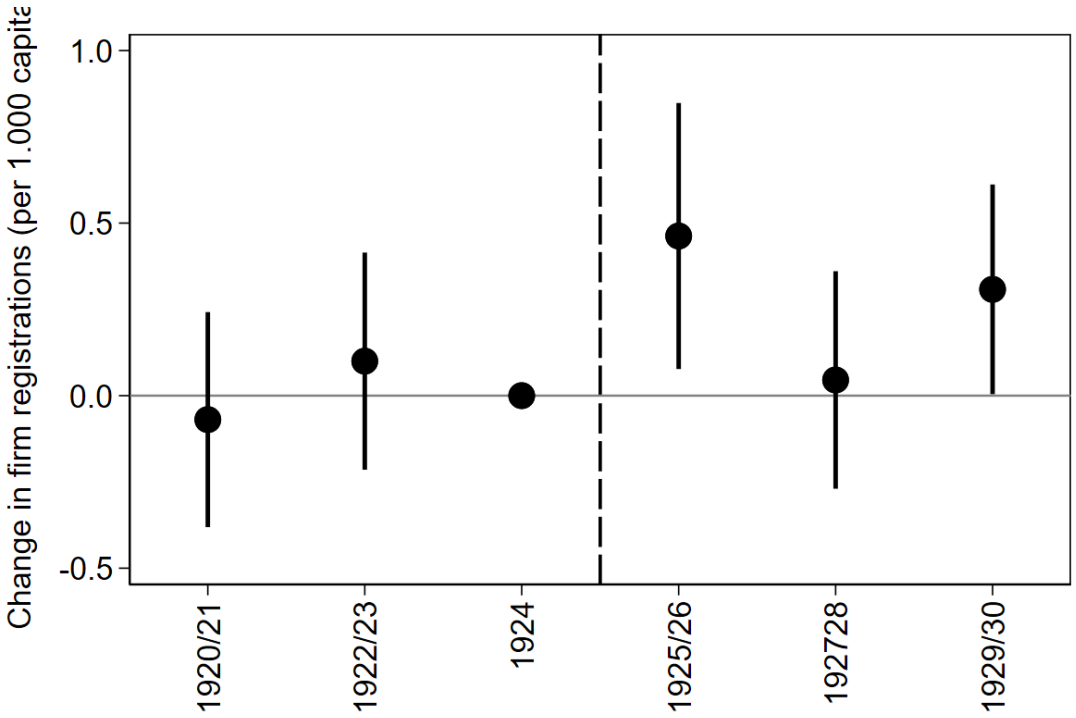
Notes: The figures compare the number of newly registered firms by sector in Grisons and in the neighboring municipalities over the decade 1920–1930. Graph (a) reports the yearly number of newly registered firms per 1,000 inhabitants per municipality. The year 1925, when the car ban was repealed, falls within the treatment period. Firms are grouped into the main industrial sectors: advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services), manufacturing (food, textiles, wood, metals and machinery, other), construction, hospitality (hotels, restaurants), retail (food, non-food, all), and the primary sector (agriculture, mining, utilities, waste management). Graph (b) mirrors this information for the neighboring municipalities (control sample). The control sample consists of municipalities in Uri, Glarus, St. Gallen (districts of Werdenberg, Sargans, and Gaster), and Ticino (districts of Bellinzona, Blenio, Leventina, and Riviera).

Figure 2.5: Event-study coefficients on newly registered firms by year



Notes: The figure presents an event-study regression estimating the impact of the repeal of the car ban in the Canton of Grisons in 1925, on total newly-registered firms per 1,000 inhabitants, relative to neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The total number of firms in Grisons and in the neighboring cantons is defined as the annual number of firms registered in each municipality from 1920 to 1930 per 1,000 inhabitants. The graph reports the coefficients from the interaction between the year fixed effects and an indicator for whether the municipality belongs to Grisons. Vertical dark lines display the 95% confidence intervals, computed using robust standard errors. The vertical dashed line marks the year of the repeal. Hence, the coefficients from 1920 to 1923 capture differences in firm registrations between Grisons and the neighboring cantons before the repeal of the ban (pre-treatment leads), while the coefficients from 1925 to 1930 capture differences after the repeal (post-treatment lags). Coefficients are normalized to the last pre-repeal year, i.e. 1924. All estimates include year fixed effects and municipality fixed effects.

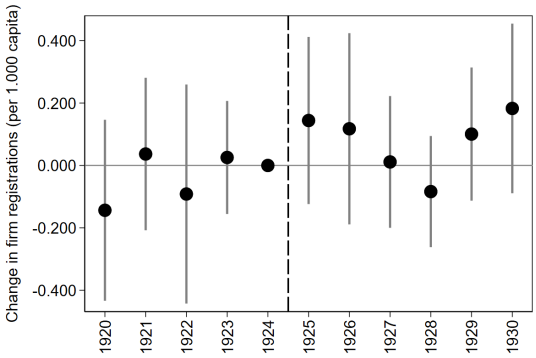
Figure 2.6: Event-study coefficients on newly registered firms in 2-years period



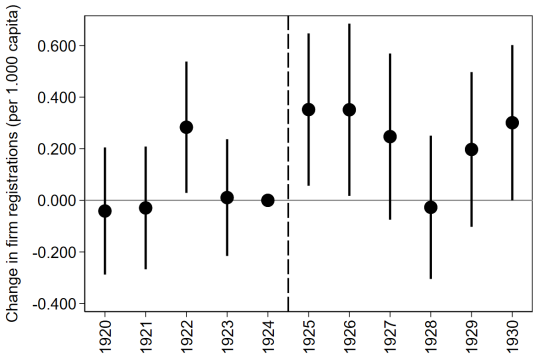
Notes: The figure presents an event-study regression estimating the impact of the repeal of the car ban in the Canton of Grisons, starting in 1925, on total new firm registrations per 1,000 inhabitants, relative to neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The total new-firm registrations in Grisons and in the neighboring cantons is defined as the annual number of firms registered in each municipality from 1920 to 1930, based on the firms-register data of each canton. The graph reports the coefficients from the interaction between the year fixed effects and an indicator for whether the municipality belongs to Grisons, the canton that implemented and later lifted the car ban. The coefficients are pooled into two-year intervals, except for 1924, which serves as the benchmark year. Vertical dark lines display the 95% confidence intervals, computed using robust standard errors. The vertical dashed line marks the year of the repeal. Hence, the coefficients 1920-1921, and 1922-1923 capture differences in firm registrations between Grisons and the neighboring cantons before the repeal of the ban (pre-treatment leads), while the coefficients 1925-1926, 1927-1928, and 1929-1930 capture differences after the repeal (post-treatment lags). All estimates include year fixed effects and municipality fixed effects

Figure 2.7: Event-study coefficients on newly-registered firms closed and survived

(a) Firm registered and closed by 1937



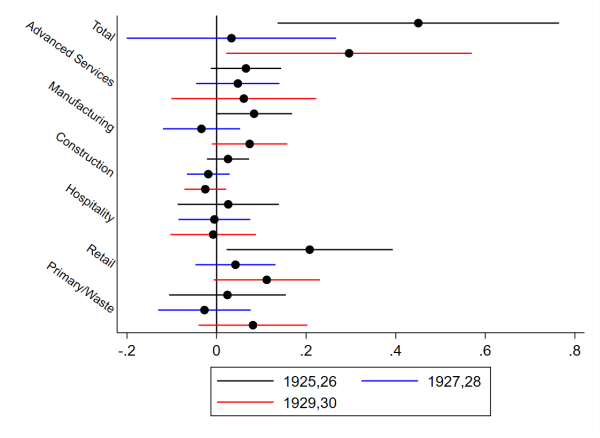
(b) Firm registered and survived beyond 1937



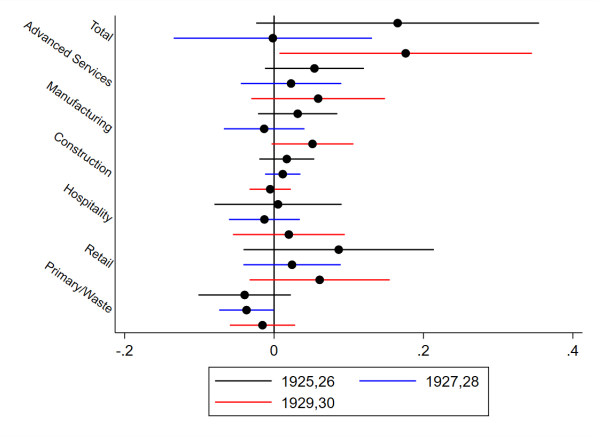
Notes: The figure presents event-study regressions estimating the impact of the repeal of the car ban in the Canton of Grisons on the number of newly-registered firms per 1,000 inhabitants that closed by 1937 or survived beyond 1937, relative to neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The year 1937 corresponds to the closing year of the firm register. Both panels report coefficients from interactions between year fixed effects and an indicator for whether a municipality belongs to the Canton of Grisons, which implemented and later repealed the car ban. Vertical solid lines represent 95% confidence intervals based on robust standard errors. The vertical dashed line marks the year of the repeal. Coefficients for the years 1920–1923 capture differences in firm registrations between Grisons and neighboring cantons before the repeal of the ban (pre-treatment leads), while coefficients for the years 1925–1930 capture differences after the ban was repealed (post-treatment lags). Coefficients are normalized to the last pre-repeal year, i.e. 1924. Graph (a) uses as the outcome the number of firms registered in each municipality between 1920 and 1930 that are recorded as closed by 1937 in the firm-register data. Graph (b) uses as the outcome the number of firms registered in each municipality between 1920 and 1930 that survived beyond 1937, excluding firms recorded as closed. All specifications include year fixed effects and municipality fixed effects.

Figure 2.8: Closure and survival rates by industrial sectors

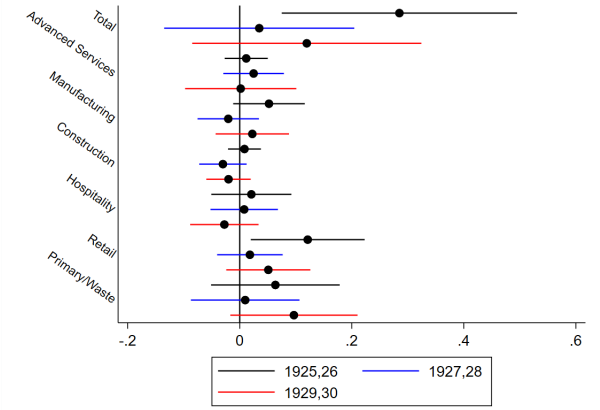
(a) Firm registered, total



(b) Firms registered and closed by 1937



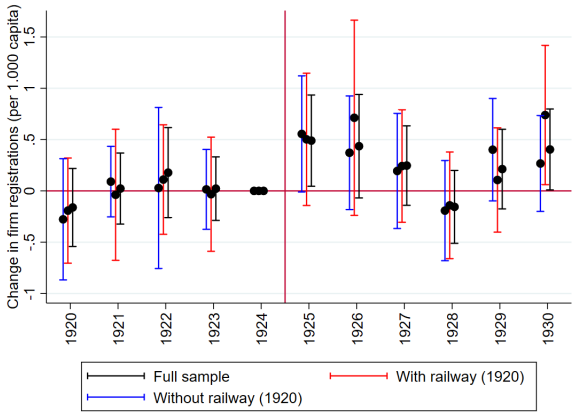
(c) Firms registered and survived beyond 1937



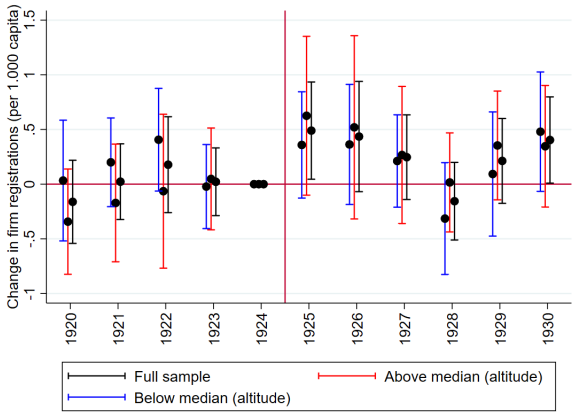
Notes: The figure reports the difference-in-differences coefficients for the total number of newly-registered firms per 1,000 inhabitants, for new firms that closed by 1937, and for those that survived beyond 1937 in Grisons. The effects are shown before and after the car ban was repealed, by industrial sector, and are compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. For each sector, the specification shows three distinct coefficients, obtained by interacting the repeal effect with indicators for the two-year periods 1925–1926, 1927–1928, and 1929–1930. Industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management). Horizontal lines display the 95% confidence intervals, computed using robust standard errors. Graph (a) uses as the outcome the number of firms registered in a municipality between 1920 and 1930 within each specific sector, based on each canton's firms-register data. Graph (b) uses as the outcome the number of firms in each sector that were registered in a municipality and had closed by 1937, according to the same register. Graph (c) uses as the outcome the number of firms in each sector that were registered in a municipality and survived beyond 1937. All estimates include year fixed effects and municipality fixed effects.

Figure 2.9: Heterogeneity by measures of centrality (center vs. periphery)

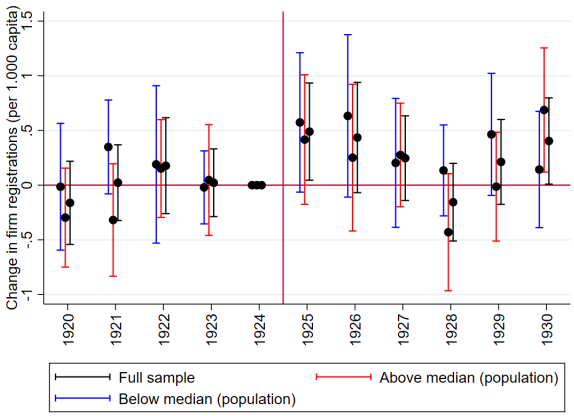
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



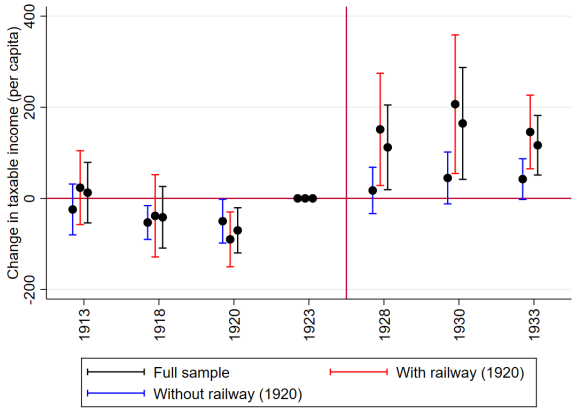
(c) Above vs. below median population



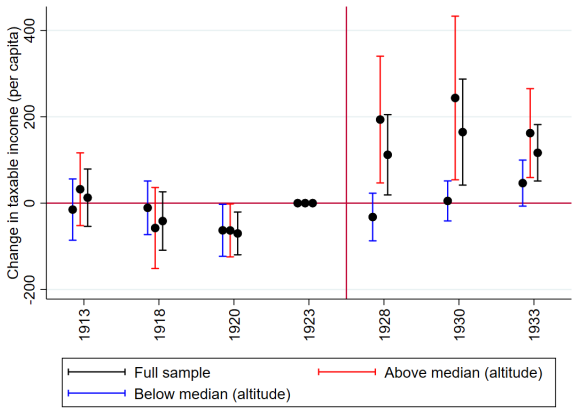
Notes: The figure shows the event-study coefficients reporting the impact of the repeal of the car ban on total number of newly-registered firms per 1,000 inhabitants in Grisons' municipalities, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. We show coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. The total new-firm registrations in Grisons and in the neighboring cantons (Uri, Glarus, St. Gallen, Ticino) is defined as the annual number of firms registered in a municipality between 1920 and 1930 on each canton's firms-register data. Centrality is proxied by railway connection, altitude, and population. Vertical lines display the 95% confidence intervals based on robust standard errors. The vertical red line marks the year of the repeal. Coefficients are normalized to the last pre-repeal year, i.e. 1924. Graph (a) compares event-study coefficients from the full-sample specification with those from samples restricted to municipalities crossed by the railway network (higher centrality) and not crossed by it (lower centrality). Graph (b) compares the full-sample coefficients with those from municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects and municipality fixed effects.

Figure 2.10: Taxable income by measures of centrality (center vs. periphery)

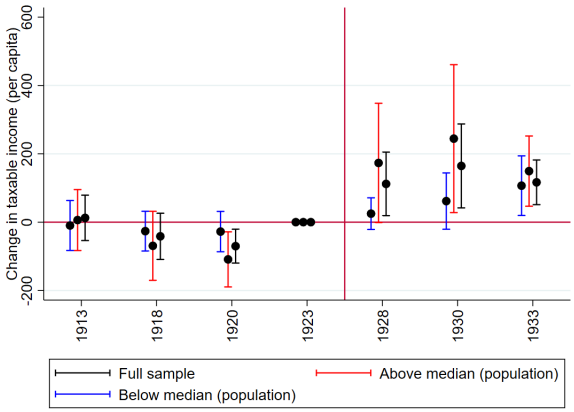
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



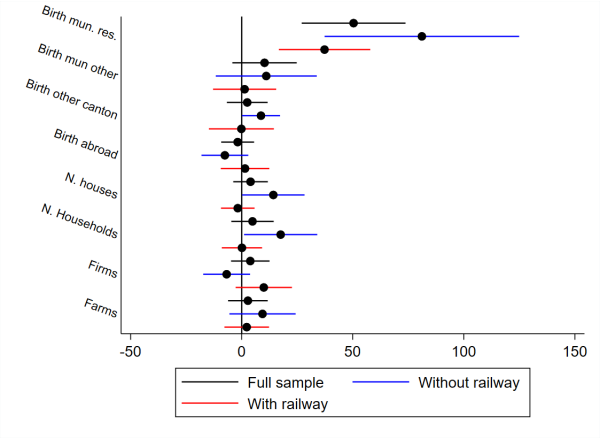
(c) Above vs. below median population



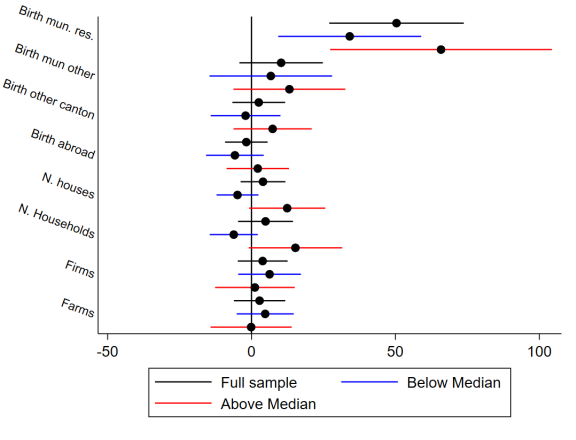
Notes: The figure shows the event-study coefficients, reporting the impact of the repeal of the car ban on total municipal taxable income per capita in Grisons, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. We show coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. The outcome is municipal aggregated income, measured as taxable income from municipal taxation and fiscal revenue data, and observed in the years for which information is available (1913, 1918, 1920, 1923, 1928, 1930, and 1933). Coefficients are standardized to the last pre-repeal year available, i.e. the 1923. Centrality is proxied by railway connection, altitude, and population. Vertical lines display the 95% confidence intervals based on robust standard errors. The vertical red line marks the year of the repeal. Graph (a) compares event-study coefficients from the full-sample specification with those from samples restricted to municipalities crossed by the railway network (higher centrality) and not crossed by it (lower centrality). Graph (b) compares the full-sample coefficients with those from municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects, municipality fixed effects, and municipal population in 1910 (the baseline year) interacted with the year fixed effects.

Figure 2.11: Socio-demographic responses to the repeal of the car ban

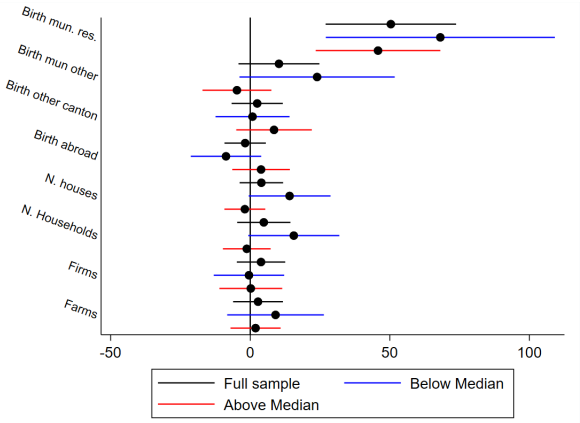
(a) Connected vs. unconnected to the railway



(b) Above vs. below median altitude



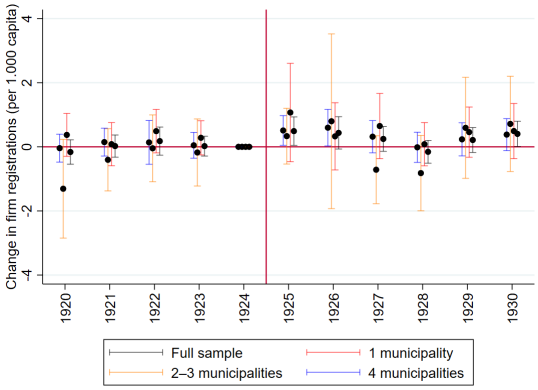
(c) Above vs. below median population



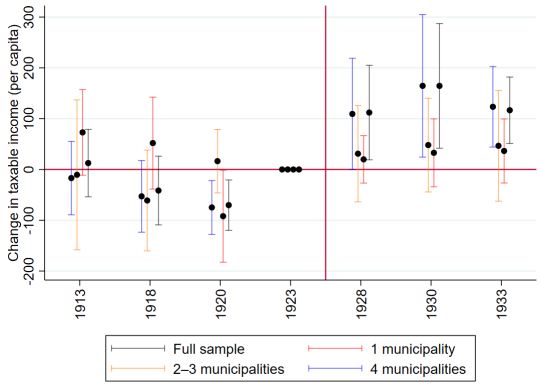
Notes: The figure reports the difference-in-differences coefficients for socio-economic variables in each municipality in Grisons, measuring the impact of the repeal of the car ban compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The variables come from the cantonal demographic and economic activity, firms, and farms census (see A.3) and include the number of inhabitants born in the municipality of residence, those born elsewhere in the same canton, those born in another canton, those born abroad, as well as the stock of houses, number of households, firms, and farms. We present coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Horizontal lines display the 95% confidence intervals computed using robust standard errors. Graph (a) compares the full-sample coefficients with those from municipalities crossed by the railway network (higher centrality) and those not crossed by it (lower centrality). Graph (b) compares the full sample with municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects, municipality fixed effects, and municipal population in 1920 (the baseline year) interacted with the year fixed effects..

Figure 2.12: Newly-registered firms and municipal income effects, north-south routes

(a) Newly-registered firms (1920-1930)



(b) Taxable income (1913-1933)



Notes: The figure reports the impact of the repeal of the car ban on the number of newly-registered firms per 1,000 inhabitants and on municipal income in each municipality in Grisons, compared with municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. We compare the full-sample coefficients with those obtained by restricting the sample to three categories: municipalities whose main town is crossed by the main north-south routes (category 1), municipalities whose territory - but not the main town - is crossed by these routes (categories 2 and 3), and municipalities not crossed by the routes (category 4). Vertical lines display the 95% confidence intervals based on robust standard errors. The vertical red line marks the year of the repeal. Graph (a) compares event-study coefficients for newly-registered firms per 1,000 inhabitants (from the firms' register) in the full sample with those estimated separately for category 1, categories 2–3, and category 4 municipalities. Coefficients are normalized to the last pre-repeal year, i.e. 1924. Graph (b) compares event-study coefficients for municipal income (from cantonal taxable-income data) in the full sample with the corresponding estimates for category 1, categories 2–3, and category 4 municipalities. Coefficients are normalized to the last pre-repeal year available, i.e. 1923.

2.11 Tables of the Main Text

Table 2.1: Difference-in-differences on newly-registered firms survived beyond 1937

	Dependent variable: number of firm registrations by municipality and year that survived beyond 1937													
			Railway connection				Altitude (median split)				Population (median split)			
	Full sample		No railway		Railway		Higher alt. places		Lower alt. places		Smaller places		Larger places	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Grisons × Post1925	0.2***		0.1		0.3***		0.3***		0.1		0.1		0.2***	
	(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)	
Grisons × $y\_1925, 26$		0.3***		0.2*		0.5***		0.4**		0.2*		0.3**		0.3**
		(0.1)		(0.1)		(0.2)		(0.2)		(0.1)		(0.2)		(0.1)
Grisons × $y\_1927, 28$		0.1		-0.1		0.1		0.2		-0.1		-0.1		0.1
		(0.1)		(0.2)		(0.1)		(0.1)		(0.1)		(0.2)		(0.1)
Grisons × $y\_1929, 30$		0.2**		0.1		0.4***		0.3*		0.1		0.2		0.3**
		(0.1)		(0.2)		(0.1)		(0.2)		(0.1)		(0.2)		(0.1)
Observations	3740	3740	1969	1969	1771	1771	1848	1848	1892	1892	1826	1826	1914	1914
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep. Var.	0.4	0.4	0.3	0.3	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.5	0.5
Effect size (c/Mean D.V.)	0.5	0.8	0.3	0.7	0.6	1.0	0.8	1.1	0.2	0.5	0.5	1.2	0.5	0.6
No. of municipalities	340	340	179	179	161	161	168	168	172	172	166	166	174	174
Within R2	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Notes: The table reports the impact of the repeal of the car ban on the total number of newly-registered firms per 1,000 inhabitants in Grisons that survived beyond 1937, the final year covered by the firms register, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using a difference-in-differences design. We present the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Centrality is proxied by railway connection, altitude, and population. The outcome is the number of firms registered between 1920 and 1930 in each municipality that survived beyond 1937. It is computed as the difference between firms registered between 1920 and 1930 and those marked as closed (crossed out) by 1937, when the firm-register closed. For both the full sample and each split, we report two sets of estimates. Columns (1), (3), (5), (7), (9), (11), and (13) pool the effect of the repeal over the entire 1925–1930 period. Columns (2), (4), (6), (8), (10), (12), and (14) replaces the pooled post-treatment effect with three distinct coefficients, obtained by interacting the repeal effect with indicators for the two-year periods 1925–1926, 1927–1928, and 1929–1930. Columns (1)–(2) present the full-sample baseline. Columns (3)–(4) restrict the sample to municipalities not crossed by the railway network (lower centrality). Columns (5)–(6) restrict to municipalities crossed by the railway (higher centrality). Columns (7)–(8) restrict to municipalities whose main-town altitude is above the canton-specific median (lower centrality), while Columns (9)–(10) restrict to those below the median (higher centrality). Columns (11)–(12) restrict to municipalities whose main-town population is below the canton-specific median (lower centrality), and Columns (13)–(14) to those above it (higher centrality). All estimates include year fixed effects and municipality fixed effects. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

A Data Sources, Coding and Access Modality

This Appendix lists the main data sources, shows examples of original documents, highlights coding issues and provides detailed access modality for replication.

A.1 Firm Register Data

Our main variable of interest is the formation and closure of registered firms. We accessed firm register excerpts from the respective State Archives in the treated region (Grisons) and in the adjacent cantons that are the control regions (Canton of St. Gallen, Glarus, Uri and Ticino). We discuss the respective data, coding and access modality by canton.

Canton of Grisons

We accessed and digitized the register of enterprises in all Grisons municipalities from 1883 to 1937. We consolidated changes of names and territorial status to 222 municipalities as of 1920. From the original 222 official municipalities, we aggregated seven municipalities into three to align with the classification in the enterprise register, resulting into 218 units of analysis for Grisons.[13]

New firm registrations from 1887 to 1937 are recorded in three different registers of enterprises. The first register collects firms registered between 1883 and 1910. The second register includes firms that survived up to 1910 and those created between 1910 and 1923. The third register includes firms that survived up to 1923 and those created between 1923 and 1937.[14] Figure A.1 shows a sample of the register of enterprises from which we extract information about the year the firm was registered, the municipality of registration, the firm's name, the owner's name, the business type, and whether the firm closed by the end of the register. We reclassify each business type into two columns: one for the primary business activity and another for the secondary business activity, capturing the complexity of businesses that engage in multiple operations. This classification is based on 28 business types and 14 membership associations, with the latter assigned to a main sector of competence. Each business type or association is further mapped to NACE Level 1 and Level 2 categories. We then reclassify these 28 business sectors into six main industrial sectors.[15] Furthermore, by leveraging owner and firm names, we could classify each firm by legal entity. Thus, similarly to business sectors, we classify

[13] *Ascharina*, *Rüti im Prätigau*, and *Castels* have been merged into a single municipality named *Castels*. *Casti* and *Wergenstein* have been merged into a single municipality named *Wergenstein*. *Strada* and *Ilanz* have been merged into a single municipality named *Ilanz*.

[14] The year 1923 is split between two registers. We exploited the fact that enterprises are recorded in chronological order and matched owners' names and business types to avoid double-counting the same enterprises across different registers.

[15] The main industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management).

firms' legal entities into seven main categories.[16] We take advantage of the fact that firms closing by the end of each register are struck through to identify those that defaulted by 1910, 1923, or 1937. Finally, we used owner names, business nature, firm defaults, and notes left by the registrar to determine whether a registered firm is entirely new or it results from a transfer of ownership - often within the same family, following inheritance or a change in the owner's marital status - or whether it represents a reopening after a company's default. The goal is to distinguish between legal and material survival. By focusing on firms' "genealogies" rather than just legal openings and closures, we track cases where a firm legally closes but its material infrastructure and organization persist.

Access modality: All municipality register of enterprises excerpts are stored by the State Archives of the Grisons (SAG) (*Staatsarchivs Graubünden*, `https://www.gr.ch/EN/institutions/administration/ekud/afk/sag/`). These documents are freely accessible. To access the data a user must write a request to the State Archives of the Grisons and pre-order the respective documents in advance over the library order portal under: `https://staatsarchiv-findsystem.gr.ch/home/#/content/55243deda0a245989285d7e07697727b/`. The firm register books are then delivered to the reading room of the SAG.

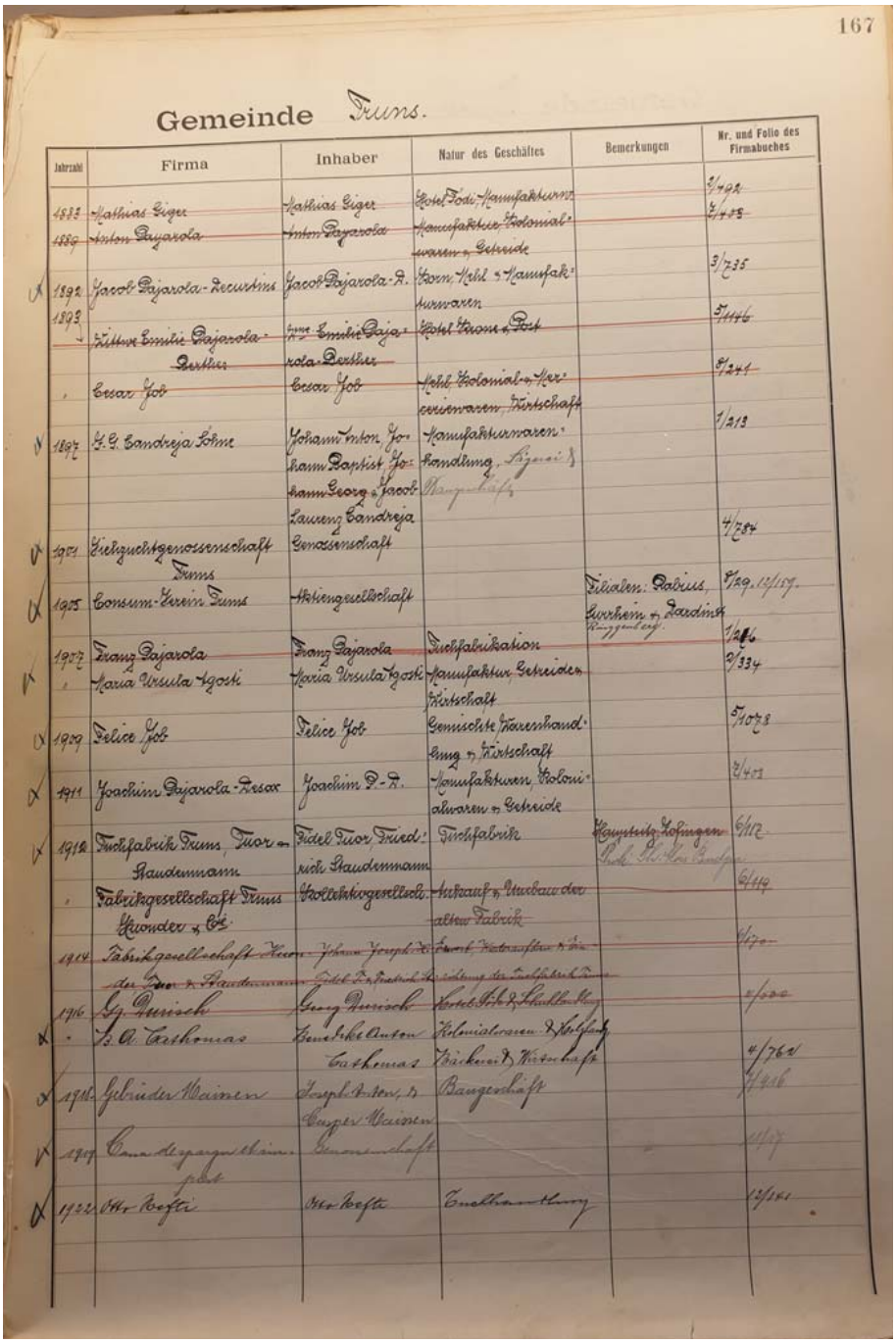
Control Sample

Canton of St. Gallen: We accessed and digitized the journal of new enterprises in all St. Gallen municipalities from 1920 to 1937 in the districts of Werdenberg, Sargans, and Gaster, which directly border the canton of Grisons. The data are not structured into different categories and columns for the year of creation, owner, enterprise's name, and business type. This information is presented in the form of a short textual notice, including notes on all changes that may have affected the life of an enterprise, such as new foundation or closure. overtake, and ownership change. Based on the text, we trace back the above-mentioned categories (see canton of Grisons), adding also reasons of entry as an additional column. We reclassified the municipalities according to the 20 official municipalities in 1920 in Werdenber, Sargans, and Gaster districts. We reclassified each business type into primary and secondary business activity, its industrial sector, and legal form, as explained for the canton of Grisons above. We exploited the fact that the journal also notes the firm's closure to assess whether a firm, once created, closed by 1937. Finally, we used the reasons for entry, owner name, business nature, firm's default year, and notes left by the registrar to determine whether a registered firm was (i) entirely new, (ii) resulted from a transfer of ownership, or (iii) represented a reopening after a company's default.

Access modality: All municipality register of enterprises excerpts are stored by the St. Gallen State Archives (*Staatsarchiv des Kanton St. Gallen*, `https://www.sg.ch/kultur/staatsarchiv.html`) as economic and, specifically, trade-related acts. These documents are freely accessible. To access the data, a user must write a request to the State Archives of St. Gallen and pre-order the respective documents in advance over the library order portal under:

[16] The categories for firms' legal entities are as follows: *private* (privately held company), *stock_company* (stock company), *coop_ass* (cooperatives and associations), *collective* (*kollektive Genossenschaft*, i.e., general partnership entity), *command* (*Kommanditgesellschaft*, i.e., limited partnership business entity), *foundation* (foundations), and *state* (state-owned company).

Figure A.1: Example of a firm register excerpt from Book No. 2



Notes: The figure shows the firm register excerpt from the municipality of Truns in Grisons. The excerpt is from the firm register Book No. 2, which covers all existing firms as of 1910 and all new registrations from 1911 to 1923. Firms closed by 1923, when the register 2 closed, are struck-through (red line). Non-struck-through firms were at least operating until 1923 and will then show up once again in Book No. 3. We digitized the foundation year, type of company, sector of the firm, owner names, and their closure until 1923 or their further survival. *Source:* State Archive of Grisons (SAG).

https://dls.staatsarchiv.sg.ch/records/hierarchy?path=0001%2F0004%2F0001%2F000G%2F0009%2F0001%2F0001&context=%2Frecords%2F16099&activeNode=15868. The enterprise register books are then delivered to the reading room of the state archive.

Canton of Glarus: We accessed and digitized the new enterprises in all Glarus municipalities from 1920 to 1937. We reclassified the municipalities in Glarus according to the 28 official municipalities in 1920. The data are already structured in two different databases. The data stem from the Commercial Register of Glarus (*Handelsregister*), and the State Archive of Glarus (*Landesarchiv des Kantons Glarus*). The Founded Companies Register (*Gegründete Firmen Register*) contains all founded and still existing firms, and the Directory of Deleted Commercial Register Entries (*Verzeichnis-Gelöschter-Handelsregistereinträge*) contains all founded firms that are not in operation anymore. We consolidated the data from the registers in a single database, including categories such as the year of foundation/registration, date of closure, owner, enterprise name, and reason of entry. We reclassified each business type into primary and secondary business activity, its industrial sector, ownership change, and legal form, as explained for the canton of Grisons above.

Access modality: The information about enterprises registration between 1920 and 1937 are split and collected by two different entities, the National State Archive of Glarus (https://www.gl.ch/verwaltung/bildung-und-kultur/kultur/landesarchiv.html/662), and the Commercial Register of Glarus (https://www.gl.ch/verwaltung/volkswirtschaft-und-inneres/wirtschaft-und-arbeit/handelsregister.html/1038). The data are already digitized by Glarus' authorities. To access the data, a user must request the Founded Companies Register by emailing the relevant cantonal authorities.

Canton of Uri: We accessed and digitized the Official Gazette of the Canton of Uri (*Amtsblatt des Kantons Uri*) from 1920 to 1937, accessible online via https://www.ur.ch/amtsblatt. We reclassified the municipalities according to the 20 official municipalities in 1920. Newly registered firms are presented in the form of a short textual notice recording the creation of a new firm in the cantonal Gazette. The Gazette takes note of all the changes that may have affected the life of an enterprise, including new registrations and closures. overtake, and ownership change. We digitized these texts and traced the above-mentioned categories. We reclassified each business type into primary and secondary business activity, its industrial sector, legal form, and overtakes, as explained for the canton of Grisons above.

Access modality: All volumes of the Official Gazette of the Canton of Uri (*Amtsblatt des Kantons Uri*) from 1849 to 1998 have been collected, stored, and digitized by the Uri State Archives (*Staatsarchiv Uri*, https://staur-digitalplattform.ch/https/-/staur-digitalplattform-ch/). The volumes are available at https://staur-digitalplattform.ch/amtsblatt/index.php/ and can be freely accessed and downloaded by visitors.

Canton of Ticino: We accessed enterprise information in Ticino's municipalities from 1920 to 1930 in the districts of Bellinzona, Blenio, Leventina, and Riviera as immediately bordering valleys to the canton of Grisons.[17] We followed administrative and name changes

[17]Records from the enterprise register for the district of Blenio (neighboring Grisons) and the municipalities

of municipalities during this period, and we identified a total of 63 municipalities as of 1920.[18] Compared to the other cantons, the data are already structured in a database, including the firm's registration date, the owner's name, the legal type of enterprise, and notes on the type of business. We reclassified each business type into primary and secondary business activity, its industrial sector, ownership change, and legal form, as explained for the canton of Grisons above.

Access modality: All municipality registers of enterprises excerpts and database are stored by the Ticino State Archives (*Archivio di Stato del Cantone Ticino*, `https://www4.ti.ch/decs/dcsu/asti/asti`). To access the data, researchers can view the original registers in the reading room of the archive, after the email announcement of a visit.

A.2 Shape Files and Street Map as of 1925

Municipality Shapefile

We used the shapefile of 1920 Swiss municipalities, based on the *Historischer Atlas der Eidgenössischen Volkszählungen* (Historical Atlas of the Federal Censuses), digitized and provided by the Federal Statistical Office (ThemaKart, 2021). We aggregated some municipalities as of 1920 to make the shapefile consistent with historical records from the enterprise register (see territorial adaptions per canton above).

Access modality: A visualization of the evolution of Switzerland's municipal administrative divisions over time is available at `https://www.atlas.bfs.admin.ch/maps/193/de/14894_14884_14771/23543.html`. To obtain access to the shapefile itself, we contacted the administrator of the Historical Atlas at `statatlas@bfs.admin.ch`.

Street Network

We digitized the network of main roads in the canton of Grisons and in the control sample in the cantons of St. Gallen, Uri, Glarus, and Ticino as of the early 1920s. To do so, we compare modern street maps with the Dufour Map (Federal Office of Topography, 1865, published from 1845 to 1865) and the Topographic Atlas of Switzerland, the Siegfried Map (Federal Office of Topography, 1926 published from 1870 and 1926). We connected each municipality, mountain passes (to check for local altitude maxima and minima between municipalities),[19] and cantonal access points to the 1920s street network and calculated all-pairs shortest-path lengths (in km) using the "Closest Facility" tool in ArcGIS. We transform altitude gains/losses as follows: 100 meters of altitude gain corresponds to 1 kilometer of flat distance, while altitude losses are not converted into different distances.

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of Personico, Prato-Fiesso, Gnosca, Anzonico, Robasacco, Sobrio, Rossura, Cavagnago, and Campello were lost. Consequently, information on firm registrations is unavailable. In specifications that include firm registrations as an outcome, we exclude this district and these municipalities from the sample.

[18] Aligning with the classification in the enterprise register, the municipalities of *Torre* and *Grumo* have been merged into a single municipality named *Torre*.

[19] The passes considered are: Passo del Lucomagno, Oberalppass, Bernina, Passo della Maloja, Passo dal Guglia, Pass d'Alvra, Flüelapass, Pass dal Fuorn(1), Pass dal Fuorn(2), Pass dal Fuorn(3), Wolfgang Pass, Luzisteig, and Passo del San Bernardino.

Access modality: For the modern street network, we used the topographic and the OpenStreetMap base maps freely available for owners of an ArcGIS Desktop license. The Dufour and the Siegfried maps are freely available online via the following link: `https://map.geo.admin.ch/`. I cross checked local altitude maxima and minima using google maps (`https://www.google.com/maps`).

Railway Network

We visualized the contemporary rail network in Switzerland with ArcGIS and assessed whether each line existed in the 1920s, adding to each existing line the year of construction. We also added two lines that are non-operative nowadays, i.e. the Bellinzona-Mesocco line and the Sernftalbahn, connecting Schwanden to Elm.

Access modality: The line-layer with the present day railway network is freely available at https://www.bav.admin.ch/bav/de/home/allgemeine-themen/fachthemen/geoinformation/geobasisdaten/schienennetz.html. We relied on Wikipedia for the information about the date of realization of each line. In particular the information can be found at the following link: `https://de.wikipedia.org/wiki/Liste_der_Schweizer_Eisenbahngesellschaften` - for still active rail-lines;
`https://de.wikipedia.org/wiki/Liste_der_ehemaligen_Schweizer_Eisenbahnstrecken` for out-of-service or closed nowadays.

A.3 Further Data

This section provides detailed data sources and the access modality of further covariates that are introduced in Section 2.4.2, 2.8.1, and 2.6.4 in the main paper.

Decennial Census Data (1900 to 1941)

Population data and socio-demographic characteristics of all municipalities in Grisons, St. Gallen, Uri, Glarus and Ticino for 1900, 1910, 1920, 1930, and 1940 are from the Swiss Federal Statistical Office. The data provide counts of the population, number of houses, living rooms, gender structure, religious denomination, spoken languages, region of origin, and number of houses and households. We consolidated the territorial status of municipalities as described above for the firm registers.

Access modality: The core data of the decennial census are provided as `.csv` or `.xls` - files and are freely accessible via the following link: `https://www.bfs.admin.ch/asset/de/su-d-01.01-vz1850-ge-01`. Censuses from other cantons, and further material from the canton of Grisons, including the number of houses, households, and living-rooms, can be accessed via the following link: `https://www.bfs.admin.ch/bfs/de/home/statistiken/katalog.html`.

Economic Activity, Firms and Farms census data (1905 to 1939)

The economic activity census data with information about the economic characteristics of all municipalities in Grisons, St. Gallen, Uri, Glarus, and Ticino for 1905, 1929, and 1939 are from the Swiss Federal Statistical Office. The data include the numbers of firms and

farms, the numbers of owner-led firms (1905 and 1939), the numbers of firms by sector (1905), the numbers of employees and their gender composition (1905 and 1939), and the numbers of employees by sector (1905). We consolidated the territorial status of municipalities as described above for the firm registers.

Access modality: The core data of the economic activity census have been digitized from the original volumes available in `.pdf` - files and are freely accessible via the following link: `https://www.bfs.admin.ch/bfs/de/home/statistiken/katalog.html`.

Altitude and Slope

We used `www.wikipedia.com`, `www.wikipedia.de`, and `www.wikipedia.it` to retrieve the altitude of each municipality's urban center in our dataset, assuming that the urban center reflects where the population is concentrated and thus is representative of the municipality as a whole. We use the altitudes of municipalities (and passes) to calculate the flat-travel distances between nodes (see above).

Access modality: The altitudes for each municipality's urban center are freely available on `wikipedia.com`, `wikipedia.de`, and `wikipedia.it`.

Tourism Statistics in Grisons

We digitized data on tourism figures preserved in the State Archives of the Grisons for 1924 to 1929. These accounts include the number of guests, number of beds, number of overnight stays per bed, and the bed occupancy rate - the proportion of available beds that were occupied by tourists.

Access modality: Statistical recordings about tourism in Grisons are stored by the State Archives of the Grisons (SAG) (*Staatsarchivs Graubünden*, `https://www.gr.ch/EN/institutions/administration/ekud/afk/sag/`). To access the data, users must pre-order the documents over the library portal under:
https://staatsarchiv-findsystem.gr.ch/home//content/e99ececd12644b749640ac2534c567f0. The documents are delivered to the reading room of the SAG.

In-Out Commuters and Workplaces According to the 1910 Census

We digitized the data on the In-Out Commuters and Workplaces According to the 1910 Census. The statistics include the employed residents, the in-commuters, and the out-commuters by sex and municipality.

Access modality: The core data of the in-out commuters and workplaces according to the 1910 Census have been digitized from the original volumes available in `.pdf` - files and are freely accessible via the following link: `https://www.bfs.admin.ch/bfs/de/home/statistiken/katalog.html`.

Municipal Income, Wealth, Taxation and Fiscal Revenues

We digitized the data on municipal taxation and fiscal revenues in each municipality in Grisons, St. Gallen, Uri, Glarus, and Tessin. In most cases, the data include the municipality's name,

sum of tax-payer's taxable wealth, sum of not-capitalized-income wealth and sum of capitalized income, number of homes, number of heads, rate per 1000 Fr., rate per home, rate per head, amount on homes, amount on heads, and amount on wealth and income. We mainly focused on the variable of the sum of taxable income.

Access Modality by Canton:

Graubünden: Municipal data on the wealth and income of citizens in Graubünden for 1913, 1918, 1920, 1923, 1928, 1930 and 1933 can be freely accessed through the SAG at `https://www.gr.ch/EN/institutions/administration/ekud/afk/sag/`. Users must register online with the SAG and pre-order the respective documents in advance over the library order portal at `https://staatsarchiv-findsystem.gr.ch/home/#/` [Search for: Steuerlisten 1. Hälfte 20. Jahrhundert (1900 - 1950); The municipal tax lists or registers are bound in books by year]. The documents are then delivered to the reading room of the SAG.

St. Gallen: Municipal data on the wealth and income of citizens in St. Gallen for the relevant years can be freely accessed through the Staatsarchiv St. Gallen at `https://www.sg.ch/kultur/staatsarchiv.html`. Users must register online with the Staatsarchiv St. Gallen and pre-order the respective documents in advance by mail to info.staatsarchiv@sg.ch [Search for: KA R.185 B 4 - Staatssteuerregister; The municipal official state tax registers are bound in books and organized in intervals of five to seven years]. The documents are then delivered to the reading room of the Staatsarchiv St. Gallen.

Uri: Municipal data on the wealth and income of citizens in Uri for the relevant years can be freely accessed through the STAUR at `https://www.staur.ch/`. Users must register online with the STAUR and pre-order the respective documents in advance over the library order portal at `https://scope.ur.ch/scopeQuery/suchinfo.aspx` [Search for: R-270-13/1017 - Kantonssteuern, Staatssteuer; Statistisches Material aus den Jahren 1922-1926, R-270-13/Steuerverwaltung/1002 - Kantonssteuern, Staatssteuer-Register and R-270-13/Steuerverwaltung/1004 - Kantonssteuern, Staatssteuer; Staatssteuer-Register]. The municipal wealth and income data for 1912, 1917, and 1922 (R-270-13/1017) can be found in the compilation of state taxation for wealth and income and for 1923 separately for each municipality. The municipality official state tax registers for 1918 to 1920 and 1927 (R-270-13/Steuerverwaltung/1002; R-270 13/Steuerverwaltung/1004) are bound in books and organized in intervals of five years. The documents are then delivered to the reading room of the STAUR.

Glarus: Municipal data on the wealth and income of citizens in Glarus for the relevant years can be freely accessed through the Landesarchiv Glarus at `https://www.gl.ch/verwaltung/bildung-und-kultur/kultur/landesarchiv.html/662/l/de`. Users must register online with the Landesarchiv Glarus. After online registration, researcher can download the documents [Search for: MA 8 5 - Landsgemeindememoriale; The records of the Landsgemeinde are organized by year]. The corresponding data can be found under the title «Landes-Rechnung - Verwaltungsrechnung» until 1920, and thereafter under «Staatssteuern».

Ticino: Municipal data on the wealth and income of citizens in Ticino for the relevant years can be viewed in the reports of the State Council under the Department of the Interior at the State-Archive. The documents are freely accessible, and the staff on site will assist in finding the correct documents. Afterward, the documents can be collected in person and

reviewed on site. The municipal tables showing the amount and distribution of the municipal tax, which include data on the wealth and income of the citizens, are bound in books and organized by year.

Motor Vehicle Permits

We digitized the data on the driving licenses per municipality in Grisons from 1919 to 1926. The data are preserved in the State Archives of Grisons and include the name of the license owner, the date of the license, the municipality, and the owner's occupation.

Access modality: Statistical recordings about driving licences in Grisons are stored by the State Archives of the Grisons (SAG) (*Staatsarchivs Graubünden*, `https://www.gr.ch/EN/institutions/administration/ekud/afk/sag/`). To access the data, users must pre-order the documents over the library portal under the following link:
https://staatsarchiv-findsystem.gr.ch/home//content/bb42b585da914a68998bad753cc034b0.
The documents are delivered to the reading room of the SAG.

Cantonal Referendums in Grisons

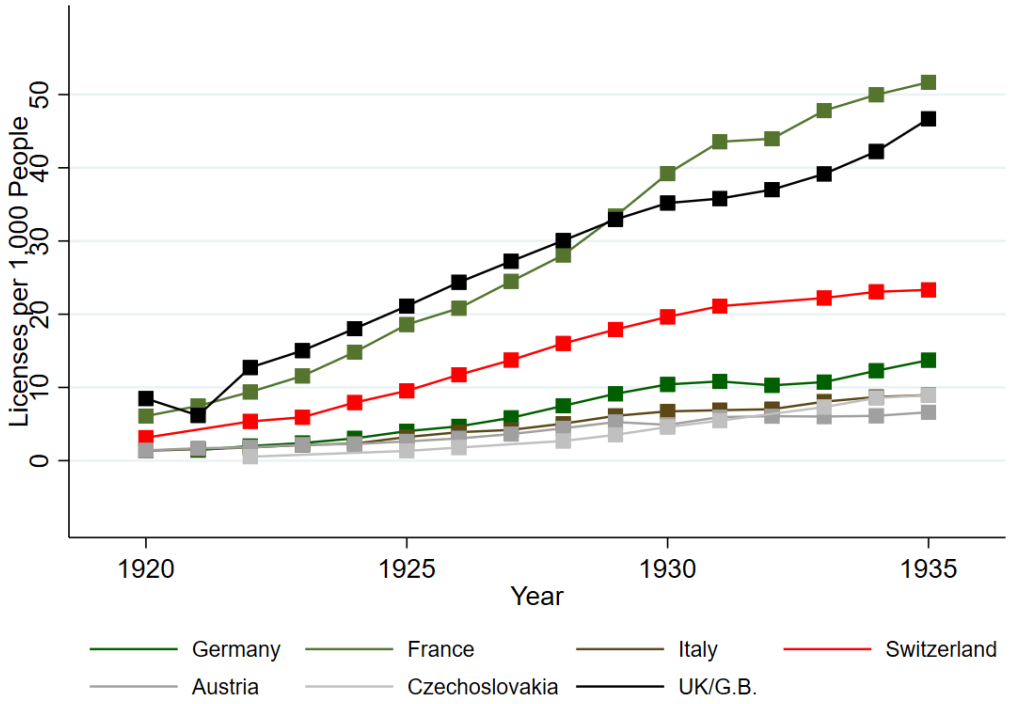
We digitized data on referendum results from 1907 to 1925 (from the first to the last popular vote on the car ban). The referendum results list includes the number of eligible voters, and yes and no votes.

Access modality: Statistical recordings about cantonal referendums are stored by the State Archives of the Grisons (SAG) (*Staatsarchivs Graubünden*, `https://www.gr.ch/EN/institutions/administration/ekud/afk/sag/`). To access the data, users must pre-order the documents on the car bills over the library portal under the following links:
https://staatsarchiv-findsystem.gr.ch/home//content/d15bbb304a154b67901e3191232a6869.
The documents are delivered to the reading room of the SAG.

B Additional Figures and Tables

B.1 Additional Figures

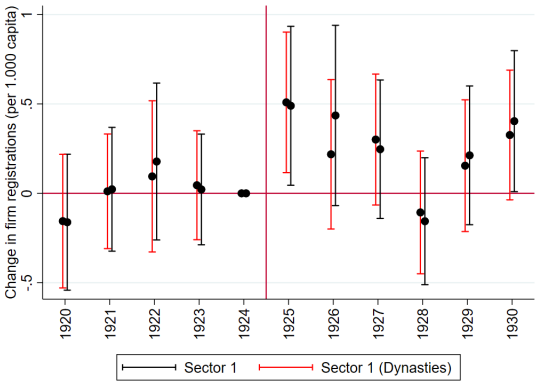
Figure B.1: Car registrations per 1,000 inhabitants by country over time



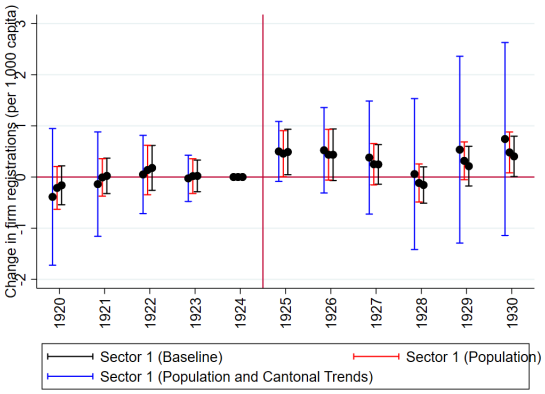
Notes: The figure shows the evolution of car licenses per 1,000 inhabitants over time by main European countries from 1920 to 1935. The number of licenses includes private cars, but also trucks and motorbikes. The number of car licenses are standardized according to the first census available for each country in the decade from 1920 to 1930. *Source:* Own calculation based on data from Mitchell (1998).

Figure B.2: Newly-registered firms, robustness to alternative definitions and samples

(a) Firm registrations vs. economic activity

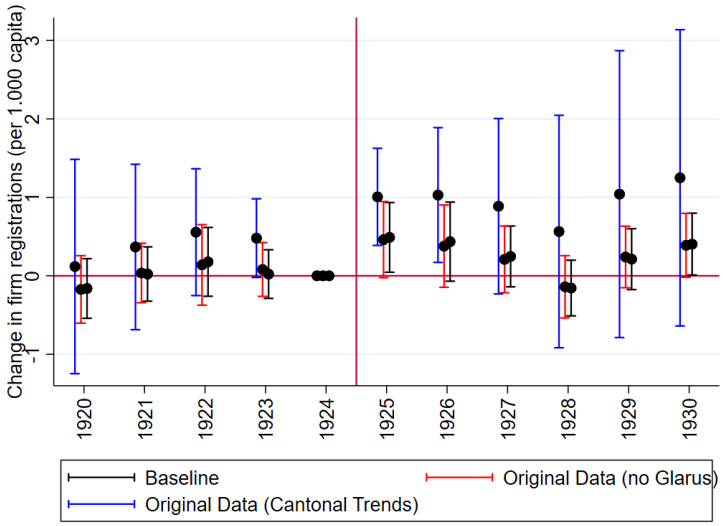


(b) Including population and cantonal trends



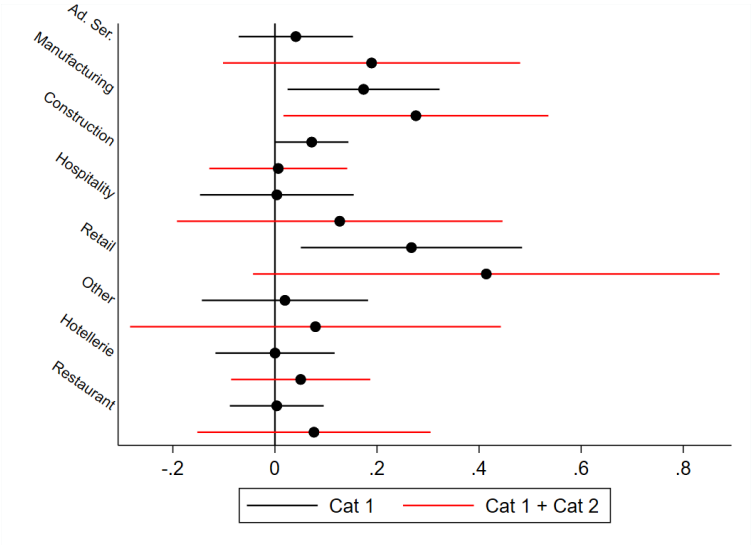
Notes: The figure assesses the robustness of the baseline results by (a) focusing on the creation of new economic activity rather than administrative registration events and (b) adopting alternative specifications that include the municipal population in 1920 interacted with year fixed effects. The specification is an event-study regression estimating the impact of the repeal of the car ban in Grisons, beginning in 1925, on firm activity. In each graph, black coefficients correspond to the baseline specification, and red or blue coefficients to the robustness specifications. Vertical lines represent the 95% confidence intervals, and the vertical red line marks the year of the repeal. Graph (a) compares the baseline with a specification that isolates the formation of new economic activity. The outcome excludes firms registered through transfers of ownership or the reopening of previously closed activities, identified using firm and sector identifiers in each canton's firm-register data. Graph (b) compares three specifications: the baseline model, a specification that adds municipal population in 1920 interacted with year fixed effects, and a specification that additionally includes canton-specific linear trends. All estimates include year fixed effects and municipality fixed effects.

Figure B.3: Newly-registered firms accounting for data quality in Glarus



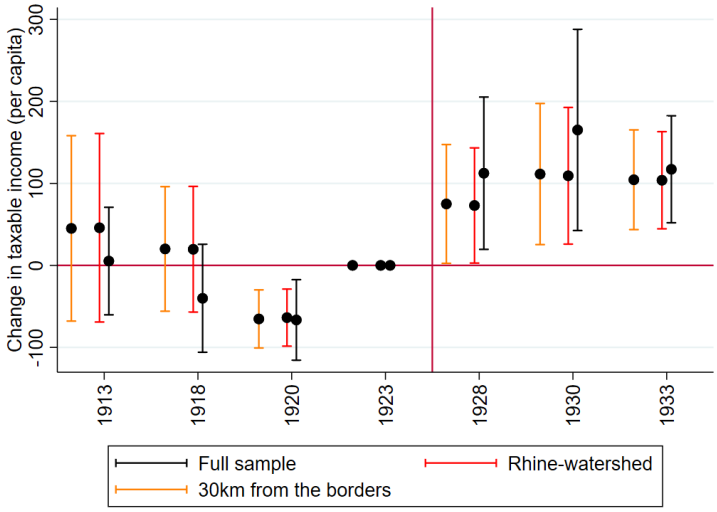
Notes: The figure assesses the robustness of the baseline results using the original dataset for municipalities of the canton of Glarus instead of replacing the 1924 number of enterprises with the average of 1923 and 1925. It compares the baseline results with the same specification estimated on the original sample, either excluding municipalities in Glarus from the control group or introducing a canton-specific linear trend to account for the 1924 observation in Glarus. The specification is an event-study regression estimating the impact of the repeal of the car ban in Grisons, beginning in 1925, on firm activity. The total new-firm registrations in Grisons and in neighboring cantons is defined as the number of firms registered in a municipality in a given year according to each canton's firm-register data. Estimates include year fixed effects and municipality fixed effects. Black coefficients correspond to the baseline specification and red coefficients to the robustness specification. Vertical lines represent 95% confidence intervals, and the vertical red line marks the year of the repeal.

Figure B.4: Newly-registered firms accounting for multi-sector activities



Notes: The figure compares difference-in-differences coefficients from the baseline specification (black), which measures the number of firms by industrial sector recorded as their first activity, with a robustness specification (red), which counts firms in each industrial sector regardless of whether the sector is listed as a first or second activity. In both specifications, the outcome is compared before and after the car ban was repealed in Grisons, relative to neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. Horizontal black and red lines display the 95% confidence intervals computed using robust standard errors. Industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management). All estimates include year fixed effects and municipality fixed effects.

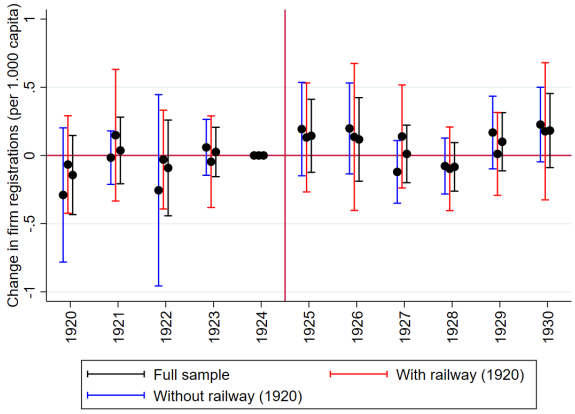
Figure B.5: Taxable income, robustness to sample restrictions



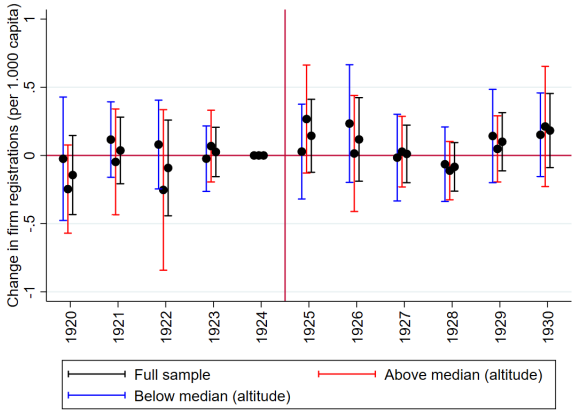
Notes: The figure tests the robustness of the baseline results (black) for the impact of the repeal of the car ban on total municipal income in Grisons by comparing the baseline with the same event-study specification estimated on samples restricted to municipalities and control areas with better data coverage and comparability. The outcome is municipal aggregated income, measured as taxable income from municipal taxation and fiscal revenue data. Both robustness specifications restrict the control sample to Glarus and St. Gallen due to better data coverage. One specification (red) restricts the municipalities in Grisons to those belonging to the 1920 districts within the Rhine watershed, while the second specification (orange) restricts the sample to municipalities whose centroids lie within 30 km of the Glarus-St. Gallen border. Vertical black, red, and orange lines display the 95% confidence intervals computed using robust standard errors, and the vertical red line marks the year of the repeal. All estimates include year fixed effects, municipality fixed effects, and municipal population in 1920 (the baseline year) interacted with the year fixed effects.

Figure B.6: Newly-registered firms closed by 1937, center vs periphery

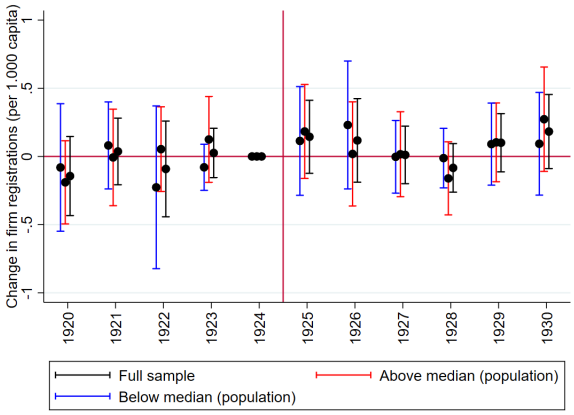
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



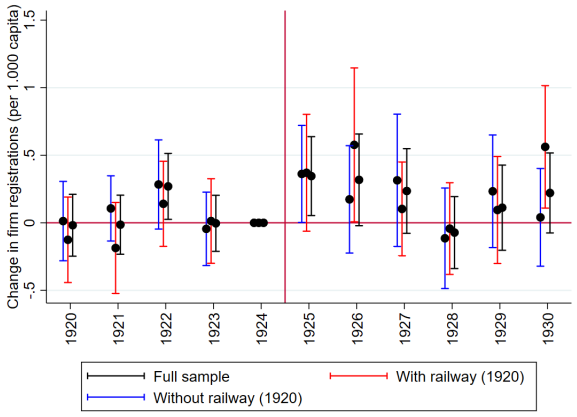
(c) Above vs. below median population



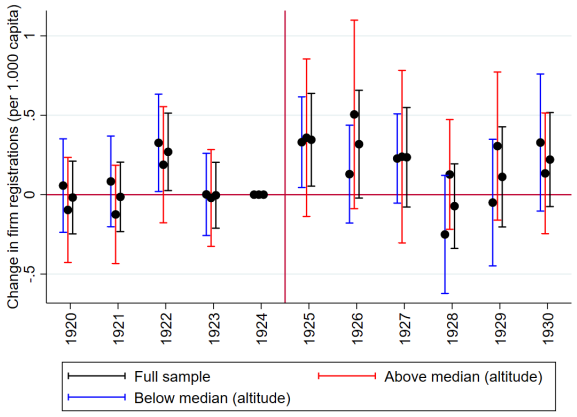
Notes: The figure reports the impact of the repeal of the car ban on the total number of newly-registered firms per 1,000 inhabitants in Grisons that had closed by 1937, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. We show coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. The outcome is the number of firms registered in each municipality between 1920 and 1930 that are marked as closed (crossed out) by 1937 in the firms-register data of each canton. Centrality is proxied by railway connection, altitude, and population. Vertical lines display the 95% confidence intervals based on robust standard errors. The vertical red line marks the year of the repeal. Graph (a) compares event-study coefficients from the full-sample specification with those from samples restricted to municipalities crossed by the railway network (higher centrality) and not crossed by it (lower centrality). Graph (b) compares the full-sample coefficients with those from municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects, and municipality fixed effects

Figure B.7: Newly-registered firms survived beyond 1937, center vs periphery

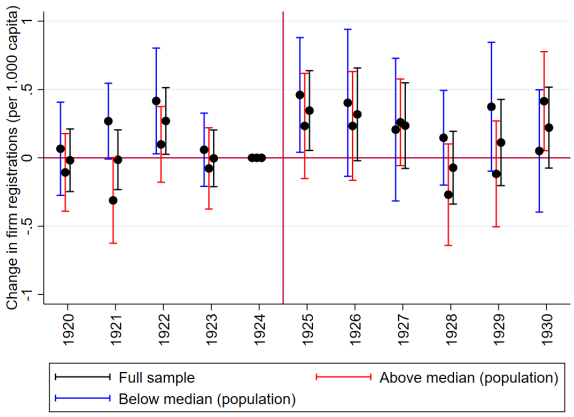
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



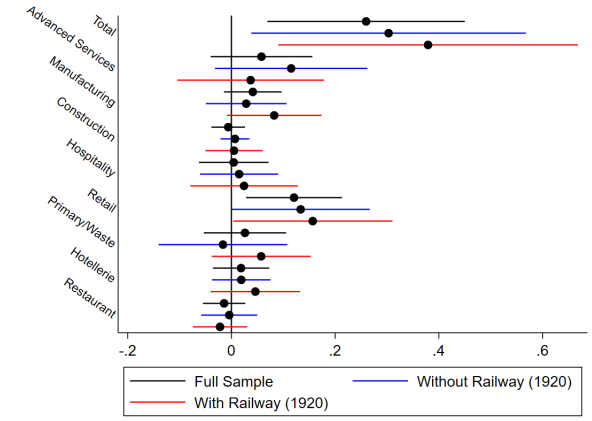
(c) Above vs. below median population



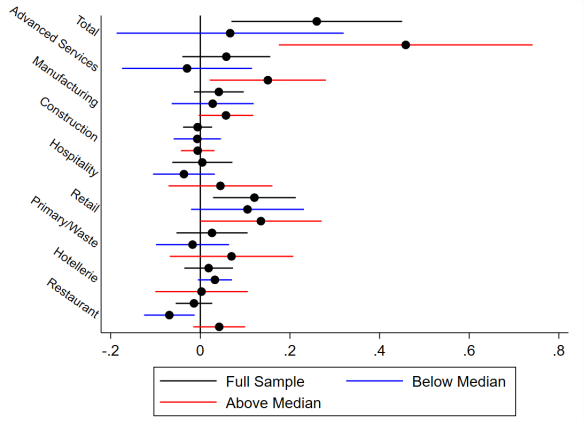
Notes: The figure reports the impact of the repeal of the car ban on the total number of newly-registered firms per 1,000 inhabitants in Grisons that survived beyond 1937, the final year covered by the firms register, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using an event-study design. We show coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. The outcome is the number of firms registered in each municipality between 1920 and 1930, net of those marked as closed (crossed out) by 1937 in the firms-register data of each canton. Centrality is proxied by railway connection, altitude, and population. Vertical lines display the 95% confidence intervals based on robust standard errors. The vertical red line marks the year of the repeal. Graph (a) compares event-study coefficients from the full-sample specification with those from samples restricted to municipalities crossed by the railway network (higher centrality) and not crossed by it (lower centrality). Graph (b) compares the full-sample coefficients with those from municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects and municipality fixed effects.

Figure B.8: Newly-registered firms by industrial sector, center vs periphery

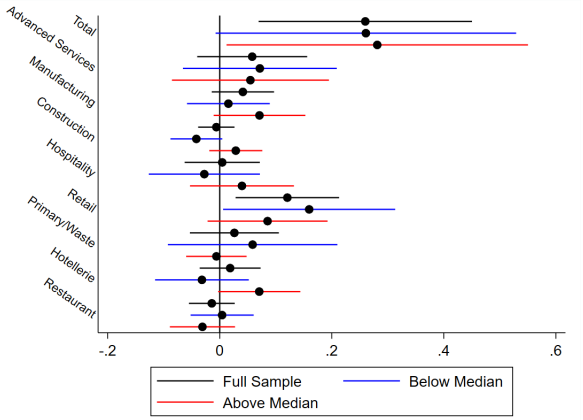
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



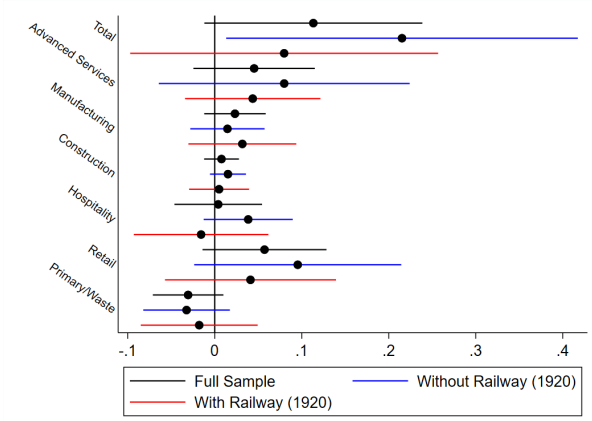
(c) Above vs. below median population



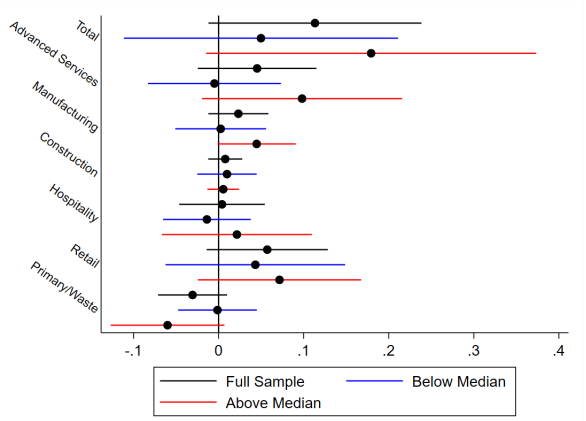
Notes: The figure reports the difference-in-differences coefficients for the number of newly-registered firms per 1,000 inhabitants after the car ban was repealed in Grisons, by industrial sector, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The outcome is represented by the number of firms registered in a municipality, in a given year, within each specific sector, based on each canton's firms register data. Industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management). We present coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Horizontal lines display the 95% confidence intervals, computed using robust standard errors. Graph (a) compares the full-sample coefficients with those from municipalities crossed by the railway network (higher centrality) and those not crossed by it (lower centrality). Graph (b) compares the full sample with municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects and municipality fixed effects.

Figure B.9: Newly-registered firms and closed by 1937 by industrial sector, center vs periphery

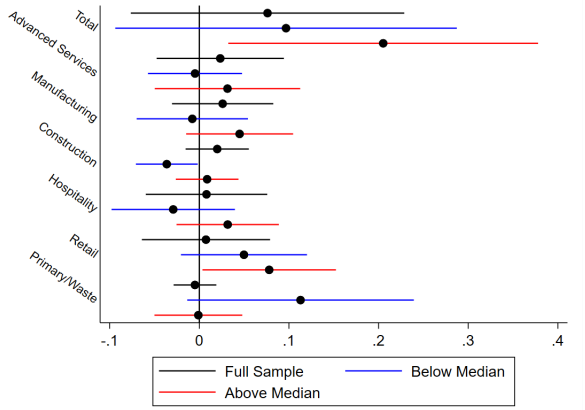
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude



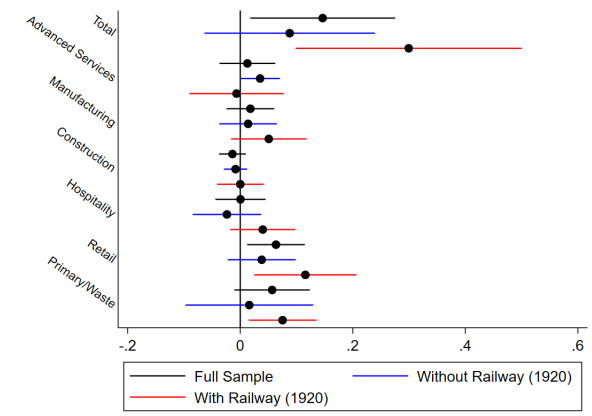
(c) Above vs. below median population



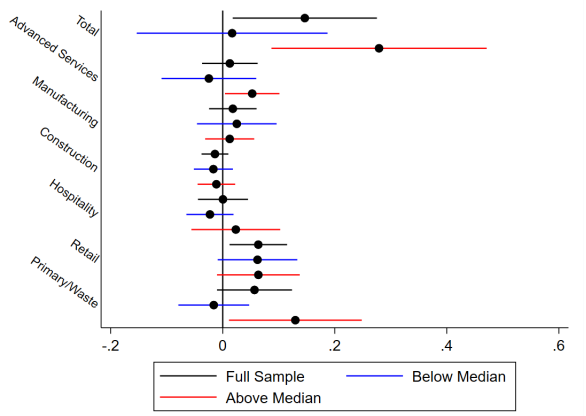
Notes: The figure reports the difference-in-differences coefficients for the number of newly-registered firms per 1,000 inhabitants after the car ban was repealed in Grisons, by industrial sector, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The outcome is the number of firms in each sector that were registered in a municipality and had closed by 1937, based on each canton's firms-register data. Industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management). We present coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Horizontal lines display the 95% confidence intervals, computed using robust standard errors. Graph (a) compares the full-sample coefficients with those from municipalities crossed by the railway network (higher centrality) and those not crossed by it (lower centrality). Graph (b) compares the full sample with municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects and municipality fixed effects.

Figure B.10: Newly firms survived beyond 1937 by industrial sector, center vs periphery

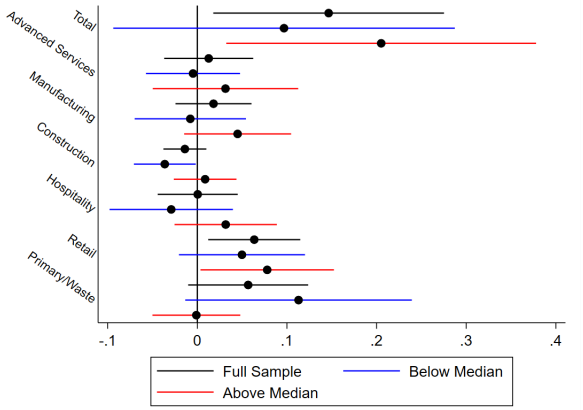
(a) Connected vs. not connected to the railway



(b) Above vs. below median altitude

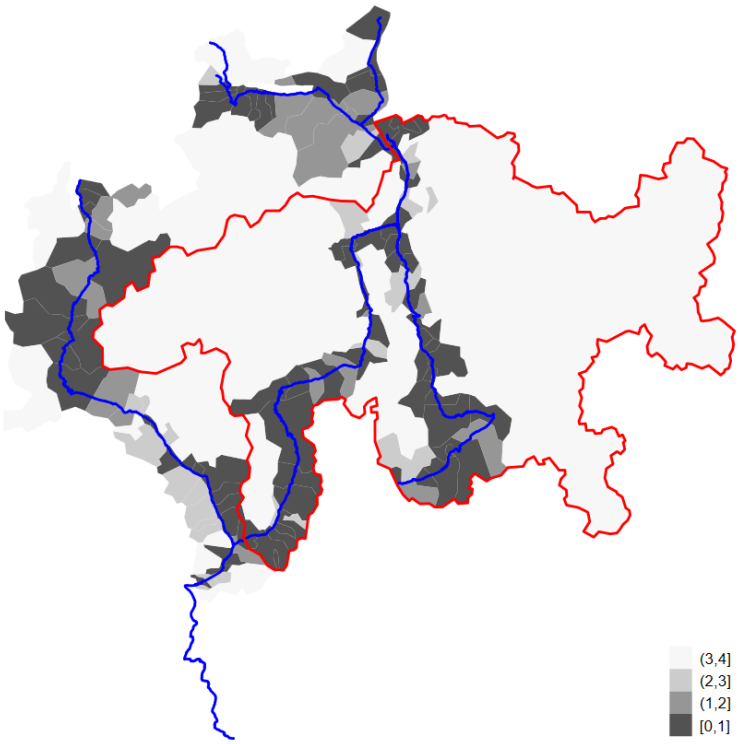


(c) Above vs. below median population



Notes: The figure reports the difference-in-differences coefficients for the number of newly-registered firms per 1,000 inhabitants after the car ban was repealed in Grisons, by industrial sector, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino. The outcome is the number of firms in each sector that were registered in a municipality and survived beyond 1937, based on each canton's firms register data. Industrial sectors include advanced services (financial, real estate, communication, professional services, agency, wholesale and trade, transportation and logistics, leisure and cultural, education, public interest, tourist services, other services), manufacturing (food, textiles, wood, metals and machinery, other), construction (constructions, installations), hospitality (hotels, restaurants), retail (food, non-food, all), and the primary, extraction, and energy sector (agriculture, mining, utilities, waste management). We present coefficients for the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Horizontal lines display the 95% confidence intervals, computed using robust standard errors. Graph (a) compares the full-sample coefficients with those from municipalities crossed by the railway network (higher centrality) and those not crossed by it (lower centrality). Graph (b) compares the full sample with municipalities whose main-town altitude is below the canton-specific median (higher centrality) and above it (lower centrality). Graph (c) compares the full sample with municipalities whose main-town population is above the canton-specific median (higher centrality) and below it (lower centrality). All estimates include year fixed effects and municipality fixed effects.

Figure B.11: North-South routes



Notes: The figure classifies municipalities according to their access to the main north-south routes crossing Grisons and the control municipalities in Uri, Glarus, St. Gallen, and Ticino, connecting the sample to the rest of Switzerland and abroad, including Italy and Germany. Red lines represent the north-south routes. Dark-gray municipalities are those whose main town is crossed by the routes (category 1). Medium-gray municipalities are those whose territory is crossed by the routes, but whose main town is not crossed yet remains easily accessible from the routes (category 2). Light-gray municipalities are those whose territory is crossed by the routes, but whose main town is not crossed and is not easily accessible due to distance or natural obstacles (category 3). Pale-gray municipalities are those not crossed by the routes (category 4). *Source*: Personal elaboration based on Dufour Federal Office of Topography (1865) and Siegfried Map Federal Office of Topography (1926) (see Section 2.4 for further information).

B.2 Additional Tables

Table B.1: Automobiles and motorization rates by canton (1924 and 1928)

Canton	N. Cars 1924	N. Cars 1928	Per 1,000 Inhab. 1924	Per 1,000 Inhab. 1928
Zurich	3,430	10,879	6.37	20.20
Bern	3,519	9,789	5.71	15.89
Geneva	2,980	6,974	17.43	40.78
Vaud	2,302	6,869	7.25	21.63
Lucerne	968	3,134	5.47	17.70
Basel-City	1,243	3,119	8.83	22.17
St. Gallen	1,320	3,075	4.47	10.40
Aargau	1,082	3,045	4.49	12.65
Neuchâtel	1,022	2,345	7.78	17.85
Grisons	136	612	1.13	5.11
Switzerland	22,500	50,200	5.80	12.94

Notes: The table shows the trend in the number of cars and cars per 1,000 inhabitants from 1924 to 1928 in selected Swiss cantons, including Grisons, and in Switzerland as a whole. The second and third columns report the absolute number of cars between 1924 and 1928. The fourth and fifth columns report the number of cars standardized per 1,000 inhabitants. *Source:* Personal elaboration from (Merki, 2002, pg.79) for Grisons and the Statistical Office of the City of Zurich (Statistisches Amt der Stadt Zürich, 1925, 1929) for other Cantons.

Table B.2: Descriptive statistics by morphology and socio-economic characteristics

	Mean	St.Dev.	Min	Max	Obs.
Sea level	946.20	422.70	215.00	1949.00	340
Railway access (1920)	0.47	0.50	0.00	1.00	340
Population (1920)	790.63	1371.31	31.00	15600.00	340
Number of houses (1920)	129.62	164.32	10.00	1342.00	340
Share German-speakers (1920)	0.44	0.43	0.00	1.00	340
Share French-speakers (1920)	0.00	0.00	0.00	0.04	340
Share Italian-speakers (1920)	0.26	0.40	0.00	1.00	340
Share Romansh-speakers (1920)	0.29	0.40	0.00	1.00	340
Share Protestants (1920)	0.42	0.42	0.00	1.00	340
Share Catholics (1920)	0.57	0.42	0.00	1.00	340
Share born municipality of residence (1920)	0.69	0.18	0.15	2.41	340
Share born other municipalities: same canton (1920)	0.20	0.11	0.00	0.84	340
Share born other cantons (1920)	0.06	0.07	0.00	0.67	340
Share born abroad (1920)	0.06	0.06	0.00	0.37	340
Share pop age <= 14 (1880)	0.30	0.05	0.14	0.42	340
Share pop age > 14, <= 59 (1880)	0.58	0.06	0.45	0.82	340
Share pop age > 59 (1880)	0.12	0.04	0.02	0.23	340
Share occupation agr. (1920)	0.59	0.25	0.02	1.00	340
Share occupation ind. (1920)	0.21	0.19	0.00	0.81	340
Share occupation trade&trans. (1920)	0.10	0.09	0.00	0.61	340
Number of earners (1920)	383.47	601.93	15.00	6281.00	340
Share female employees (1905)	0.41	0.18	0.00	1.00	337
Share male employees (1905)	0.59	0.18	0.00	1.00	337
N. employees per firm (1905)	2.57	1.61	0.17	10.82	337
Number of employees (1905)	216.24	514.46	0.00	4846.00	340
Number of firms (1905)	59.27	102.40	0.00	879.00	340
Number of farms (1905)	75.22	70.42	2.00	473.00	340
N	340				

Notes: The table reports descriptive statistics for the environmental and socio-economic characteristics of the municipalities in the sample just before or at the beginning of the analyzed period. The brackets next to each variable in the first column indicate the closest available year prior to the analysis window. For each dimension we provide standard distributional statistics, including the mean, standard deviation, minimum, maximum, and number of observations. The dimensions include altitude (meters above sea level); access to the railway network (whether the railway crosses the municipal territory); the stock of houses; the composition of the municipal population (language, religion, place of birth, age); and economic indicators (occupation by sector, number of earners, gender composition of employees, average firm size measured as employees per firm, total number of employees, and number of firms and farms). *Source:* Personal elaboration based on demographic census data for demographic variables; economic activity, firms, and farms census data for economic variables; and altitude information (see Section 2.4 for further information)..

Table B.3: Balance table, Grisons vs. neighboring municipalities

	Mean(Full Sample)	Mean(Treatment)	Mean(Control)	Diff	p-value
Sea level	946.20	1134.24	610.20	-524.03***	0.00
Railway access (1920)	0.47	0.39	0.62	0.23***	0.00
Population (1920)	790.63	549.79	1220.99	671.20***	0.00
Number of houses (1920)	129.62	86.77	206.20	119.43***	0.00
Share German-speakers (1920)	0.44	0.39	0.54	0.15**	0.00
Share French-speakers (1920)	0.00	0.00	0.00	-0.00	0.38
Share Italian-speakers (1920)	0.26	0.15	0.45	0.30***	0.00
Share Romansh-speakers (1920)	0.29	0.46	0.00	-0.46***	0.00
Share Protestants (1920)	0.42	0.52	0.24	-0.28***	0.00
Share Catholics (1920)	0.57	0.47	0.75	0.27***	0.00
Share born municipality of residence (1920)	0.69	0.68	0.70	0.02	0.34
Share born other municipalities: same canton (1920)	0.20	0.23	0.16	-0.07***	0.00
Share born other cantons (1920)	0.06	0.04	0.09	0.05***	0.00
Share born abroad (1920)	0.06	0.05	0.08	0.02**	0.00
Share pop age <= 14 (1880)	0.30	0.29	0.31	0.02*	0.01
Share pop age > 14, <= 59 (1880)	0.58	0.58	0.59	0.01	0.07
Share pop age > 59 (1880)	0.12	0.13	0.10	-0.03***	0.00
Share occupation agr. (1920)	0.59	0.65	0.46	-0.19***	0.00
Share occupation ind. (1920)	0.21	0.15	0.33	0.18***	0.00
Share occupation trade&trans. (1920)	0.10	0.10	0.11	0.01	0.19
Number of earners (1920)	383.47	264.40	596.23	331.83***	0.00
Share female employees (1905)	0.41	0.40	0.44	0.04*	0.03
Share male employees (1905)	0.59	0.60	0.56	-0.04*	0.03
N. employees per firm (1905)	2.57	2.24	3.16	0.91***	0.00
Number of employees (1905)	216.24	152.19	330.68	178.49**	0.00
Number of firms (1905)	59.27	39.35	94.88	55.53***	0.00
Number of farms (1905)	75.22	60.37	101.76	41.40***	0.00
N	340	218	122		

Notes: The table reports the balance between municipalities in Grisons canton and neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino across variables measuring accessibility, morphology, and socio-economic characteristics just before or at the beginning of the analyzed period. The brackets next to each variable in the first column indicate the closest available pre-treatment year. The second column reports the mean for the full sample, while the third and fourth columns report the means for Grisons and the neighboring municipalities, respectively. The fifth and sixth columns summarize the balance tests. The fifth column reports the mean difference between Grisons and the neighboring municipalities, and the sixth column reports the corresponding p-value from a two-sample t-test of equality of means. Asterisks next to the values in the fifth column indicate statistical significance of the mean difference, where $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.. The variables include altitude (meters above sea level); access to the railway network (whether the railway crosses the municipal territory); the stock of houses; the composition of the municipal population (language, religion, place of birth, age); and economic indicators (occupation by sector, number of earners, gender composition of employees, average firm size measured as employees per firm, total number of employees, and number of firms and farms). *Source:* Personal elaboration based on demographic census data for demographic variables; economic activity, firms, and farms census data for economic variables; and altitude information (see Section 2.4 for further information).

Table B.4: Difference-in-differences on newly-registered firms

	Dependent variable: number of firm registrations by municipality and year													
			Railway connection				Altitude (median split)				Population (median split)			
	Full sample		No railway		Railway		Higher alt. places		Lower alt. places		Smaller places		Larger places	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Grisons × Post1925	0.3***		0.3*		0.4***		0.5***		0.1		0.4**		0.3**	
	(0.1)		(0.2)		(0.1)		(0.2)		(0.1)		(0.2)		(0.1)	
Grisons ×$y\_1925, 26$		0.5***		0.5**		0.6**		0.7**		0.3		0.6***		0.4*
		(0.2)		(0.2)		(0.2)		(0.3)		(0.2)		(0.2)		(0.2)
Grisons ×$y\_1927, 28$		0.1		-0.0		0.1		0.3		-0.1		0.0		0.0
		(0.1)		(0.2)		(0.2)		(0.2)		(0.2)		(0.2)		(0.2)
Grisons ×$y\_1929, 30$		0.4***		0.5**		0.5***		0.5***		0.3*		0.4		0.5***
		(0.1)		(0.2)		(0.2)		(0.2)		(0.2)		(0.2)		(0.2)
Observations	3740	3740	1969	1969	1771	1771	1848	1848	1892	1892	1826	1826	1914	1914
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep. Var.	0.7	0.7	0.5	0.5	1.0	1.0	0.7	0.7	0.7	0.7	0.4	0.4	1.0	1.0
Effect size (c/Mean D.V.)	0.4	0.6	0.7	1.1	0.4	0.6	0.7	0.9	0.2	0.4	0.8	1.5	0.3	0.4
No. of municipalities	340	340	179	179	161	161	168	168	172	172	166	166	174	174
Within R2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: The table reports the impact of the repeal of the car ban on the total number of newly-registered firms per 1,000 inhabitants in Grisons, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using a difference-in-differences design. We present the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Centrality is proxied by railway connection, altitude, and population. The outcome is the total new-firm registrations in each municipality between 1920 and 1930, based on the firms-register data of each canton. For both the full sample and each split, we report two sets of estimates. Columns (1), (3), (5), (7), (9), (11), and (13) pool the effect of the repeal over the entire 1925–1930 period. Columns (2), (4), (6), (8), (10), (12), and (14) replaces the pooled post-treatment effect with three distinct coefficients, obtained by interacting the repeal effect with indicators for the two-year periods 1925–1926, 1927–1928, and 1929–1930. Columns (1)–(2) present the full-sample baseline. Columns (3)–(4) restrict the sample to municipalities not crossed by the railway network (lower centrality). Columns (5)–(6) restrict to municipalities crossed by the railway (higher centrality). Columns (7)–(8) restrict to municipalities whose main-town altitude is above the canton-specific median (lower centrality), while Columns (9)–(10) restrict to those below the median (higher centrality). Columns (11)–(12) restrict to municipalities whose main-town population is below the canton-specific median (lower centrality), and Columns (13)–(14) to those above it (higher centrality). All estimates include year fixed effects and municipality fixed effects. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

Table B.5: Difference-in-differences on newly-registered firms closed by 1937

	Dependent variable: number of firm registrations by municipality and year that closed by 1937													
			Railway connection				Altitude (median split)				Population (median split)			
	Full sample		No railway		Railway		Higher alt. places		Lower alt. places		Smaller places		Larger places	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Grisons × Post1925	0.1*		0.3**		0.1		0.2		0.1		0.2		0.1	
	(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)	
Grisons ×$y\_1925, 26$		0.2		0.3**		0.1		0.2		0.1		0.3*		0.1
		(0.1)		(0.1)		(0.1)		(0.2)		(0.1)		(0.2)		(0.1)
Grisons ×$y\_1927, 28$		0.0		0.0		0.0		0.1		-0.0		0.1		-0.1
		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)
Grisons ×$y\_1929, 30$		0.2**		0.4***		0.1		0.2*		0.2*		0.2		0.2**
		(0.1)		(0.1)		(0.1)		(0.1)		(0.1)		(0.2)		(0.1)
Observations	3740	3740	1969	1969	1771	1771	1848	1848	1892	1892	1826	1826	1914	1914
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep. Var.	0.3	0.3	0.2	0.2	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.5	0.5
Effect size (c/Mean D.V.)	0.4	0.5	1.4	1.8	0.2	0.2	0.5	0.7	0.2	0.3	1.2	1.8	0.2	0.2
No. of municipalities	340	340	179	179	161	161	168	168	172	172	166	166	174	174
Within R2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: The table reports the impact of the repeal of the car ban on the total number of newly-registered firms per 1,000 inhabitants in Grisons that had closed by 1937, the final year covered by the firms register, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using a difference-in-differences design. We present the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Centrality is proxied by railway connection, altitude, and population. The outcome is the number of firms registered in each municipality between 1920 and 1930 that are marked as closed (crossed out) by 1937 in the firms-register data of each canton. For both the full sample and each split, we report two sets of estimates. Columns (1), (3), (5), (7), (9), (11), and (13) pool the effect of the repeal over the entire 1925–1930 period. Columns (2), (4), (6), (8), (10), (12), and (14) replaces the pooled post-treatment effect with three distinct coefficients, obtained by interacting the repeal effect with indicators for the two-year periods 1925–1926, 1927–1928, and 1929–1930. Columns (1)–(2) present the full-sample baseline. Columns (3)–(4) restrict the sample to municipalities not crossed by the railway network (lower centrality). Columns (5)–(6) restrict to municipalities crossed by the railway (higher centrality). Columns (7)–(8) restrict to municipalities whose main-town altitude is above the canton-specific median (lower centrality), while Columns (9)–(10) restrict to those below the median (higher centrality). Columns (11)–(12) restrict to municipalities whose main-town population is below the canton-specific median (lower centrality), and Columns (13)–(14) to those above it (higher centrality). All estimates include year fixed effects and municipality fixed effects. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

Table B.6: Impact of the repeal of the car ban on municipal taxable income

Dependent variable: total taxable income by municipality and year														
			Railway connection				Altitude (median split)				Population (median split)			
	Full sample		No railway		Railway		Higher alt. places		Lower alt. places		Smaller places		Larger places	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Grisons × Post1925	157.5***		60.9***		199.1***		224.4**		27.3		73.9**		233.8**	
	(58.0)		(23.2)		(72.2)		(91.0)		(25.3)		(31.0)		(100.2)	
Grisons ×y_1928		139.6**		47.6**		183.0**		218.4**		-8.1		39.2		219.6**
		(59.4)		(23.9)		(77.2)		(93.7)		(32.2)		(27.0)		(107.1)
Grisons ×y_1930		192.8**		74.2***		239.1**		268.7**		30.2		75.7**		290.9**
		(74.8)		(27.9)		(91.8)		(114.2)		(28.0)		(37.4)		(130.0)
Grisons ×y_1933		144.8***		71.7***		178.0***		187.3***		71.4**		120.8***		195.7***
		(44.7)		(21.5)		(53.0)		(68.6)		(32.1)		(44.5)		(71.0)
Observations	2043	2043	1093	1093	950	950	1018	1018	1025	1025	1026	1026	1017	1017
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep. Var.	205.5	205.5	127.8	127.8	295.0	295.0	202.5	202.5	208.6	208.6	132.7	132.7	279.0	279.0
Effect size (c/Mean D.V.)	0.8	0.7	0.5	0.4	0.7	0.6	1.1	1.1	0.1	-0.0	0.6	0.3	0.8	0.8
No. of municipalities	349	349	184	184	165	165	174	174	175	175	175	175	174	174
Within R2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2

Notes: The table reports the impact of the repeal of the car ban on total municipal income in Grisons, compared with neighboring municipalities in Uri, Glarus, St. Gallen, and Ticino, using a difference-in-differences design. We present the full sample and several sample splits to assess heterogeneity between more central and more peripheral areas. Centrality is proxied by railway connection, altitude, and population. The outcome is municipal aggregated income, measured as taxable income from municipal taxation and fiscal revenue data, and observed in the years for which information is available (1913, 1918, 1920, 1923, 1928, 1930, and 1933). Centrality is proxied by railway connection, altitude, and population. For both the full sample and each split, we report two sets of estimates. Columns (1), (3), (5), (7), (9), (11), and (13) pool the effect of the repeal over the entire 1925–1930 period. Columns (2), (4), (6), (8), (10), (12), and (14) replaces the pooled post-treatment effect with three distinct coefficients, obtained by interacting the repeal effect with indicators for the years 1928, 1930, and 1933. Columns (1)–(2) present the full-sample baseline. Columns (3)–(4) restrict the sample to municipalities not crossed by the railway network (lower centrality). Columns (5)–(6) restrict to municipalities crossed by the railway (higher centrality). Columns (7)–(8) restrict to municipalities whose main-town altitude is above the canton-specific median (lower centrality), while Columns (9)–(10) restrict to those below the median (higher centrality). Columns (11)–(12) restrict to municipalities whose main-town population is below the canton-specific median (lower centrality), and Columns (13)–(14) to those above it (higher centrality). All estimates include year fixed effects, municipality fixed effects, and municipal population in 1920 (the baseline year) interacted with the year fixed effects.
$^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

Table B.7: NACE Categories, Firm Classifications, and Industrial Sectors

NACE category	**Firm classification**	**Industrial sector**
A	agriculture	Primary, extraction, and energy
	membership association	
B	mining	Primary, extraction, and energy
C	manufacture food	Manufacturing
	manufacture metals and machinery	Manufacturing
	manufacture other	Manufacturing
	manufacture textiles	Manufacturing
	manufacture wood	Manufacturing
	membership association	
D	utilities	Primary, extraction, and energy
E	waste management	Primary, extraction, and energy
F	installations	Construction
	construction	Construction
	membership association	
G	retail food	Retail
	retail mixed	Retail
	retail non-food	Retail
	wholesale and trade	Advanced services
H	transportation and logistics	Advanced services
	membership association	
I	hotellerie	Hospitality
	restaurant	Hospitality
	membership association	
J	communication and publishing	Advanced services
K	financial sector	Advanced services
	membership association	
L	real estate	Advanced services
M	professional services	Advanced services
N	agency	Advanced services
	tourism	Advanced services
	membership association	
O	public interest	Advanced services
P	education	Advanced services
	membership association	
Q	public interest	Advanced services
	membership association	
R	leisure and cultural	Advanced services
	membership association	
S	other services	Advanced services
	membership association	

Notes: The table maps NACE categories to the firm classifications used in the construction of the main dataset. These classifications constitute the baseline sectoral definition in the data and are further aggregated into the main industrial sectors employed in the paper.

Chapter 3

Colonialism, Cash Crops, and Women in Africa

3.1 Introduction

A consolidated body of literature connects agricultural systems implemented through history to persistent gender norms and women's status (Alesina et al., 2013; Voigtlander and Voth, 2013; Hansen et al., 2015; Michalopoulos et al., 2019; Papite, 2017; Baten et al., 2021; Cappelli and Baten, 2021; Becker, 2019). Africa offers a valuable setting for study this topic thanks to its diverse ethnic and anthropological heritage, its history of traumatic colonial contact, and how these factors may explain persisting inequalities across several dimensions, including gender norms.[1] Alesina et al. (2013), Michalopoulos et al. (2019), and Papite (2017) show how the interaction between geography and the prevalence of farming practices, pastoralism, and husbandry in preindustrial era has fostered male-favoring norms. For example, the use of ploughs advantaged men due to the physical strength required, reinforcing a gendered division of labor that marginalized women to domestic roles and reduced their status (Alesina et al., 2013, 2021).[2] Cappelli and Baten (2021) and Baten et al. (2021) instead explore educational gender inequality in pre- and post-colonial Africa, identifying factors including openness, agriculture, religion, colonial heritage, and family systems as determinants of this gender gap.

However, much of the existing literature treats the relationship between agriculture and gender norms as largely immutable, shaped by enduring factors including landscape, land suitability, and traditional farming systems. In contrast, this paper examines how a historically driven transformation in agricultural systems reshaped gender roles, with persistent effects on women's status today. Specifically, we study the shift from traditional subsistence farming to a cash- and market-based agricultural economy and its long-term consequences for women's empowerment. As a historical natural experiment, we leverage the introduction of the cash crop system under British colonial rule in Tropical Africa, which altered gendered divisions of labor in two opposing ways. While the colonial agricultural regime disproportionately favored African men - recognizing them as primary economic counterparts, breadwinners, and taxpayers - it simultaneously relied on the unpaid labor of women (Boserup, 1970; Etienne, 1977; Korieh, 2001). This setting allows us to assess the persistent impact of colonial cash crop production, through these conflicting dynamics, on gender norms and empowerment of present-day women in the region.

The historical and anthropological literature has long suggested that women's marginalization to domestic roles following the transition from a subsistence to a market- and cash-based economy harms their socio-economic status (Boserup, 1970; Rodney, 1972; Davison, 1988; Grier, 1992). Moreover, in addition to their duties in the domestic[3] and food crop production[4], women's workloads increased as they were needed to provide additional labor in their husbands'

[1] UN, Gender statistics: https://genderstats.un.org/#/indicators.

[2] Similarly, Dincecco et al. (2024) link patriarchal norms in India to historical warfare that privileged male physical power.

[3] Domestic production refers to all activities and services carried out within households for the benefit of household members, which are not directly sold on the market. It typically includes tasks such as cooking, cleaning, childcare, shopping, gardening, and household maintenance (International Monetary Fund et al., 2002).

[4] By food crop production, we refer to all remaining crops that are not classified as cash crops and are primarily oriented toward household subsistence. For further details, see Section 3.3.2.

cash crops. However, the impact of cash crop agriculture on women's empowerment and gender norms remains ambiguous when examined through the lens of contemporary economic literature.

On one hand, in line with the arguments in Alesina et al. (2013), Hansen et al. (2015) and Alesina et al. (2021), specialization in cash crops and the imposition of European norms may have reinforced male dominance in society, especially where a patriarchal foundation already existed. Furthermore, higher agricultural productivity and higher income within families could elevate the husband's role as the primary breadwinner, pushing women more toward childcare and domestic work (Goldin, 1995). On the other hand, recent empirical literature on the determinants of gender inequality suggests that increased female labor participation, even if non-remunerated, can lead to persistently better outcomes for women (Atkin, 2009; Kagy, 2014; Majlesi, 2016; Teso, 2018; Heath and Tan, 2020; Molina and Tanaka, 2023).[5] In line with this literature, cash crop agriculture may have increased women's empowerment by relying increasingly on their labor, both in domestic and agricultural production, to meet colonial demand. Greater involvement can lead to higher social visibility and stronger bargaining power within households, persistently reshaping social norms and women's status across generations.

As we cannot directly test the historical dynamics of the cash crop economy and empowerment of women due to a lack of consistent, granular micro data, we test current persistence of the effects of such an economy across generations. We build a dataset linking three main sets of information and historical sources. First, we obtain outcome variables capturing empowerment of women from various editions of the Demographic and Health Survey - the DHS - (from 2000 to 2019) in the former British colonies in tropical Africa. We construct two indicators: a *Beating Free Index* and a *Decision Index*. The former measures women's attitude toward rejecting rather than justifying a partner's violent behavior, while the latter assesses women's decision-making power within the household. The choice of these two indicators aims to test women's empowerment in terms of status and self-perception, which can potentially be translated into tangible social outcomes beyond the household dimension. Second, the intensity of cash crop export production, our "treatment", is taken from a map in Hance et al. (1961) and digitized by Baten et al. (2021).[6] We measure our treatment at the level of colonial districts, combining cash-crop production from Hance et al. (1961) with the administrative boundaries of British colonial rule, obtained through the digitization of historical maps. Third, we use ethnicity information provided in Murdock's (1967) Ethnographic Atlas, to match current data on women with their ancestral involvement in the cash crop economy and to take into account migration concerns.

We restrict our analysis to the British colonies in tropical Africa after 1919, as this ensures more homogeneity on how the treatment is applied at the colonial administrative level. We then compare the current status of women whose ancestors lived in colonial districts with higher cash crop intensity with women whose ancestors lived in districts less (or not at all)

[5]Additionally, Goldin (1995) and Baten et al. (2021) highlight a U-shaped trend in the educational gender gap and women's social roles as a function of the development trajectory of a country or region. Initial setbacks in the educational gender gap have been followed by improvements, with greater freedom and educational opportunities for women as household income increases above subsistence levels.

[6]We are deeply grateful to Michiel de Haas for generously sharing these data.

involved in cash crop agriculture. A central empirical challenge is represented by the possible endogeneity of cash crop production to unobserved characteristics of local populations. For this reason, we create a measure of cash crop suitability using the FAO-GAEZ land suitability indexes and instrument actual cash crop production with our suitability measure.

We find that women whose ancestors lived in districts with higher cash crop intensity exhibit higher contemporary levels of empowerment, supporting the hypothesis that cash crop production enhanced women's empowerment through their involvement in both domestic and agricultural work. An increase of one standard deviation in cash crop production, the *Beating Free Index* increases by approximately 0.32 standard deviations, and the *Decision Index* increases by 0.50 standard deviations. We verify our results through an extensive set of robustness checks, including the addition of potential competing economic, ethnic, and historical explanations and dimensions to our specifications, as well as the use of alternative outcome variables.

We analyze possible mechanisms that can help to shed light on the positive relationship between cash crop production and women's status. First, we study the channel of intergenerational transmission of culture. By exploiting the patterns of women's migration away from their ancestral lands, we compare women currently living in similar settings but belonging to ethnic groups with historically different degrees of involvement in cash crop agriculture. We show that the effects of cash crop intensity persist regardless of the respondents' current place of residence. This suggests that women's empowerment is transmitted through norms rooted in the family, ethnic group, and immediate social network, rather than being driven by the surrounding social environment or local labor market opportunities.

Second, we test whether empowerment of women is shaped by the interaction between cash crops intensity and women's pre-colonial presence in agriculture in the form of hoe-farming (Baten et al., 2021). This allows us to more precisely capture the relationship between involvement in agricultural labor and women's status. We find that introduction of cash crops has a greater effect on women's empowerment in areas where women were not previously involved in agriculture, in line with our findings that cash crop-induced participation of women in this type of labor acted as a significant shock in their traditional role.

Finally, we explore whether our results are driven by specific cash crops, leveraging the fact that Hance et al. (1961) provides the precise spatial position of cash-crop production, and that different crops may require varying degrees and types of women's involvement. We find that cocoa and palm oil are the two crops that drive our results. According to historical literature (Grier, 1992; Austin, 2014), the production of these crops were particularly labor intensive for women, further supporting the hypothesis that female labor and involvement in cash crop production leads to persistent empowerment.

While few studies have examined the impact of cash crops on various dimensions of economic development, there are some notable contributions. Roessler et al. (2022), for example, connect cash crops to ethnic group identity and their boundary formation. They argue that the shift to commercially-oriented agriculture empowered ethnic groups endowed with cash crops by enhancing their mobilization capacity and reinforcing descent-based property rights. Similarly, Muller-Crepon (2020) investigates how cash crops interact with the direct or indirect colonial type of governance to influence provision of public services, particularly

education. Finally, Pengl et al. (2022) link cash crops and cash crop exports to urbanization, economic agglomeration, and geographical imbalances, showing that the development of cash crop-intensive areas often came at the expense of surrounding regions. To our knowledge, this paper is the first to explore the connection between cash crops, colonial rule, and gender norms governing intra-household dynamics and labor specialization.

By examining the introduction of cash crop production in African colonies as a historical shock, our paper also contributes to the literature that uses natural experiments to empirically investigate the determinants of economic development. This literature suggests that historical shocks can reshape gender roles - especially those of women - and influence their transmission over time as social norms and beliefs. For instance, the transatlantic slave trade has been shown to affect contemporary female labor force participation (Teso, 2018) and the acceptability of polygyny (Edlund and Ku, 2011; Dalton and Leung, 2014). Studies including Acemoglu et al. (2004), Fernández et al. (2004), and Goldin and Olivetti (2013) demonstrate that higher rates of male mobilization during World War II had a positive and lasting impact on the participation of women in the labor force in the United States. Becker and Woessmann (2008) examine the long-term effects of the Protestant Reformation, showing a reduction in the gender gap in basic education and literacy. Similarly, Campa and Serafinelli (2019) document the emergence of more equal gender-role attitudes in state-socialist regimes. Xue (2018) finds that premodern cotton textile production is systematically correlated with more progressive gender norms and daughter preference. Grosjean and Khattar (2018) exploits the fact that, by the late eighteenth century, far more male than female convicts were sent to Australia, finding worse cultural attitudes and lower female labour supply in areas with historically more male-biased sex ratios. We contribute to this literature by examining how the introduction of cash crops in Africa, as another major structural shift, impacted gender norms and women's empowerment.

Lastly, this paper contributes to the debate on colonialism and women's status, which spans different fields including economic history, history, and anthropology. A major stream of research linking colonialism and gender norms looks at the role played by Christian mission education. Among others, Boserup (1970), Rodney (1972), and Akyeampong and Fofack (2014) suggest that Christian mission schools provided gender-biased education, reflecting the typical Western view of the domestic role of women, disproportionally teaching males the types of knowledge that are useful for participation in the modern colonial economy and leading to large gender gaps in education (Nunn, 2014; Meier zu Selhausen and Weisdorf, 2016; De Haas and Frankema, 2018). Other studies have additionally argued that a channel through which colonialism affected women's status is the decline in land control and use-rights of women. This process takes various forms. It can be institutionalised, as in Rhodesia with the Native Land Husbandry Act of 1951, which gave male heads of household individual, rather than lineage, rights to land (Peters and Peters, 1998). Alternatively, it could occur as a consequence of land becoming scarce and hence more expensive, making it less affordable to African women (Sheldon, 2017). We contribute to this research by providing the first quantitative test of the prominent cash crop hypothesis, complementing the evidence based on qualitative methods from the anthropology and historical literature. We do so by exploiting geographical, within-country variations in cash crop production, using variation in soil suitability for cash crops for identification, large-scale representative surveys of country populations, and

extensive historical data to control for different possible explanations of our results.

The remainder of the paper is structured as follows: in Section 3.2 we outline the history of cash crop introduction in British Colonial Africa and introduce the debate on the relationship between cash crops and women's empowerment. In Section 3.3, we describe the data used and present descriptive statistics. Section 3.4 details the main empirical strategy and underlying assumptions, providing evidence on how these are satisfied within the empirical framework. In sections 3.5 and 3.6 we examine the relationship between cash crops and present-day women's empowerment, and assess the robustness of the empirical analysis. In Section 3.7, we explore the main channels through which cash crops influence women's empowerment. Section 3.8 concludes.

3.2 Historical Setting

3.2.1 Cash Crops and Colonisation

Cash crops are grown mainly for export markets, in contrast to food crops, which are used for subsistence and are only occasionally sold for cash (Klein, 1980; Hart et al., 1982; Bates, 1983). With the exception of a few native cash crops including palm oil and kola, the introduction of the first cash crops in Africa and the resulting emergence of mass-export agriculture began in the nineteenth century, before the European Scramble for Africa, primarily along the coasts. During colonial rule, agricultural-export economies expanded and incorporated the fertile hinterlands (Austin, 2009) under the pressure of colonial administrations, which encouraged market-oriented crop production by both persuasion and coercion (Usoro, 1977; Ochonu, 2018).

As cash crops were frequently foreign in origin, they typically served a purely economic purpose and lacked social meaning, particularly in kinship contexts.[7] In contrast, food crops often carried social significance - for example, in ceremonial contexts - and held varied meanings across different local settings. Thus, the lack of social meaning facilitated gender and social separation of agricultural tasks when new crops were introduced Linares (1985).

3.2.2 Cash crops and British Colonial Rule

English colonial administrations followed a system of indirect rule, meaning colonial rulers did not have direct control over many aspects of colonies' economies. Instead, they co-opted local tribal elites into their system of power, leveraging these elites' greater knowledge of the territory and control over local resources. British district officers, responsible for managing a single colonial district, played a significant role in the British administrative system and,

[7]For instance, cotton was introduced to Ghana by the British administration from 1903 (Meier zu Selhausen, 2015); Groundnuts were introduced to Senegal by the French (Linares, 1985); Cocoa was introduced to Ghana by British missionaries in the 1860s (Hill, 1963) and to the Ivory Coast by the French in 1910 (Ruf, 1995); Tobacco was introduced to South Africa by Jehovah's Witnesses at the beginning of the twentieth century (Coquery-Vidrovitch, 1997).

indirectly, in the management of cash crop production. District officers were ultimately responsible for district administration, including its costs, and for generating revenue through taxation. As a result, they often acted as mediators between local elites, who extracted resources through taxation, and the British authorities in England, reporting on the district's economic and financial status (Frankema, 2011). Consequently, where suitable, cash crop production was directly encouraged by both local elites and colonial officers as an important component of exports that were easy to sell on the markets (Usoro, 1977; Ochonu, 2018).

3.2.3 Cash Crops and Gender Norms

According to a substantial body of historical and anthropological literature, women's exclusion from the growing colonial cash economy had a negative and persistent effect on their status. Their marginalization can be seen as the outcome of few combined forces.

Colonial states introduced monetization in Africa in the form of monetary wage payments and monetary tax collection.[8] In parallel, a tax system was introduced, primarily aimed to make colonies financially self-sufficient. Colonial officials created either a flat-rate hut tax on African dwellings or a poll tax paid mostly by African men.[9] This tax system considered the man as head-of-household by default, and therefore solely responsible for all household tax payments, imposing the coloniser's idealized notion of women's dependent status on men (Sheldon, 2017; Byfield, 2018). This was based on the European model of the time, in which the husband and father was considered the head of the household and responsible for paying taxes, and for other interactions with the state (Sheldon, 2017).

Although households were not formally obliged to cultivate cash crops, the fiscal pressure of the newly introduced tax system indirectly compelled farmers and households to market their agricultural output, thereby maximizing cash crop production (Bryceson, 1990; Mandala, 1990; Wrigley, 1959). While these crops assumed a monetary value, men quickly assumed control over their production, the land used for their cultivation, and especially over the resulting profits. This process was the result of two forces. First, due to the patriarchal assumption regarding the appropriate role of women, colonial officials dictated agricultural development policies that enabled men to dominate the cultivation of cash crops for the international market (Korieh, 2001), and only recognised them as counterparts in their transactions (Hailey and Hailey, 1957). Second, as the primary target of taxation, men had to acquire cash, which tended to justify and reinforce their control over cash crops (Etienne, 1977), and lead to exclusion of women from the cash economy. Boserup (1970) argues that European settlers and colonial administrators neglected the female agricultural labor force

[8] Rudimentary currencies were already used throughout the continent, however, colonial states outlawed pre-colonial standards of value and currencies such as manilla, cowrie shells, metal bars, cloth, and others, in favour of unified official currencies within sovereign states and their colonies and protectorates (Ochonu, 2018).

[9] In the vast majority of cases, taxes were imposed on African dwellings or men. As the imposition of taxation was heterogeneous across and within countries, there were exceptions. For instance, the colonial government in Nigeria initially imposed taxation on African women as well, however, after the Abeokuta Women's Revolt in the 1940s, women were excluded from taxation. Likewise, women in Kenya were subject to taxation (Gardner, 2012). In Ghana, direct taxation was not imposed until the 1950s (Sederberg, 1971; Frankema and van Waijenburg, 2013).

when they introduced modern commercial agriculture, and promoted the productivity of male labor.

However, the virtually complete exclusion of women from taxation did not imply their exclusion from the work involved in cash crop production. In most cases, women continued to work alongside their husbands to produce valuable crops. This was generally considered an extension of domestic chores, while the husband became the owner of the land and made a profit from farming (Etienne, 1977; Guyer, 1980; Davison, 1988; Grier, 1992; Coquery-Vidrovitch, 1997). Cash crop production required additional labor from women, as they also continued to play a critical role in subsistence agriculture, from which men largely withdrew. Although essential, mediated by cash and the capitalist commodity economy, women's labor became less visible and largely unremunerated (Etienne, 1977; Byfield, 2018).

The contradiction of formally excluding women while relying on their labor may have gradually created conditions that supported greater women's empowerment. Contemporary economic literature and empirical evidence on the determinants of gender inequality would suggest that increased female labor may lead to better outcomes for women (Atkin, 2009; Kagy, 2014; Majlesi, 2016; Teso, 2018; Heath and Tan, 2020; Molina and Tanaka, 2023). For example, Teso (2018) shows that the shortage of African men in areas more severely affected by the Transatlantic slave trade pushed more women into the labor force, substituting missing men in new areas of work. He finds positive long-term effects on both current labor participation and attitudes toward women. Reflecting the inverse relationship, Alesina et al. (2013) show that descendants of societies that traditionally practiced plough agriculture, where men had a physical advantage in farming and women were therefore less involved in agricultural work, today have less equal gender norms, and fewer female participation in the workplace, politics, and entrepreneurial activities. Hansen et al. (2015) find that societies with long agricultural histories exhibit greater dissimilarity in gender roles and more patriarchal values and beliefs as their higher technological advancement led to higher fertility and reduced women's roles outside the home in a Malthusian context.

3.3 Description of Data

This paper utilizes a cross-sectional dataset comprised of approximately 161,700 individual-level observations from present-day Africa. The dataset covers the former British colonies in tropical Africa after 1919, specifically Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Tanzania, and Uganda. The dataset links several sets of information: individual-level indicators of contemporary women's empowerment; each individual's ethnic ancestry; colonial-era cash crop production in their ancestral district; and a broad set of control variables at the individual, ethnic, and district levels. These controls account for competing social, economic, historical, geographical and environmental factors that could confound the relationship between colonial agriculture and the persistence in gender norms. This section outlines the data sources and processes used to construct the main variables and Table 3.1 provides useful summary statistics.

[Table 3.1 about here]

3.3.1 Empowerment of Women

The main outcome variables are derived from the data collected by the Demographic and Health Survey (DHS) program.[10] We use all available rounds from 2000 to 2019 for the many ex-British colonies where additional indicators on women's status and empowerment were included in the surveys.[11] The DHS data were collected using a stratified two-stage cluster design intended to provide a representative sample of women aged 15-49 at national and state levels. We construct two main outcome variables capturing women's empowerment, which we refer to as the *Beating Free Index (BFI)* and the *Decision Index (DI)*.

The *BFI* is the share of questions on attitudes towards domestic violence for which a woman responds that a husband is not justified to beat his wife.[12] A higher value on this index means that women do not justify husband's violence or beating in a larger set of circumstances, a behavior we use as proxy for empowerment. Those circumstances are: if she argues with the partner, if she burns food, if she goes out without telling the partner, if she refuses to have sex, and if she neglects the children.[13]

The *DI* is constructed in a similar way and provides information on whether women report having some say in different domestic domains.[14] Questions include decisions regarding major household purchases, household purchases for daily needs, visits to family or relatives, how her earnings are used, how her partner's earnings are used, her own health care, children's healthcare, and what food to be cooked each day. The possible answers to these questions are: woman alone, woman and husband/partner, woman and someone else, husband/partner, someone else. We classify the first three answers as proxies for women's empowerment and construct the index as the share of those circumstances for which women have at least some decision power.[15]

We primarily focus on the *Beating Free* and *Decision* indices as they can provides insights into an intrinsic dimensions of female empowerment that is not endogenous to market forces and, therefore, capture an uncontaminated measure of status. The first two rows of Table 3.1 show that, on average, women do not justify violence toward them from their husband in three scenarios out of four, and have some decision power over just half of household-related business.[16]

[10]Hereafter, the Demographic and Health Survey program is referred to as DHS.

[11]DHS survey rounds we use for the main results are the following: Ghana 2003, 2008, 2014; Kenya 2003, 2008-09, 2014; Malawi 2000, 2004, 2010, 2016; Nigeria 2003, 2008, 2013, 2018; Sierra Leone 2008, 2013, 2019; Tanzania 2010, 2015; Uganda 2011, 2016.

[12]Similar indices can be found, for example, in Alesina et al. (2021), Leyaro et al. (2017) and Teso (2018).

[13]Because surveys can be different across countries, not all women are asked the same questions; moreover, even when asked, women can decide not to respond; thus, our index should be interpreted as the share of instances for which the respondent answers that beating is not justified among the questions with non-missing information, conditionally on a specific set of questions being asked.

[14]Decision making power has been widely employed in the literature to measure women's empowerment, as reviewed in Duflo (2012).

[15]As for the *BFI*, missing information is excluded from the construction of the index, and different countries are subject to variation in the questions asked.

[16]Throughout the empirical analysis, we have normalized both indices based on the empirical distribution of individual respondents.

To further explore mechanisms, we also look at more widely used variables to infer women's status, including years of education and labor force participation. While in some cases these may be measurable with more precision than our preferred outcomes, they should not be interpreted as pure indicators of empowerment, because they are also determined by different market forces and other variables such as poverty and economic security. The women in our sample, as shown in rows three and four of Table 3.1, have on average 5 years of education and the majority are currently working.[17]

For our analysis, it is also important to retrieve information about women's ancestors pre-colonial status. To this end, we use information on ancestral anthropological and cultural practices of women's ethnic groups taken from Murdock's (1967) Ethnographic Atlas. The Ethnographic Atlas is an ethnicity-level database with pre-colonial information for more than 1,200 ethnic groups worldwide. To control for women's empowerment during pre-colonial times, we use many of the same variables that the previous economic and anthropological literature has used regarding women's status or value. We use data on bride price customs, practice of polygyny, the descent system of matriliny, and whether agriculture was the main subsistence source for an ethnicity's economy.[18] Bride price can be considered to capture an implicit economic value of women following arguments articulated in Boserup (1970), Goody (1973), Becker (1981), and Alesina et al. (2021); Polygyny is a practice that generally correlates negatively with female bargaining power (Tertilt, 2005; Doepke et al., 2012) because having more than one wife customarily indicates less progressive attitudes and a lower consideration of women's status (Alesina et al., 2021); Matrilineal systems of descent are associated with a higher status of women in different sources including Guyer (1980), Grier (1992), Henderson and Whatley (2014), Sheldon (2017); Agriculture as main subsistence activity can reflect a higher status of women, as discussed in Alesina et al. (2021), because, in economies based on agriculture, especially without the plough, as in nearly all of Africa, women could participate more in the labor force and develop a more equal status in society and in the family.[19]

The link between DHS respondents to their ancestors' ethnic groups in the Ethnographic Atlas is complicated by the tendency of ethnicities' to have different names across space and time. To address this empirical challenge, we use different sources: the Ethnologue, a catalogue of more than 6,700 languages spoken in 228 countries, the Joshua Project, an online directory of more than 10,000 ethnic groups, and the Ethnohistorical Dictionary, a book with information on more than 1,800 different ethnic societies.[20] These sources provide alternative names for ethnicities and specify links among societies (based on location or supergroup), that make it possible to connect distinct names in the DHS surveys and the Ethnographic Atlas. When we find no match, we use pre-existing matches from two datasets provided by

[17]Labor Force Participation is a dummy variable taking value one if the respondent was officially employed in the twelve months prior to the survey.

[18]Appendix A lists how we code these variables starting from the original variables in the Ethnographic Atlas.

[19]Alesina et al. (2013) relate prevailing gender norms to aboriginal use of plough and find strong evidences that descendants of societies that traditionally practised plough agriculture today have less equal gender norms. However, there is no society in our sample which practised plough agriculture before colonial times, reflecting the general trend for African societies present in Murdock's Atlas.

[20]Ethnologue: https://www.ethnologue.com; Joshua Project: https://joshuaproject.net; Ethnohistorical Dictionary: Olson (1996).

Nunn and Wantchekon (2011) and Fenske (2014). To fill a small remaining gap we checked further online sources for possible matches.

3.3.2 Colonial Agricultural Production and Production Suitability

We measure cash crop production under British rule at the administrative district level. We focus on the colonial district as the unit of analysis, because the interaction between cash crop production and the colonial administration can also indirectly capture resource extraction by the colonial district officers and the local elites. We digitized the colonial system of districts by country using historical maps and administration reports resulting in a sample of districts as in Figure B.1.[21]

As an indicator of colonial cash crop production - the main treatment of our analysis - we use the cash crop export volume per colonial district weighted by the area of the respective district. Row five of Table 3.1 shows the descriptive statistics about cash crop production. On average, for every 1,000 km^2, there is one unit of exported cash crop, corresponding to \$289,270 or 0.01% of tropical Africa's exports. We follow Roessler et al. (2022), De Haas and Travieso (2022) and Baten et al. (2021) and use data on cash crop export production and its spatial distribution in tropical Africa from a map in Hance et al. (1961). The map contains 95% of exports from 38 countries in Sub-Saharan Africa in 1957 classified into 12 categories of agricultural products. As noted above, the advantage of the Hance et al. (1961) map is that it represents colonial production with spatially located dots of equal value. This standardization allows for precise identification of the geographical location of colonial production and enables comparisons across different regions, as each dot represents a standardized unit of measure for the quantity exported.

As is often done in the literature, we consider the following products to be cash crops: cocoa, coffee, cotton, groundnuts, and palm oil. We cannot include coconut/copra and tobacco in our list as they do not have a dedicated category in the Hance et al. (1961) data. Instead, tobacco is included in the supra-category "other stimulants and spices" together with tea, cloves, khat, and chilies. Similarly, coconut/copra is included in the supra-category "other oils" together with coconut, cashew, castor, beniseed, and other oils. In the appendix (Tables C.2 and C.7), we verify the robustness of our results by adding "other stimulants and spices", "other oils" and both combined with the cash crop count. Figure 3.1a displays the spatial distribution of cash crop production location used in our analysis, where we first plot all crops together. Figures 3.1b to 3.1f show the geographical distribution of each crop separately. In Section 3.7.5, we construct individual measures of cash crop production to explore the effect

[21] District borders are retrieved from historical administrative maps. For Ghana, we use the administrative borders from 1930 as reported in the "Administration Report 1930" (National Archives CO98/55,58); for Kenya we use administrative borders from 1931 as reported in the "Administration Report 1931" (National Archives CO544/33,34); for Nigeria district level data are not available, we use province borders are retrieved from Falola and Heaton (2008); for Malawi we use administrative borders from 1928 as reported in the "Administration Report 1933" (National Archives CO626/12); for Sierra Leone we use Abraham (1978) (National Archives CO657/6); for Tanzania we use administrative borders from 1933 reported in Berry (1971); for Uganda we use administrative borders from 1950 as reported in the "Administration Report 1948" (National Archives CO685/31).

of each crop separately.

[Figure 3.1 about here]

Cash crop Suitability We use data on terrain suitability for the cultivation of different crops to provide a source of exogenous geographic variation in colonial cash crop agriculture.[22] Data on suitability are provided by the Global Agro-Ecological Zones (GAEZ) project from the Food and Agriculture Organization (FAO).[23] The FAO-GAEZ data provide global estimates of land suitability for different crops (potential yield - kg/ha) within cells of approximately fifty-six kilometres by fifty-six kilometres, based on land and climate characteristics, and assuming various levels of water supply and input use. To closely mimic historical land conditions and agriculture during colonial rule, we use variables constructed under the assumption that cultivation occurs under rain-fed conditions and low input intensity. As with cash crop production, we average grid-cell-level suitability data at the colonial district level.

3.3.3 Other Data

We collect additional data from various sources to control for further characteristics of colonial districts and ethnicities. For ethnic ancestral homelands, we retrieve information on log-distance from rivers and the coast from the Natural Earth dataset, log-distance from the closest railway track using maps available in Jedwab and Moradi (2016), and on the number of slaves involved in both the Transatlantic and the Indian slave trade using data from Nunn and Wantchekon (2011). At the colonial district level, we combine a host of historical data: on population density in 1930 from the Historical Database of the Global Environment (HYDE); on the historical rule of Islam by geocoding a 1918 map of the geographic distribution of religions in Africa from Bartholomew and Brooke (1918); on conflicts occurring before colonization between 1400 and 1700 from Brecke (1999); on vegetation zones using White's (1983) map; on the distance to the closest Christian missions from Becker and Meier zu Selhausen (2023);[24] on soil ruggedness using Nunn and Puga's (2012) data; on the presence of diamond mines from Lujala et al.'s (2005) DIADATA dataset; and on the suitability for

[22]We use all crops available in the FAO-GAEZ database and divide them in two categories: cash crops (cocoa, coffee, cotton, groundnuts, and palm oil) and all remaining as food crops (banana, cassava, foxtail and pearl millet, maize, phaseolus beans, dry and wet rice, sorghum, sweet and white potato, sugar beet, sugar cane, wheat).

[23]http://www.fao.org/nr/gaez.

[24]Jedwab et al. (2018) also highlight the challenges of relying on historical mission data, noting severe under-reporting in commonly used sources. For instance, Beach (1903) lists only 26 missions in Ghana in 1900, and Roome (1925) lists 23 in 1924, while Jedwab et al. (2018) identify 304 and 1,213 missions, respectively, during those same periods. Our analysis relies on the dataset compiled by Becker and Meier zu Selhausen (2023), which combines information from Beach and Fahs (1925) for Protestant missions (1,659 missions) and Streit (1929) for Catholic missions (770 missions). Given these figures, the map from Becker and Meier zu Selhausen (2023) represents an improvement over the data provided by Roome (1925), which lists 933 Protestant and 361 Catholic missions. We are deeply grateful to Bastian Becker for generously sharing these data. While the dataset we use marks a substantial advancement in coverage and accuracy, some of the concerns raised above may still apply. Nonetheless, we assume that it adequately captures the most significant mission establishments relevant to our analysis.

malaria and tsetse flies, using Cervellati et al. (2017) and Alsan (2015), respectively. We use the general land suitability index developed by Ramankutty et al. (2002) as a measure of land quality. Finally, we account for geographic heterogeneity in the gender division of labor in hoe-based agriculture across Sub-Saharan Africa prior to colonization, using a map from Baumann (1928), digitized by Baten et al. (2021).[25] A full list of all variables used in the analysis along with detailed information on sources can be found in appendix A.

3.4 Empirical Strategy

To measure the persistent effect of colonial cash crop production on current-day women's status we estimate the following equation:

$$Y_{ised} = \alpha + \beta CCP_d + \gamma I_{ised} + \delta E_e + \zeta D_d + \eta_s + \varepsilon_{ised} \tag{3.1}$$

where Y_{ised} is women's empowerment status, measured either through the *BFI* or the *DI* for individual i surveyed in DHS round s (combining together country and year), of ethnicity e, and with ancestors living in district d; CCP_d denotes intensity in cash crop production in the ancestral colonial district; I_{ised}, E_e, D_d are, respectively, contemporary individual level controls, ethnicity level controls, and ancestral district level controls. Furthermore, we include DHS country-wave fixed effects η_s. Standard errors throughout the analysis are robust and clustered at ethnicity level.[26]

Estimating equation 3.1 using OLS would, however, not allow for a causal interpretation of β. Ethnicities more likely to engage with Europeans in cash crop agriculture could, for instance, also be those with particularly regressive gender norms, matching those of the colonizers. On the other hand, ethnicities with more inclusive gender norms could be more open to cooperation with colonizers. In either case, OLS estimates of β would be biased. Another potential concern is that the data on colonial cash crop production is derived from historical sources. This might generate measurement error that could bias OLS estimates towards zero. To deal with these concerns, we use the relative suitability of land for cash crops compared to food crops as an instrument for colonial cash crop agriculture. Using land suitability as a measure or instrument for agricultural production is well established in the literature. Seminal contributions include Nunn and Qian (2011), who instrument Old World population growth, interacting potato suitability with the timing of introduction, and Alesina et al. (2013), who instrument traditional plough use with the differential suitability of land for plough-conducive crops. Studies based on land suitability have since been extended across a wide range of settings. Michalopoulos (2012) uses variation in land quality to instrument for ethnolinguistic diversity; Galor et al. (2009) instrument landownership inequality with land quality in US cross-state data; Galor and Özak (2016) exploit agro-climatic suitability from the Columbian Exchange to instrument for time preferences; Fenske (2013, 2014) uses agricultural suitability to study African institutions and pre-colonial state formation; and Bruhn and Gallego (2012) use suitability for plantation crops to identify colonial economic

[25] We are deeply grateful to Michiel de Haas for generously sharing these data.

[26] In Table C.8 of appendix C, we show that the main results are robust using standard errors adjusted for two-way clustering within ethnic group and district of origin.

activity types in the Americas. More recent work using cash crop suitability specifically includes Acharya et al. (2016), Baiardi (2025), and Masera and Rosenberg (2025), who use land suitability for cotton to study the long-run effects of slavery in the US, and Michalopoulos et al. (2019), who instrument ancestral agricultural practices with land suitability to study individual economic outcomes in Sub-Saharan Africa.

In our paper, we take the ratio of average suitability for all cash crops over average suitability for all cash and food crops at the colonial district level ($SuitCC$) and estimate the first stage as:

$$CCP_d = \theta_0 + \theta_1 SuitCC_d + \theta_2 I_{ised} + \theta_3 E_e + \theta_4 D_d + \iota_s + \upsilon_{ised} \tag{3.2}$$

The key identifying assumption to satisfy the exclusion restriction is that the instrument is uncorrelated with the error term in equation 3.1, ε_{ised}. That is, suitability for cash crops should predict contemporary women's empowerment only via the channel of agricultural production. To this end, in equation 3.1 we explicitly control for a rich set of other possible ways that cash crops can be correlated with the outcomes of interest. Importantly, in one of our specification, we control for pre-colonial women's status, which could have a direct effect on women's current status in society, by controlling at the ethnicity-level for the custom of bride price, the practice of polygyny, the descent system of matriliny, and the dependence of an ethnicity on agriculture as main form of subsistence, during the pre-colonial period. Furthermore, Table C.1 shows that relative land suitability for cash crops is not systematically correlated with pre-colonial empowerment under these measures.

For the two-stage least squares estimates to identify causal estimates, the instrument also needs to be a good predictor of colonial cash crop production. We report the Kleibergen-Paap F-statistic in each regression table to assess the strength of the suitability for cash crops as instrumental variable.

3.5 Results

3.5.1 Baseline Model

In panel A of Table 3.2, we present the baseline estimation results, examining the relationship between the intensity of cash crop production in colonial districts and the BFI, measuring the extent to which female respondents do not find violence or beating by a partner acceptable. Columns 1 and 2 employ a simple OLS approach to estimate the coefficients. In column 1, we use a parsimonious model, regressing the BFI directly on our measure of cash crop intensity. Column 2 introduces a control for the survey wave, represented as a categorical variable accounting for factors specific to the country and the year in which a survey was conducted. In both specifications, the coefficients are positive and statistically significant. When translated into standardized coefficients, a one-standard-deviation increase in cash crop intensity corresponds to an increase in the BFI by 0.11 and 0.18 standard deviations in columns 1 and 2, respectively. These results suggest that women with ancestors from districts with higher colonial-era cash crop production are less likely to justify instances of spousal violence.

Columns 3 and 4 explore the relationship between cash crops and women's empowerment using a 2SLS framework, employing relative suitability for cash crops as an instrument for cash crops intensity. Column 3 includes controls for survey-wave only, while column 4 adds baseline controls for district area, land quality (Ramankutty et al., 2002), ruggedness of terrain (Nunn and Puga, 2012), and the average population density in 1930 within each district. These controls verify the robustness of the results by accounting for district-level heterogeneity in demographic trends and suitability for civil and agricultural development. Land quality reflects the constraints on agricultural and resource productivity that shape the behavior of economic actors (Fenske, 2014), including households and tribal or colonial authorities.[27]

The coefficients for columns 3 and 4 remain positive and robust: these results correspond to standardized increases in the BFI of 0.35 in column 3 and of 0.32 in column 4 per one-standard-deviation increase in cash crop production. In Table 3.2, panel B, we turn to analyze how cash crop intensity in colonial districts influences the decision-making power of women descended from these regions. We employ standard OLS in the first two columns and 2SLS in the last two columns. The results are very consistent with the findings for the BFI, both in terms of significance and of magnitude. In the most demanding specification of column 4, we find that a one standard deviation increase in cash crop production leads to an increase of approximately 0.49 standard deviations in women's household decision-making power.

[Table 3.2 about here]

3.6 Robustness

In the following paragraphs, we assess the robustness of our findings by introducing various competing variables and exploring dimensions that could provide alternative explanations or account for sample heterogeneity at the colonial-district, ethnic, or individual levels. We use the specification from column 4 of Table 3.2 as our main baseline as it addresses endogeneity in the treatment-outcome relationship while controlling for key demographic trends and factors related to agricultural and civil suitability, including district area, land quality, ruggedness of terrain, and population density in 1930.

3.6.1 Potential Competing Dimensions: Economic-level

In Table 3.3, we test the robustness of our results by incorporating controls for economic-level factors into the baseline specification. These controls address alternative economic

[27] Potential implications for women's status are mixed. On the one hand, high agricultural output and surplus may reinforce male-favoring gender norms by promoting specialization in market and defense roles, which are traditionally dominated by men. On the other hand, a high surplus could increase labor demand and strengthen women's roles, as colonizers intensified extraction and placed greater burdens on the local population, increasing women's involvement in the process. Ruggedness of terrain, often used to measure topographic relief, also serves as a proxy for natural protection from external threats (Dincecco et al., 2024; Nunn and Puga, 2012) and geographical isolation (Michalopoulos et al., 2019; Voigtlander and Voth, 2012). In both cases, ruggedness of terrain is positively associated with women's status, as more isolated communities may limit household specialization, indirectly mitigating gender-biased norms.

explanations that can compete with cash crop intensity in influencing women's decision-making power and their rejection of abusive partner behavior.

[Table 3.3 about here]

Diamond Mines In column 1 we control for the number of diamond mines per km^2 in each district. The presence of diamond mines can increase the risk of ethnic and civil war onset (Lujala et al., 2005), as they can provide resources to finance insurgent groups. More generally, the presence of diamond mines serves as a proxy for the proximity to resource deposits, which, like diamonds, might elevate the risk of intrastate and interstate wars and encourage extractive behavior by governments or ruling elites (Robinson et al., 2006). The presence of diamonds mines may therefore negatively affect women's empowerment: according to Dincecco et al. (2024), conflict environments can strengthen the position of males due to their comparatively greater physical strength. Diamonds could further reinforce the power of rulers or local elites, entrenching hierarchical social structures and perpetuating existing gender-biased norms. Despite these dynamics, the results remain positive and significant for both the BFI and the DI, with coefficients of approximately 0.36 and 0.51, respectively.

Distance from Water In column 2 we account for the log-distance from water, defined as the distance from a river or coastline, to capture the greater likelihood of a colonial presence near ports. More broadly, distance from water can also serve as a proxy for accessibility, as well as economic and urban suitability. Historically, greater access and openness via waterborne trade routes could expand market opportunities, reinforce specialization, and reduce women's roles in agriculture. However, proximity to coastlines also facilitated the slave trade, which may have led to greater empowerment for women due to more scarcity of male labor (Nunn and Puga, 2012; Teso, 2018). Although the coefficients are smaller in magnitude compared to the baseline specification, they remain positive and significant for both the BFI (0.18) and the DI (0.20).

Distance from Railway Networks As shown in Jedwab and Moradi (2016), rail connectivity had a profound impact on cash crop production, population growth, and urban expansion, primarily due to improved mobility and market access in areas close to rail infrastructure. To test the robustness of our specification, we include the log-distance from railway networks as a control variable in column 3. Similar to distance from water, railway proximity indicates greater openness, which can be detrimental to women's empowerment in traditional societies. However, it also implies a higher colonial presence and increased capacity for resource exploitation, including cash crops. Additionally, Baten et al. (2021) highlight that, in contemporary societies, openness and trade are associated with higher levels of women's education, which in turn may contribute indirectly to greater women's empowerment. Including this variable results in only minimal changes from the baseline findings, with the coefficients remaining positive and significant: 0.27 for the BFI and, approximately, 0.37 for the DI.

Economic-level Controls: Together In column 4, we include all above-mentioned control variables in the specification: geographical log-distance from diamond mines, distance from water, and distance from railway networks. Including these controls slightly reduces the magnitude of the coefficients, but they remain positive and highly significant.

3.6.2 Potential Competing Dimensions: Ethnicity-level

In Table 3.4, we extend the baseline model by incorporating ethnicity-level control variables. These controls are linked to the ethnic background of the respondents' ancestors. Accordingly, the specification includes ethnicity-level characteristics from the Murdock Ethnographic Atlas on women's pre-colonial status to account for initial levels of women's empowerment associated with their ethnic heritage.

[Table 3.4 about here]

Ethnicities Location and Year of Observation In column 1, we include the geographical coordinates of the ethnic group of origin, using the centroid latitude and longitude of the territory historically inhabited by each ethnic group. Additionally, we incorporate the year in which the ethnicity was observed as cited in Murdock (1967). Our findings are consistent with those of the baseline model.

Women's Pre-colonial Empowerment In column 2, we control for proxies of pre-colonial empowerment of women which might indirectly affect a woman's current level of empowerment through her ethnicity: bride price (associated with lower levels of women's empowerment as in Alesina et al., 2021), polygyny (associated with lower female status as in Fenske, 2015 and Baten et al., 2021), the presence of a matrilineal descent system (connected to a higher status of women as in Henderson and Whatley, 2014, Hansen et al., 2015), and an agriculture-based subsistence system (often connected to higher levels of initial women's empowerment as in Alesina et al., 2013, and Alesina et al., 2021).[28] Including these variables has minimal impact on the main results, with coefficients remaining positive and significant.

Ethnic-level Controls: Together In column 3 we verify that our baseline results are robust to including all these ethnicity-level characteristics together. This specification does not significantly alter the coefficients for BFI and DI, which remain positive and significant at the 5% and 1% levels, respectively.

3.6.3 Other Competing Explanations

In Table 3.5, we assess the robustness of the main specification across a range of alternative dimensions identified in the literature as potential factors that may influence the outcome variables and could also be correlated with cash crop production.

[28] In section 3.7.4 we will analyze another aspect of pre-colonial women's status related to a specific aspect of it: their direct involvement in agriculture.

[Table 3.5 about here]

Presence of Islam In column 1 we include a dummy variable indicating whether Islam was a significant component of a district's religion at the beginning of the twentieth century. Regions with strong Islamic influence may have been less accessible to Christian missions - central to colonial education efforts - or already embedded in alternative religious and educational networks, potentially limiting the reach and influence of mission-led efforts. Additionally, Islamic practices in this region typically prohibited women from working outside the home. Consequently, Islam could directly affect women's status (Norton and Tomal, 2009; Izama, 2014; Akyeampong and Fofack, 2014). Adding religion as a control does not notably alter the effect of cash crop intensity on either the BFI or the DI.

Conflicts In column 2 we include the number of conflicts between 1400 and 1700 to account for pre-colonial levels of warfare. Besley and Reynal-Querol (2014) showed that a history of pre-colonial conflicts is associated with lower levels of trust today, which in turn may influence gender norms. Additionally, Dincecco et al. (2024) links conflicts involving heavy weaponry and demanding high physical strength to the emergence of male-favoring cultural norms. Including these controls does not substantially affect the coefficients on the cash crop production.

Transatlantic Slave Trade In column 3 we incorporate ethnicity-level data on the number of persons taken as slaves during the Transatlantic and Indian Ocean slave trade. This variable is constructed as the logarithm of 1 plus the number of persons taken as slaves from the respondent's ethnic group during the slave trade, adjusted by the area of land historically inhabited by the group. Nunn (2008) finds that the slave trade had a negative impact on long-term development, while Nunn and Wantchekon (2011) links differences in trust within Africa, potentially tied to gender norms, to the slave trade. Furthermore, Teso (2018) directly connects the Transatlantic slave trade to modern women's labor force participation and gender norms. Other works, such as Dalton and Leung (2014), Edlund and Ku (2011), and Thornton (1983), argue that the slave trade contributed to the prevalence of polygyny. Adding this control reduces the coefficients' magnitude, but the positive relationship between cash crop production and our indices remains positive and significant.

Malaria and Tsetse Fly Suitability In columns 5 and 6 we add controls for the suitability of regions for malaria and tsetse fly presence. Cervellati et al. (2017) and Alsan (2015) document how malaria and tsetse fly prevalence negatively affect long-term development. In the context of gender norms, however, Alsan (2015) finds that the suitability for tsetse flies is positively correlated with women's participation in agriculture, as it increases land availability and promotes subsistence-based agricultural systems. A similar effect is expected for malaria. Including these controls reduces the coefficients' magnitude. The positive relationship between cash crop production and the BFI remains positive and significant, also including malaria or tsetse fly suitability. However, for malaria, the cash crop coefficient on the DI loses its significance while retaining its positive sign.

Other Competing Explanations: Together Finally, in column 7, we include all the aforementioned controls to the baseline specification. While the magnitude of the coefficients is reduced, the signs remain unchanged with estimated effects of approximately 0.23 and 0.10 on BFI and DI, respectively.

3.6.4 Potentially Endogenous Variables and Bad Controls

While in Tables 3.2, 3.3, 3.4, and 3.5, we included only pre-determined controls, in Table 3.6, we add variables that may be endogenous to the model but are still relevant to analyze, given the advancements in recent literature.

[Table 3.6 about here]

Contemporary Individual-level Controls In Table 3.6, column 1, we include contemporary individual-level characteristics, which could potentially be influenced by colonial cash crop agriculture and may themselves affect gender equality. These characteristics include age, marital status, number of children, religion, and urban vs rural status. Although the DHS dataset does not provide information on individuals' incomes, it does includes a categorical variable capturing wealth by ranking households into quintiles, from the poorest to the richest, within each country. Respondents' individual characteristics and wealth could intuitively affect their empowerment within the household.[29]

In this specification, the coefficient for the BFI decreases to 0.18, while the DI coefficient remains relatively stable at 0.30. Despite this reduction, both coefficients in column 1 remain positive and statistically significant.

Christian Missions Another strand of research linking colonialism to gender norms examines the role of Christian mission education in shaping persistent gender norms. Studies such as Baten et al. (2021), Boserup (1970), Rodney (1972), and Akyeampong and Fofack (2014) suggest that Christian mission schools pushed gender-biased education, emphasizing the domestic roles of women while disproportionately teaching men skills relevant to participation in the colonial economy. At the same time, Jedwab et al. (2018) find that cash crop exports attracted European missionaries, making missions a potentially problematic control variable.

Taking these considerations into account, we add the logarithm of the distance to the nearest Christian or Protestant mission as a control in column 2 of Table 3.6 and show that, reassuringly, this control does not meaningfully alter the main findings.

[29]Wealth and subsistence agriculture are positively associated with women's empowerment (Borker et al., 2026; Michalopoulos et al., 2019). Conversely, early marriage and higher numbers of children are generally associated with lower levels of women's empowerment in developing countries (Klasen and Pieters, 2015; Calvi, 2020; Afridi et al., 2024). Urbanization is typically linked to positive effects on women's status (Banks, 2013; Vakulabharanam and Motiram, 2023; Mitra, 2019). However, recent research by Dhamija et al. (2023) reports mixed effects in India, where urban environments are associated with increases in labor force participation, women's agency, and attitudes against domestic violence, but reductions in financial autonomy and health-related empowerment.

3.7 Mechanisms

In the next paragraphs we discuss and investigate the main mechanisms which characterize the relation between cash crops intensity and empowerment of women.

3.7.1 Alternative Outcome: Education and Labor Force Participation

In Table 3.7, we test whether an increase in subjective empowerment is linked to an improvement in women's objective conditions within the social community and labor market. We thus introduce two key alternative outcomes: education and labor market participation. These variables reflect distinct dimensions of social development. While education measures human capital accumulation among women, it does not necessarily translate into active labor market participation, which is directly assessed by the second outcome. Accordingly, we replicate the analysis in Table 3.2 using the baseline specification with these alternative outcomes.

The relationship between subjective empowerment and social empowerment should not be interpreted causally but rather as complementary. Subjective empowerment and shifts in social norms can lead to more active roles for women within the social community and labor market. In turn, higher education and greater labor force participation can dynamically reinforce changing gender norms, empowering women's subjective attitudes and perceptions of their roles in society and in the family. Despite the non-causal interpretation, analyzing objective measures of social empowerment offers insights into whether subjective empowerment is confined to the household and personal context, or has broader implications in social and market dynamics.

[Table 3.7 about here]

Education Education is one of the most established indicators of human development in the economic literature (Korieh, 2001; Becker and Woessmann, 2008; Nunn, 2014). A recent study by Baten et al. (2021) investigates the nonlinear relationship between development and the gender gap in education. They propose an "educational gender Kuznets curve" where early stages of development are associated with smaller gender gaps in education. As development progresses, the gap initially widens in favor of men, driven by increased male educational attainment, and then narrows as women begin to catch up. The study tests this theory in African countries, examining factors including the presence of engagement in producing cash crops. Interestingly, the presence of cash crop does not significantly influence this relationship.

In panel A of Table 3.7 we find that cash crops are positively associated with women's education. This effect remains robust in a 2SLS model, when we for population density, ancestral district size, land quality, and ruggedness of terrain. In this specification, a one standard deviation increase in cash crop intensity corresponds to a 0.71 standard deviation increase in women's education. These results suggest that cash crop agriculture facilitates education, in line with a mechanism in which the returns of the cash crops economy are

invested in household improvements and children's education (Berry, 1975; Cogneau and Jedwab, 2012). This evidence may also suggest that colonial districts with high cash crop intensity are located at the upward-sloping segment of the U-shaped relationship between development and education, partially due to the role played by subjective empowerment of women and female-favoring gender norms.

Labor Force Participation A well-established literature links development to labor force participation (Acemoglu et al., 2004; Fernández, 2007; Goldin and Olivetti, 2013). Recent studies also examine the male-female labor force participation gap, focusing on the historical roots of gender roles (e.g., Alesina et al., 2013, Teso, 2018). Similar to the education gap, labor force participation follows a U-shaped pattern of development in both developed (Goldin, 1995; Olivetti, 2014) and developing countries (Mammen and Paxson, 2000; Fatima and Sultana, 2009). Initially, development widens the gender gap by increasing male labor force participation. Over time, this gap narrows as female labor force participation rises, driven by improvements in education, human capital, and empowerment.

Panel B of Table 3.7 shows a positive, albeit smaller, effect of cash crop suitability on labor force participation, with an increase of 0.17 standard deviations for a one standard deviation increase in cash crop intensity. However, this coefficient loses significance in the 2SLS model when we control for population density, ancestral district size, land quality, and ruggedness of terrain (with a p-value of 0.14, just below the conventional levels for statistical significance). The weaker response in labor force participation compared to education suggests that increased household involvement in the cash crop economy does not necessarily translate into broader labor market empowerment, at least a few decades down the line. Thus, this evidence highlights that subjective empowerment and education are not entirely associated with labor market opportunities and, more generally, the external environment.

Furthermore, the U-shaped relationship between development and labor force participation may lag behind the education curve. Women often experience improvements in education and human capital first, followed by increased labor force participation as labor markets grow more complex with overall economic development. This could explain the greater heterogeneity in evidence regarding labor force participation.

3.7.2 Intergenerational Transmission of Culture

In this section, we account for the effect of intergenerational transmission of cultural values on women's empowerment - from those exposed to cash crop production during the colonial period to their present-day descendants.- This helps us to distinguish the transmission of gender norms from the changes in the external environment. In line with this view, current norms are most often transmitted through family, social environment, or ethnic identity rather than being influenced or shaped by present-day labor market opportunities.

A broad literature has studied the intergenerational transmission of gender norms and women's status in developing countries (Jayachandran, 2021; Miyata and Yamada, 2016; Dhar et al., 2019; Leight, 2021; Asiedu et al., 2021). However, while a branch of the literature points out the role of the external environment, in particular peers and teachers, and cultural context

(Lundberg, 2024; Eble and Feng, 2022; Cools et al., 2022; Alan et al., 2018; Ferrara et al., 2012; Chong and La Ferrara, 2009; Jensen and Oster, 2009), other papers highlight the role played by the norms, culture, and education transmitted internally by the family and, especially, by parents (Asiedu et al., 2021; Dhar et al., 2019; Miyata and Yamada, 2016).

To account for intergenerational transmission, we exploit the fact that many individuals in our dataset are characterized by a migrational background: their self-reported ethnicity is not native to their current living place. By controlling for present-day location and thus contemporary external environment, we can isolate the influence of family, ethnic group, and colonial district of origin. We pursue this in two ways: by including, in turn, fixed effects for current administrative districts and for geographical clusters as classified by DHS. Table 3.8 presents the new set of results. In both cases, the estimated coefficients are smaller than those in the baseline results, but remain positive and significant under these more demanding specifications.

[Table 3.8 about here]

3.7.3 Dissipation Over Time

In Table 3.9 we test whether our main findings are slowly vanishing over time, or if the effect of cash crop agriculture is still present throughout generations. To this end, we add an interaction term between the main explanatory variable and women's age, given that the DHS data we use include women between the age of 15 and 49.

While our main findings remain robust to this specification, the coefficients on the interaction of cash crop production with age are virtually all equal to zero. Notice, however, that in these specification, there is a sharp drop in the value of the Kleibergen-Paap F-statistic below the critical threshold of 10, limiting the conclusiveness of our findings.

[Table 3.9 about here]

3.7.4 Hoe-farming Culture

In this section, we shed light on the specific gender dynamics active in agricultural labor at the time of the colonial cash crop revolution. Our goal is to account for preexisting heterogeneity in women's status directly linked to their involvement in agricultural labor.

To measure this specific aspect of women's empowerment before British colonization, we use a map from Baumann (1928), digitized by Baten et al. (2021). While this measure might proxy only one dimension of empowerment, it reflects work divisions in farming, speaking to a well-established literature that links gendered labor division to women's empowerment (Boserup, 1970; Alesina et al., 2013; Nunn, 2020; Baten et al., 2021). Accordingly, we augment our baseline specification interacting the main explanatory variable (*cash crop production*) with an indicator variable indexing whether women had at least some role in hoe agriculture (in the Baumann (1928) map these are the categories "men take part" and "women do the

work").[30] The interaction term captures how pre-existing social structures shaped the effect generated by the introduction of cash crops.

Table 3.10 presents the results of this exercise. The cash crop coefficients remain positive and robust, indicating a positive effect in those areas where agriculture was mainly male-dominated. The interaction term is always negative, and notably significant for the BFI and labor force participation. This means that the effect of cash crops on women's empowerment proved to be weaker in those places where women were previously involved in agriculture, probably because they already retained value due to their involvement in this type of labor. However, when agricultural labor becomes even more valuable (specifically linked to returns on cash crop) there were still margins for improvements in their status, supporting our main findings that female labor contributes to greater empowerment. Note, though, that the interaction term is not significant concerning the effects on the DI, showing that not all aspects of empowerment are affected the same way.[31]

[Table 3.10 about here]

3.7.5 Crop-by-crop Analysis

The analysis so far has looked at cash crop agriculture as a bundle of five export crops: cocoa, coffee, cotton, groundnuts, and palm oil. In this section, we separate the effect of each crop and construct individual measures of production and suitability to explore whether the positive relationship between cash crop agriculture and women's status is particularly driven by some specific crops.

Table 3.11 presents the crop by crop results on the two main outcomes of interest, the BFI and DI. Analogously to the main specification, we construct separate measures of cash crop production and relative suitability for each individual crop. Each column refers to a different crop and shows the estimates of equation 3.1 with all baseline controls and DHS country-wave fixed effects. The results show that it is mainly cocoa and palm oil production that match the main results. Cotton and coffee show non-significant coefficients, while groundnuts production displays negative and significant effects. These differences are not surprising, given the complex relationship between cash-crop cultivation and women's roles, which vary by crop due to differences in farming practices, institutional arrangements, and interactions with British officials. As a result, the baseline effects likely reflect the net outcome of opposing dynamics, which become clearer when disaggregated by individual crop.

[Table 3.11 about here]

[30] Specifically, we calculate the share of a colonial district occupied by these two categories and assign the whole district to have a value of 1 if the share is higher than the sample-mean, 0 if agriculture is male-dominated.

[31] Further, the Kleibergen-Paap F-statistic of the first stage is below the critical threshold of 10, likely due to the more demanding specification. This weakens the conclusiveness of our results, though the observed patterns provide suggestive evidence of an interaction between cash crops and pre-colonial gendered labor divisions.

What is different about cocoa and palm oil with respect to other crops? Looking at cocoa, Grier (1992), argues that, in the labour-intensive processes of establishing a cocoa farm by clearing virgin forest, planting the cocoa seeds or seedlings, and intercropping with food crops, the labour of women and girls largely dominates. Austin (2014) highlights the importance of women in the establishment of cocoa farms, as they plant plantain and cocoyam to shade the young cocoa plants. He also reports that sometimes women were among the early cocoa farm owners.[32] This evidence suggests that women were particularly valuable in the production of cocoa. Thus, an expansion of this crop production to meet demand from colonisers lead to an increasingly important role for women in the local economy, resulting in persistent, more progressive gender norms.

Palm oil production also exhibits a particularly close relationship with women's participation in cash cropping. For instance, while men in Nigeria took over the production of palm oil, previously a female activity in precolonial societies of West Africa (Maier, 2009), women were rewarded for helping in palm-oil processing through the allocation of property rights to its by-product, the palm kernels (Martin, 2006). Thus, women living in households producing palm fruits profited directly from the production of palm oil. Byfield (2018) argues that women's involvement in palm oil processing was conspicuous at least till the post-Second World War period, to the extent that missionary accounts and colonial reports acknowledged women's important role in processing palm fruit, while remaining silent on their involvement on other cash crops.

Conversely, for cotton, coffee, and groundnuts, historical sources document a similar increase in labor demands for both men and women, but with a shift toward male dominance, often resulting in exploitation of women's labor. These crops became male-dominated domains, and unlike cocoa and palm oil, the existing literature (Sheldon, 2017; Coquery-Vidrovitch, 1997; Etienne, 1977) does not document corresponding remuneration or gains in social status for women. This pattern is particularly evident in the case of groundnuts, where British colonial rule determined a marked shift from a crop traditionally cultivated by women to one increasingly dominated by men - a dynamic consistently observed across all major producing areas, including Nigeria, Tanzania, and Malawi (Wycliff, 2022; Bezner Kerr, 2010; Kalinga, 1993).

The crop by crop analysis also suggests that the main findings are not driven by economic growth. Even though we show in subsection 3.6.4 that including household wealth does not change the results, the effect on women's empowerment could still be partially driven by income, a variable we cannot control for due to lack of data. However, if this were the case, we would see significant positive results for all cash crops individually, because the production of each one leads to an increase in income and economic growth.

[32] Austin (2014) draws from Kyei and Allman (2001) and specifies that where women were among the early cocoa farm owners, they tended to be "elderly and unattached", therefore freed from the obligation to help men.

3.8 Conclusion

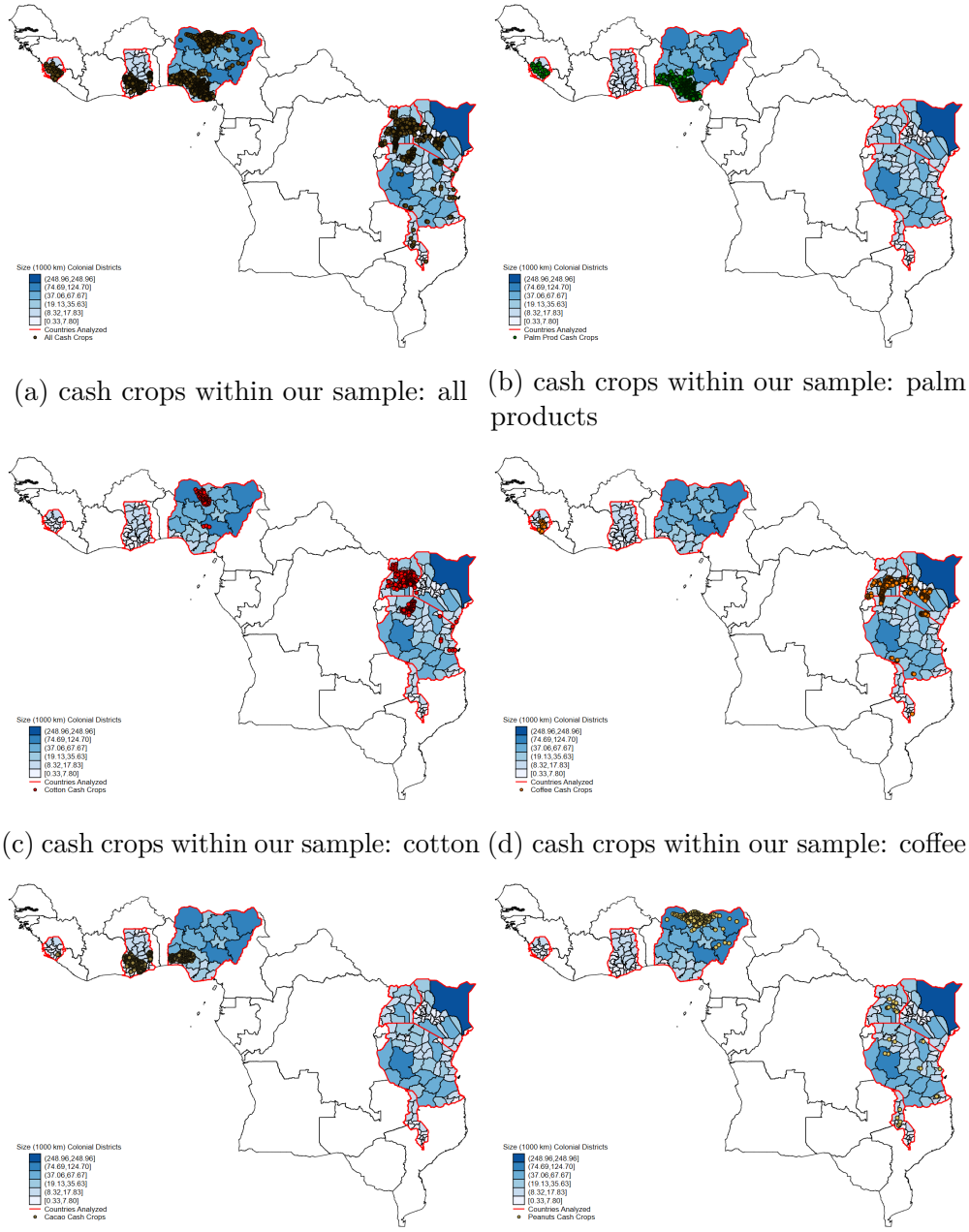
In this paper, we test the effect of a historically driven shift from traditional subsistence agriculture to market-oriented cash crop production on women's empowerment. We exploit variation in the introduction of cash crops by British colonial administrations across colonial districts in Tropical Africa. We link this historical exposure to present-day measures of empowerment among women descended from those colonial districts. Our measure of empowerment is drawn from nationally representative DHS surveys. To address potential endogeneity between women's empowerment and historical cash crop production, we instrument the latter using a measure of cash crop suitability based on FAO data.

We find that higher historical intensity of cash crop production at the colonial district level is associated with significantly greater present-day women's empowerment: impacted women are less likely to justify spousal violence and to exhibit greater decision-making power within the household. These subjective indicators are complemented by more objective measures, including higher levels of education and labor force participation. Using cross-country migration patterns, we further show that the empowerment effects are linked to ethnic and colonial-district origin rather than their current environment: women whose colonial districts and ethnic group were more engaged in cash crop production show greater empowerment, regardless of where they live today. The effects persist across generations, and we find no evidence of age-based decay in the impact of historical cash crop production on women's empowerment. The effect is stronger in regions where men dominated pre-colonial agriculture, suggesting that cash crops reshaped existing gender roles and norms. Finally, we show that our results are primarily driven by cocoa and palm oil production, two crops that, according to historical literature, required substantial involvement from women in their production chains.

Our findings contribute to the literature on the long-run impacts of environment and agricultural systems on gender norms and women's empowerment. In particular, focusing on the interaction between agriculture and colonial rule, historical scholarship emphasizes how colonial cash crop economies marginalized women by assigning them to domestic and food production roles and placing men in charge of cash crops, taxes, and administrative relations. Conversely, recent economic research suggests a more mixed view. Although women were often unpaid, their labor, both in the domestic and cash crop production, became increasingly essential in supporting household production to meet colonial demands. This greater involvement may have increased their bargaining power within the family and contributed to women long-term empowerment. Our findings support this latter view: on balance, colonial cash crop production appears to have had a positive effect on women's empowerment.

3.9 Figures

Figure 3.1: **Cash-crop export production by point and colonial districts**



(a) cash crops within our sample: all

(b) cash crops within our sample: palm products

(c) cash crops within our sample: cotton

(d) cash crops within our sample: coffee

(e) cash crops within our sample: cacao

(f) cash crops within our sample: peanuts

Notes: Geographical distribution of cash crops and the size of colonial districts in the selected sample of countries. Each dot represents \$289,270 or 0.01% of tropical Africa's exports for a selected cash crop. Red lines delineate the countries in our sample, i.e. the British colonies in Tropical Africa. Within these boundaries, each polygon corresponds to a colonial district. The darker the shade of blue, the larger the district's geographical size.
Sources: Cash crop data from Hance et al. (1961), as digitized by Baten et al. (2021). British colonial districts were manually digitized from historical maps (see Appendix A)

3.10 Tables

Table 3.1: **Summary statistics**

	Mean	*St Dev*	*Min*	*Max*	*N*
Outcome Variables					
Beating free index	0.73	0.36	0.00	1.00	161777
Decision Index	0.52	0.38	0.00	1.00	161777
Education	5.26	4.85	0.00	26.00	161777
Labor Force Participation	0.70	0.46	0.00	1.00	161777
Treatment and Instrument					
Cash crop intensity (1000 squared km)	0.99	1.64	0.00	7.29	71
Cash crop suitability	0.45	0.08	0.31	0.62	71
District Level Controls					
Land quality	0.56	0.19	0.15	0.92	71
Ruggedness of terrain	62462.46	44133.24	8801.72	227515.30	71
Population density in 1930 (inh/squared km)	18.86	20.32	0.41	117.37	71
N. diamonds/squared km	0.00	0.00	0.00	0.00	71
Distance from coastline (Log)	12.68	1.14	9.23	13.93	71
Distance from rivers (Log)	10.89	1.23	5.24	12.28	71
Distance from railway line (Log)	10.98	1.26	7.30	12.91	71
Islam ($>$ 20%)	0.30	0.46	0.00	1.00	71
N. conflicts/squared km	0.00	0.00	0.00	0.00	71
Hoe: women do the work or men take part	0.57	0.49	0.00	1.00	71
Malaria	13.04	8.65	0.20	28.57	71
Ethnic Level Controls					
Bride price	0.96	0.20	0.00	1.00	123
Polygyny	0.98	0.15	0.00	1.00	123
Agriculture	0.89	0.32	0.00	1.00	123
Matriliny	0.26	0.44	0.00	1.00	123
TseTse suitability index	0.07	0.87	-2.14	1.45	123
N. religious missions (log)	3.47	0.97	-0.39	5.45	123
N. slaves traded (log)	0.37	0.79	0.00	3.84	123
Individual Level Controls					
Age	30.85	8.81	15.00	49.00	161777
Urban vs rural status					
Urban	0.31	0.46	0	1	161777
Rural	0.69	0.46	0	1	161777
Other	0.00	0.03	0	1	161777
Wealth quintiles					
Poorest	0.21	0.41	0	1	161777
Poorer	0.20	0.40	0	1	161777
Middle	0.19	0.39	0	1	161777
Richer	0.20	0.40	0	1	161777
Richest	0.20	0.40	0	1	161777
Religion					
Christian	0.55	0.50	0	1	161777
Islamic	0.38	0.49	0	1	161777
No religion	0.01	0.07	0	1	161777
Other	0.07	0.25	0	1	161777
Marital status					
Married	0.95	0.23	0	1	161777
Not married	0.05	0.23	0	1	161777
Total children ever born	3.75	2.77	0.00	18.00	161777

Note: All variables' construction and sources used are listed in the main text in section 3.3 and in appendix A.

Table 3.2: **Women's empowerment and colonial cash crops**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.121*	0.201***	0.392***	0.352***
	(0.062)	(0.041)	(0.103)	(0.121)
Std. β	0.109	0.181	0.353	0.316
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.37	10.94
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.127***	0.216***	0.589***	0.497***
	(0.044)	(0.074)	(0.165)	(0.172)
Std. β	0.125	0.213	0.579	0.488
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.37	10.94
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. Unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops, measured in dollars per square kilometer. For details on how these variables are constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of colonial district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Rows **Std.** β in Panels A and B report coefficients standardized by the ratio of the standard deviation of cash-crop intensity to the standard deviation of the main outcome: *Beating Free Index* in Panel A and *Decision Index* participation in Panel B. Standard errors clustered at the ethnicity level in parentheses. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.3: **Competing explanations: economic level**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.360***	0.184**	0.271***	0.184**
	(0.124)	(0.085)	(0.084)	(0.081)
Observations	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	10.74	13.53	14.37	12.38
Country-wave FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y
Additional controls	Diamonds	Distance	Distance	All
	mines	water	rail	

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.516***	0.205**	0.369***	0.223***
	(0.178)	(0.091)	(0.115)	(0.079)
Observations	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	10.74	13.53	14.37	12.38
Country-wave FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y
Additional controls	Diamonds	Distance	Distance	All
	mines	water	rail	

Table reports 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). Economic level controls include: number of diamond mines by district area (Lujala et al., 2005); distance from water as the minimum (log of the) distance of a district border from river and coastline; distance from railway as the minimum (log of the) distance of a district border from railway line (Jedwab and Moradi, 2016). For details on how the control variables are constructed, see section 3.3.3 and appendix A. Standard errors clustered at the ethnicity level in parentheses. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.4: **Competing explanations: ethnicity level**

Panel A: Beating Index

	(1)	(2)	(3)
Cash crop production	0.267***	0.337***	0.308***
	(0.102)	(0.114)	(0.117)
Observations	161777	161777	161777
Model	2SLS	2SLS	2SLS
K-P F-Stat	13.82	11.94	9.433
Country-wave FE	Y	Y	Y
Baseline controls	Y	Y	Y
Additional controls	Ethno Atlas	Ethno Atlas	All
	lat, long, year	women emp.	

Panel B: Decision Index

	(1)	(2)	(3)
Cash crop production	0.325**	0.555***	0.297**
	(0.140)	(0.208)	(0.143)
Observations	161777	161777	161777
Model	2SLS	2SLS	2SLS
K-P F-Stat	13.82	11.94	9.433
Country-wave FE	Y	Y	Y
Baseline controls	Y	Y	Y
Additional controls	Ethno Atlas	Ethno Atlas	All
	lat, long, year	women emp.	

Table reports 2SLS estimates. The unit of observation is a DHS respondent. *Beating Free Index* and *Decision Index* are constructed as explained in the main text. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). Ethnographic Atlas (Murdock, 1967) core variables include the geographical coordinates of the ethnic group of origin, based on the centroid latitude and longitude of the territory historically inhabited by each group, as well as the year in which the ethnicity was observed. Ethnographic atlas (Murdock, 1967) variables measuring empowerment of women include: dummy for bride price; dummy for polygyny; dummy for descent system of matriliny; dummy for agriculture as main subsistence activity. For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.5: **Competing explanations: others**

Panel A: Beating Index

	(1)	(2)	(3)	(5)	(6)	(7)
Cash crop production	0.324***	0.361***	0.296**	0.278**	0.264**	0.226***
	(0.109)	(0.119)	(0.148)	(0.119)	(0.118)	(0.078)
Observations	161777	161777	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	12.37	10.87	11.07	8.519	11.42	18.18
Country-wave FE	Y	Y	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y	Y	Y
Additional controls	Religion	Conflicts	Trans. Slave	Malaria	TseTse	All

Panel B: Decision Index

	(1)	(2)	(3)	(5)	(6)	(7)
Cash crop production	0.481***	0.531***	0.314*	0.140	0.237**	0.107*
	(0.158)	(0.167)	(0.185)	(0.107)	(0.120)	(0.062)
Observations	161777	161777	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	12.37	10.87	11.07	8.519	11.42	18.18
Country-wave FE	Y	Y	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y	Y	Y
Additional controls	Religion	Conflicts	Trans. Slave	Malaria	TseTse	All

Table reports 2SLS estimates. The unit of observation is a DHS respondent. *Beating Free Index* and *Decision Index* are constructed as explained in the main text. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). Control variables to account for other potential competing explanation include: Islam, a dummy variable indicating the historical presence of the Islamic religion in each colonial district's territory, based on the map from (Bartholomew and Brooke, 1918); conflicts as the number of precolonial conflicts between 1400 and 1700 by district area (Brecke, 1999); Transatlantic slave trade as the (log of the) number of persons removed from each ethnic region of origin during the Transatlantic slave trade era; malaria as the stability of malaria transmission index from Kiszewski et al. (2004); TseTse as TseTse suitability index (Alsan, 2015). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors clustered at the ethnicity level in parentheses. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.6: **Potentially endogenous variables and bad controls**

Panel A: Beating Index		
	(1)	(2)
Cash crop production	0.183**	0.338**
	(0.084)	(0.131)
Observations	161777	161777
Model	2SLS	2SLS
K-P F-Stat	11.66	11.89
Country-wave FE	Y	Y
Baseline controls	Y	Y
Additional controls	DHS indiv.	Missions

Panel B: Decision Index		
	(1)	(2)
Cash crop production	0.299***	0.500***
	(0.108)	(0.192)
Observations	161777	161777
Model	2SLS	2SLS
K-P F-Stat	11.66	11.89
Country-wave FE	Y	Y
Baseline controls	Y	Y
Additional controls	DHS indiv.	Missions

Table reports 2SLS estimates. The unit of observation is a DHS respondent. *Beating Free Index* and *Decision Index* are constructed as explained in the main text. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). DHS individual level controls include: age, categorical variable for religion (christian, islamic, no religion, other), categorical variable for marital status (married, non-married), number of children, dummy for urban vs. rural residence, categorical variables for household wealth quantile (poorest, poorer, middle, richer, richest). Mission controls include: (log of the) distance from nearest Christian and Protestant mission using Becker and Meier zu Selhausen's (2023) database. For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors clustered at the ethnicity level in parentheses. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.7: **Alternative outcomes**

Panel A: Education

	(1)	(2)	(3)	(4)
Cash crop production	0.264***	0.410***	0.962***	0.739***
	(0.092)	(0.104)	(0.252)	(0.216)
Std. β	0.253	0.395	0.925	0.711
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.37	10.94
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Labor Force Participation

	(1)	(2)	(3)	(4)
Cash crop production	0.048***	0.060**	0.144***	0.081
	(0.016)	(0.027)	(0.055)	(0.055)
Std. β	0.100	0.126	0.301	0.170
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.37	10.94
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. Education is measured in years of education. Labor Force Participation is a dummy equal to 1 if a woman was employed in the last 12 months before the survey. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Rows **Std.** β in Panels A and B report coefficients standardized by the ratio of the standard deviation of cash-crop intensity to the standard deviation of the main outcome: Education in Panel A and Labor Force Participation in Panel B. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.8: **Intergenerational transmission of culture**

	Beating Index	Decision Index	Education	Labor Force Participation
	(1)	(2)	(3)	(4)
Cash crop production	0.049	0.187***	0.360***	0.007
	(0.041)	(0.058)	(0.113)	(0.027)
Observations	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	17.24	17.24	17.24	17.24
Country-wave FE	Y	Y	Y	Y
Current admin. area FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y
	Beating Index	Decision Index	Education	Labor Force Participation
	(1)	(2)	(3)	(4)
Cash crop production	0.055**	0.131***	0.250***	0.059**
	(0.023)	(0.045)	(0.067)	(0.026)
Observations	161120	161120	161120	161120
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	13.42	13.42	13.42	13.42
Country-wave FE	Y	Y	Y	Y
DHS geog. cluster FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y

Table reports 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Fixed effects include: in Panel A, DHS country-wave fixed effects and fixed effects for the modern-day first sub-national administrative division (Current admin. area FE); in Panel B, DHS country-wave fixed and the geographical area cluster from DHS. Further information is available in A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.9: **Dissipation over time**

	Beating Index	Decision Index	Education	Labor Force Participation
	(1)	(2)	(3)	(4)
Cash crop production	0.361***	0.398**	0.713***	-0.012
	(0.125)	(0.173)	(0.251)	(0.059)
Cash crop production × age	-0.000	0.002	0.001	0.002***
	(0.001)	(0.003)	(0.004)	(0.001)
Age	0.003***	0.019***	-0.013***	0.011***
	(0.001)	(0.002)	(0.002)	(0.000)
Observations	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	5.477	5.477	5.477	5.477
Country-wave FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y

Table reports 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. $Cash\ crop\ production \times age$ is the cash crop production interacted with respondents' age in the DHS. For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.10: **Hoe-farming culture and cash crops**

	Beating Index	Decision Index	Education	Labor Force Participation
	(1)	(2)	(3)	(4)
Cash crop production	0.519***	0.507***	0.842***	0.121**
	(0.112)	(0.162)	(0.186)	(0.061)
Hoe: women or shared × Cash crop	-0.428***	-0.024	-0.260	-0.103*
	(0.111)	(0.187)	(0.238)	(0.054)
Observations	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	4.660	4.660	4.660	4.660
Country-wave FE	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y

Table reports 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). Hoe controls include: *Hoe: women or shared* as a dummy equal to 1 if the share of the land where "men take part" (so the work is shared between men and women) and "women do the work" is higher than the sample-mean. For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table 3.11: **Crop-by-crop analysis**

Panel A: Beating Index

	Cotton	Cocoa	Coffee	Palm Oil	Groundnuts
	(1)	(2)	(3)	(4)	(5)
Cash crop production	-3.925	0.347***	-0.304	0.280***	-0.146**
	(7.889)	(0.091)	(0.364)	(0.107)	(0.064)
Observations	161777	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	0.214	6.286	1.761	7.705	9.230
Country-wave FE	Y	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y	Y

Panel B: Decision Index

	Cotton	Cocoa	Coffee	Palm Oil	Groundnuts
	(1)	(2)	(3)	(4)	(5)
Cash crop production	-7.623	0.536***	-0.525	0.479***	-0.237***
	(15.549)	(0.182)	(0.534)	(0.136)	(0.060)
Observations	161777	161777	161777	161777	161777
Model	2SLS	2SLS	2SLS	2SLS	2SLS
K-P F-Stat	0.214	6.286	1.761	7.705	9.230
Country-wave FE	Y	Y	Y	Y	Y
Baseline controls	Y	Y	Y	Y	Y

Table reports 2SLS estimates. The unit of observation is a DHS respondent. Outcome variables are constructed as explained in section 3.3.1, and in the appendix A. Cash crop production is the production of cotton, cocoa, coffee, palm oil and groundnuts per square km. For details on how this variable was constructed, see section 3.3.2 and 3.7.1. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

A List of Variables Used in the Paper

Outcome Variables

Beating Free Index: share of questions on attitudes towards domestic violence for which a woman answers that it is justified for a husband to beat his wife. Index components: if she argues with the partner, if she burns food, if she goes out without telling the partner, if she refuses to have sex, if she neglects the children, if she commits infidelity. The index is the share of times a woman replies "No" to these questions. Because the answer to some of these questions can be missing for some respondents, this variable should be intended as the share of instances for which the respondent answers that beating is justified among the questions with non-missing information. Individuals answering while the husband is present have been excluded. Source DHS (Individual Recode).

Decision Index: share of questions on a woman's participation in household decisions for which the woman answers that she has a say in the decision, even when the decision is taken together with her partner. Questions include decisions regarding: major household purchases, household purchases for daily needs, visits to family or relatives, how her earnings are used, how partner's earnings are used, her own health care, children's healthcare, what food to be cooked each day. The possible answers to these questions are *woman alone, woman and husband/partner, woman and someone else, husband/partner, someone else*. The decision variable on these situations takes a value of 1 whenever a woman has some degree of say in a decision (first three options) and 0 otherwise (last two options). Because the answer to some of these questions can be missing for some respondents, this variable should be considered the share of decisions in which a woman has some say with non-missing information. Source DHS (Individual Recode).

Education: years of education. Source DHS (Individual Recode).

Labor Force Participation: dummy taking a value of one if a respondent was employed in the 12 month prior to the survey. Source DHS (Individual Recode).

Main Explanatory Variable

Cash Crop Production: Cash crop production oriented to export, measured in dollars per square kilometer. Using GIS software, we employ the map from Hance et al. (1961), as digitized by Baten et al. (2021), to aggregate each point belonging to cash crops (cocoa, coffee, cotton, groundnuts, palm oil) within each colonial district. The map records the spatial distribution of export production across 38 countries in sub-Saharan Africa in 1957, covering 95% of total exports and classified into 12 categories of agricultural products. Each point corresponds to $289,270 or 0.01% of tropical Africa's exports.

Instrumental Variables

Suitability for Cash Crop: as in eq. 3.3, average suitability of a district for cash crops (cocoa, coffee, cotton, groundnuts, and palm oil) divided by average suitability of a district for cash and domestic food crops (banana, cassava, foxtail and pearl millet, maize, phaseolus beans, dry and wet rice, sorghum, sweet and white potato, sugar beet, sugar cane, wheat). Source: FAO-GAEZ.

$$SuitCC_d = \frac{\frac{1}{C}\sum_{c=1}^{C} Suit_{cd}}{\frac{1}{C}\sum_{c=1}^{C} Suit_{cd} + \frac{1}{F}\sum_{f=1}^{F} Suit_{fd}} \tag{3.3}$$

where $c = 1, .., C$ and $f = 1, .., F$ are cash and food crops.

Individual Level Controls

Age: age of the respondent. Source: DHS (Individual Recode).
Urban: dummy taking a value of one if a respondent lives in a urban location. Source: DHS (Individual Recode).
Married: dummy taking a value of one if a respondent is married. Source: DHS (Individual Recode).
Religion: dummies for different religions. Source: DHS (Individual Recode).
Number of children: number of children ever born. Source: DHS (Individual Recode).
Wealth: dummies for household-level wealth quintiles. Source DHS (Individual Recode).
Latitude: latitude of respondent's DHS cluster. Source DHS (Geographic Data).
Longitude: longitude of respondent's DHS cluster. Source DHS (Geographic Data).

Colonial Districts Level Historical Controls

Islam: Dummy variable equal to 1 if the Islamic religion covers a significant portion (approximately $\geq 20\%$) of the colonial district area, based on the map from Bartholomew and Brooke (1918). Source: personal elaboration from Bartholomew and Brooke (1918).
Population Density in 1930. Source: Historical Database of the Global Environment (Klein Goldewijk et al., 2017).
Colonial district area: area of colonial district in squared kilometres. Computed in ArcGIS.
Vegetation type: dummies for dominant vegetation type. Source: White (1983).
Ruggedness of terrain: average of soil ruggedness weighting grid-cells by their sea-level surface area. Source: Nunn and Puga (2012).
General land suitability index: suitability of land for cultivation based on climate and soil constraints, averaged at district level. Source: Ramankutty et al. (2002).
Diamond mines: number of diamond mines divided by the district area. Source: Lujala et al. (2005)'s DIADATA.
Precolonial conflicts: number of recorded conflicts between 1400 and 1700 in the district area. Source: Brecke (1999).
Christian missions: log of the distance to the closest Christian missions in the district area. Source: Becker and Meier zu Selhausen (2023).
Malaria suitability: index by Kiszewski et al. (2004) measuring the intensity and stability of malaria transmission, based on the biological characteristics of different mosquito vectors in interaction with the climate. Source: Cervellati et al. (2017)
Tsetse fly suitability: An index measuring the environmental suitability for a steady-state population of the TseTse fly, based on a biological population growth model using historical climate data from the National Oceanic and Atmospheric Administration's (NOAA) 20th Century Reanalysis (year 1871). Source: Alsan (2015)
Hoe: Share of the area of the colonial district categorized by the traditional gender division of

labor in hoe agriculture prior to colonization. The classification is based on Baumann (1928), who identified five categories: (1) "male takes part", (2) "women do the work", (3) "cultivation with plough", (4) "cattle raising/hunting", and (5) "man takes most part." In our analysis, we group the regions into: areas where women were actively involved in agriculture - categories (1), (2); and areas where men predominantly led in agriculture - categories (4) and (5). Source: Baten et al. (2021)

Distance Controls

Log-distance from rivers: log of the distance of the centroid of the land historically inhabited by the ethnic group from the closest river. Source for rivers: Natural Earth Data; source for ancestral land: Murdock (1959).

Log-distance from coast: log of the distance of the centroid of the land historically inhabited by the ethnic group from the closest coast. Source for coast: Natural Earth Data; source for ancestral land: Murdock (1959).

Log-distance from railway: log of the distance of the centroid of the land historically inhabited by the ethnic group from the closest railway line built before 1960. Source for railway: Jedwab and Moradi (2016); source for ancestral land: Murdock (1959).

Ethnicity's Homeland Level Controls

ln(1+Slave trade/area): logarithm of 1 plus the number of persons taken as slaves from the respondent's ethnic group in the Transatlantic and Indian slave trade divided by the area of land historically inhabited by the group. Source: Nunn and Wantchekon (2011); source for ancestral land: Murdock (1959).

Pre-Colonial Ethnicity Level Controls

Bride price: comes from variable v6 of the Ethnographic Atlas; we create a dummy variable for bride price taking value 1 if the prevalent mode of marriage prior to industrialization was characterized by bride price or wealth transfers to the bride's family, services to the bride's family, or a token bride price, and taking value 0 in the remaining cases of absence of consideration, dowry, reciprocal gift exchange, or sister or female relative exchanged for bride. Source: Murdock (1967).

Polygyny: comes from variable v9 of the Ethnographic Atlas; we create a dummy for polygyny taking value 1 if the prevalent marital composition was independent nuclear (polygyny), non-sororal (cowives in same dwellings), non-sororal (cowives in separate dwellings), preferentially sororal (cowives in separate dwellings), independent polyandrous families, and taking value 0 in the remaining case of independent nuclear (monogamous). Source: Murdock (1967).

Matriliny: comes from variable v43 of the Ethnographic Atlas; we create a dummy for matriliny taking value 1 if the prevalent descent system was not solely based on the patrilineal line, therefore: matrilineal, duolateral, bilateral, ambilineal, mixed, and taking value 0 in the remaining case of patrilineal. Source: Murdock (1967).

Subsistence Economy Agriculture: comes from variable v42 of the Ethnographic Atlas, which reports what activity (agriculture, fishing, gathering, hunting, pastoralism) is mainly practised for subsistence. we create a dummy taking value 1 if extensive agriculture, intensive agriculture, or agriculture of an unknown type contributed most to the local economy, and taking value 0 otherwise. Source: Murdock (1967).

Ethnicity latitude: latitude of the centroid of the land historically inhabited by the ethnic group.

Source: Murdock (1967).
Ethnicity longitude: longitude of the centroid of the land historically inhabited by the ethnic group. Source: Murdock (1967).
Year of observation: year in which an ethnicity was observed for the construction of the variables in Murdock's Atlas (1967). Source: Murdock (1967).

Fixed Effects
DHS country-wave fixed effects: fixed effects where each wave is defined as a unique combination of country and DHS survey year. Source: DHS ICF (2023)
Current administrative area (ADM1) fixed effects: fixed effects based on modern-day first sub-national administrative division. Source: Runfola et al. (2020)
DHS clusters (DHS id) fixed effect: A unique 14-character identifier for DHS clusters, combining country code, survey year, and cluster number. Used to link IPUMS-DHS microdata with DHS cluster shapefiles. Source: ICF (2023)

Colonial District Borders' Sources

Gold Coast
District borders are the administrative borders from 1930 as reported in the "Administration Report 1930" (National Archives CO98/55,58).

Kenya
District borders are the administrative borders from 1931 as reported in the "Administration Report 1931" (National Archives CO544/33,34).

Nigeria
District level data for Nigeria is not available. Instead, I use provinces. Province borders are retrieved from Falola and Heaton (2008).

Nyasaland
District borders are the administrative borders from 1928 as reported in the "Administration Report 1933" (National Archives CO626/12).

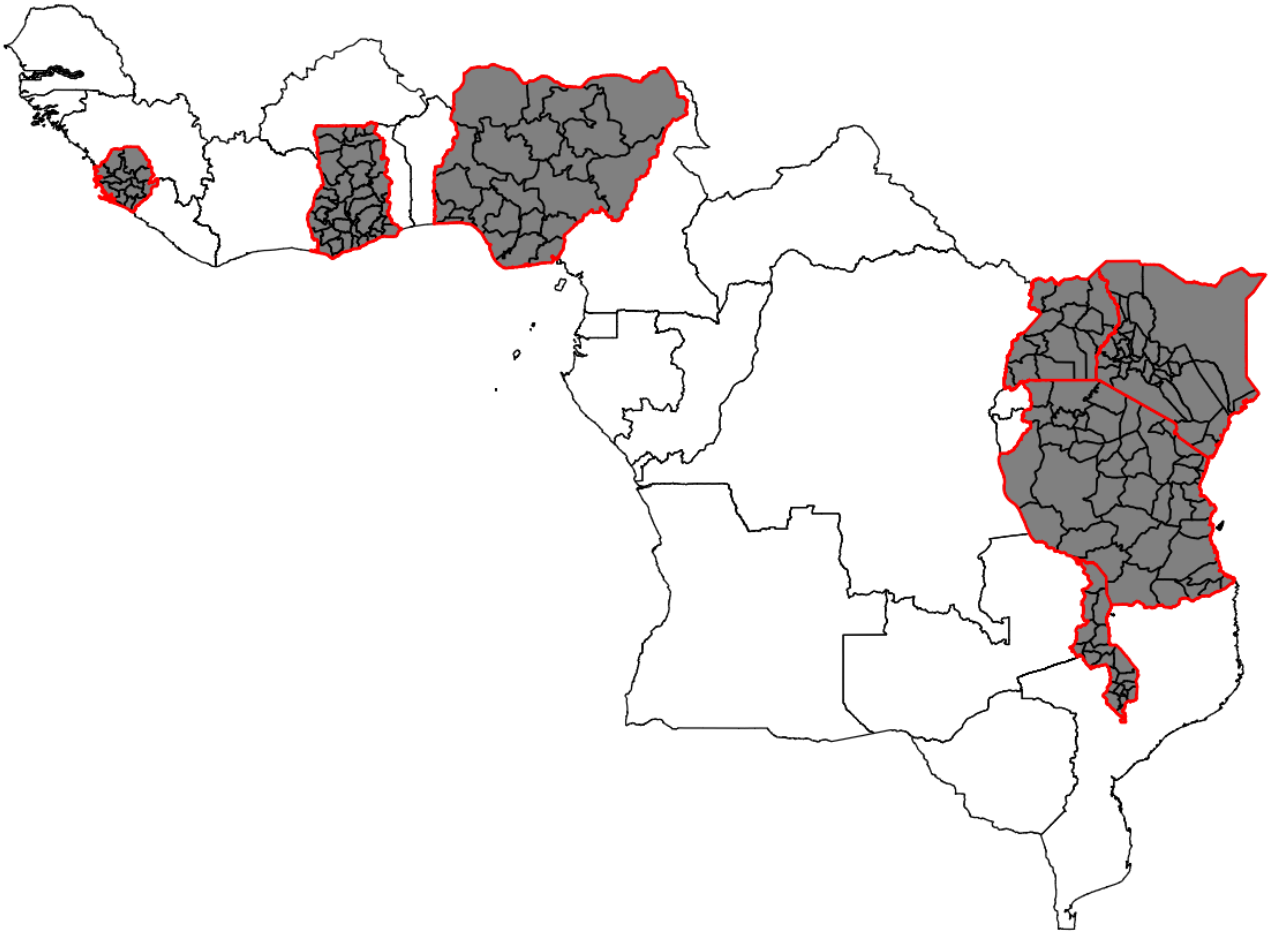
Tanganyika
District borders are the administrative borders from 1933 reported in Berry (1971).

Uganda
District borders are the administrative borders from 1950 as reported in the "Administration Report 1948" (National Archives CO685/31).

Sierra Leone
District borders are the administrative borders from 1920-1930 reported in Abraham (1978) (National Archives CO657/6).

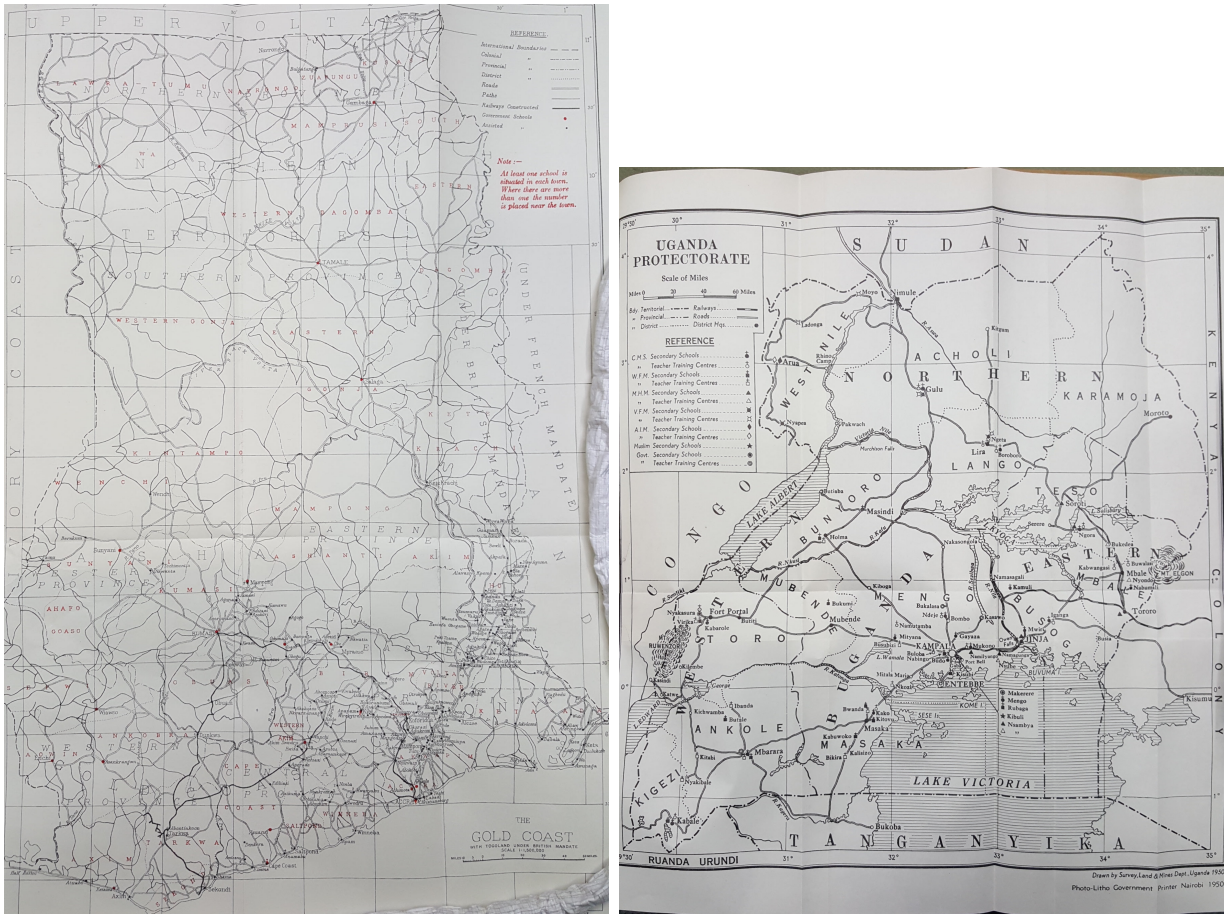
B Additional Figures

Figure B.1: **British colonial districts in tropical Africa**



Notes: British colonial districts in tropical Africa. Red lines delineate the countries in our sample, i.e. the British colonies in tropical Africa. Within these boundaries, each gray polygon corresponds to a colonial district. Sources: authors' elaboration from historical maps; see appendix A

Figure B.2: **Historical map with administrative division by colonial districts: Gold Coast (1930) and Uganda (1950)**



Notes: The figure presents two historical maps showing colonial administrative district divisions during the British colonial period. Picture (a) depicts the administrative structure of the Gold Coast (present-day Ghana), with districts as of 1930. Picture (b) shows the administrative map of Uganda and its colonial districts in 1950. Sources: Picture (a), Administration Report 1930 (National Archives CO98/55, 58); Picture (b), Administration Report 1948 (National Archives CO685/31).

C Additional Tables

Table C.1: **Instrument and pre-colonial measures of women's status**

	(1) Bride price	(2) Polygyny	(3) Dependence on Agriculture	(4) Matriliny
Cash crop suitability	0.0238	0.0233	0.0508	0.0907*
	(1.38)	(1.46)	(1.20)	(1.99)
Observations	123	123	123	123

The table reports OLS estimates. Unit of observation is ethnicity. Cash Crop Suitability Index is the instrument as constructed in equation 3.3. Bride price is a dummy equal to 1 if a bride price is customary; Polygyny is a dummy equal to 1 if polygyny is practiced instead of monogamy; Matriliny is a dummy equal to 1 if the system of descent is not patrilineal; Dependence on agriculture is a percentage of an ethnic dependence on such activity as main source of subsistence. Standard errors clustered at the district level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.2: **Women's empowerment and colonial cash crops (adding Tobacco)**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.139***	0.199***	0.367***	0.354***
	(0.052)	(0.040)	(0.087)	(0.125)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.14	10.56
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.127***	0.208***	0.481***	0.363**
	(0.044)	(0.073)	(0.134)	(0.152)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.14	10.56
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.3: **Women's empowerment and colonial cash crops (adding coconut/copra)**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.121*	0.202***	0.412***	0.427***
	(0.063)	(0.041)	(0.115)	(0.142)
Observations	161786	161786	161786	161786
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.41	8.660
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.128***	0.218***	0.631***	0.649***
	(0.044)	(0.074)	(0.184)	(0.229)
Observations	161786	161786	161786	161786
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.41	8.660
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.4: **Women's empowerment and colonial cash crops (adding tobacco and coconut/Copra)**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.139***	0.199***	0.395***	0.436***
	(0.052)	(0.040)	(0.105)	(0.150)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.74	8.840
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.127***	0.208***	0.558***	0.556***
	(0.044)	(0.073)	(0.161)	(0.213)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.74	8.840
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.5: **Alternative outcome (adding tobacco)**

Panel A: Education

	(1)	(2)	(3)	(4)
Cash crop production	0.267***	0.394***	0.813***	0.589***
	(0.093)	(0.104)	(0.208)	(0.200)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.14	10.56
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Labor Force Participation

	(1)	(2)	(3)	(4)
Cash crop production	0.046***	0.058**	0.103**	0.018
	(0.016)	(0.026)	(0.048)	(0.049)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.14	10.56
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. Education is measured in years of education. Labor Force Participation is a dummy equal to 1 if a woman was employed in the 12 months prior to the survey. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.6: **Alternative outcome (adding cocoa/copra)**

Panel A: Education

	(1)	(2)	(3)	(4)
Cash crop production	0.265***	0.414***	1.010***	0.911***
	(0.092)	(0.104)	(0.276)	(0.282)
Observations	161786	161786	161786	161786
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.41	8.660
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Labor Force Participation

	(1)	(2)	(3)	(4)
Cash crop production	0.048***	0.061**	0.155***	0.110*
	(0.016)	(0.027)	(0.058)	(0.063)
Observations	161786	161786	161786	161786
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.41	8.660
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. Education is measured in years of education. Labor Force Participation is a dummy equal to 1 if a woman was employed in the 12 months prior to the survey. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.7: **Alternative outcome (adding tobacco and cocoa/copra)**

Panel A: Education

	(1)	(2)	(3)	(4)
Cash crop production	0.267***	0.394***	0.909***	0.806***
	(0.093)	(0.104)	(0.244)	(0.270)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.74	8.840
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Labor Force Participation

	(1)	(2)	(3)	(4)
Cash crop production	0.046***	0.058**	0.127**	0.062
	(0.016)	(0.026)	(0.052)	(0.057)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			13.74	8.840
Country-wave FE		Y	Y	Y
Baseline controls				Y

The table reports OLS and 2SLS estimates. The unit of observation is a DHS respondent. Education is measured in years of education. Labor Force Participation is a dummy equal to 1 if a woman was employed in the 12 months prior to the survey. Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). For further details on how the above-mentioned control variables are constructed, see Section 3.3.3 and appendix A. Standard errors are clustered at the ethnicity level. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Table C.8: **Robustness to Two-Way Clustering by Ethnic Group and District of Origin**

Panel A: Beating Index

	(1)	(2)	(3)	(4)
Cash crop production	0.121*	0.201***	0.392***	0.352***
	(0.062)	(0.041)	(0.109)	(0.128)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			11.71	10.26
Country-wave FE		Y	Y	Y
Baseline controls				Y

Panel B: Decision Index

	(1)	(2)	(3)	(4)
Cash crop production	0.127***	0.216***	0.589***	0.497**
	(0.044)	(0.074)	(0.183)	(0.193)
Observations	161777	161777	161777	161777
Model	OLS	OLS	2SLS	2SLS
K-P F-Stat			11.71	10.26
Country-wave FE		Y	Y	Y
Baseline controls				Y

This table reports OLS and 2SLS estimates, assessing the robustness of baseline results using two-way clustered standard errors by ethnic group and district of origin. The unit of observation is a DHS respondent. The *Beating Free Index* and the *Decision Index* are constructed from DHS survey responses, measuring respectively women's attitudes toward rejecting rather than justifying a partner's violent behavior, and women's decision-making power within the household (see Section 3.3.1). Cash crop production refers to the value of export-oriented cash crops in each colonial district, from Hance et al. (1961), divided by the area of the district, with the resulting measure expressed in dollars per square kilometer. For further details on how this variable was constructed, see section 3.3.2. Baseline controls include: mean population density in 1930 (Klein Goldewijk et al., 2017), dimension of ancestral district in squared km (authors' elaboration in GIS); land quality (Ramankutty et al., 2002); ruggedness of terrain (Nunn and Puga, 2012). Standard errors are clustered along two dimensions: ethnicity group and district of origin. *, ** and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Reference List

Abraham, A. (1978). *Mende Government and Politics Under Colonial Rule: A Historical Study of Political Change in Sierra Leone, 1890-1937*. Sierra Leone University Press.

Acemoglu, D., D. H. Autor, and D. Lyle (2004). Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Midcentury. *Journal of Political Economy 112*(3), 497–551.

Acemoglu, D., J. Moscona, and J. A. Robinson (2016). State Capacity and American Technology: Evidence from the Nineteenth Century. *American Economic Review 106*(5), 61–67.

Acemoglu, D. and J. A. Robinson (2023). Weak, Despotic, or Inclusive? How State Type Emerges from State versus Civil Society Competition. *American Political Science Review 117*(2), 407–420.

Acemoglu, D., J. A. Robinson, and R. Torvik (2020). The Political Agenda Effect and State Centralization. *Journal of Comparative Economics 48*(4), 749–778.

Acharya, A., M. Blackwell, and M. Sen (2016). The Political Legacy of American Slavery. *Journal of Politics 78*, 621–641.

Afridi, F., M. Bishnu, K. Mahajan, and S. J. S. S. Marg (2024). What Determines Women's Labor Supply? The Role of Home Productivity and Social Norms. *Journal of Demographic Economics 90*(1), 55–87.

Aghion, P. and P. Howitt (1992). A Model of Growth Through Creative Destruction. *Econometrica 60*(2), 323–351.

Aghion, P. and P. Howitt (1998). *Endogenous Growth Theory*. Cambridge, MA: MIT Press.

Akyeampong, E. and H. Fofack (2014). The Contribution of African Women to Economic Growth and Development in the Pre-Colonial and Colonial Periods: Historical Perspectives and Policy Implications. *Economic History of Developing Regions 29*(1), 42–73.

Alan, S., S. Ertac, and I. Mumcu (2018). Gender Stereotypes in the Classroom and Effects on Achievement. *Review of Economics and Statistics 100*(5), 876–890.

Alesina, A., B. Brioschi, and E. L. Ferrara (2021). Violence Against Women: An Cross-cultural Analysis for Africa. *Economica 88*(349), 70–104.

Alesina, A., P. Giuliano, and N. Nunn (2013). On the Origins of Gender Roles: Women and the Plough. *Quarterly Journal of Economics 128*(2), 469–530.

Ali, M. and O. H. Fjeldstad (2023). Pre-colonial Centralization and Tax Compliance Norms in Contemporary Uganda. *Journal of Institutional Economics 19*(3), 379–400.

Allcott, H. and D. Keniston (2017). Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America. *Review of Economic Studies 85*(2), 695–731.

Allen, R. C., M. C. Bertazzini, and H. Leander (2023). The Economic Origins of Government. *American Economic Review 113*(10), 2507–2545.

Alsan, M. (2015). The Effect of the Tsetse Fly on African Development. *American Economic Review 105*(1), 382–410.

Andersen, T. B., P. S. Jensen, and C. V. Skovsgaard (2016). The Heavy Plow and the Agricultural Revolution in Medieval Europe. *Journal of Development Economics 118*, 133–149.

Andersson, D., T. Berger, and E. Prawitz (2023). Making a Market: Infrastructure, Integration, and the Rise of Innovation. *Review of Economics and Statistics 105*(2), 258–274.

Angrist, J. D. and J.-S. Pischke (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.

Arnold, U. (1989). In U. Arnold (Ed.), *Zur Wirtschaftsentwicklung des Deutschen Ordens im Mittelalter [On the Economic Development of the Teutonic Order in the Middle Ages]*, Volume 39 of *Quellen und Studien zur Geschichte des Deutschen Ordens [Sources and Studies on the History of the Teutonic Order]*. Marburg: Elwert.

Asher, S. and P. Novosad (2020). Rural Roads and Local Economic Development. *American Economic Review 110*(3), 797–823.

Asiedu, E., T. T. Azomahou, Y. Getachew, and E. Yitbarek (2021). Share the Love: Parental Bias, Women Empowerment and Intergenerational Mobility. *Journal of Economic Behavior Organization 191*, 846–867.

Atkin, D. (2009). Working for the Future: Female Factory Work and Child Health in Mexico. *Unpublished Manuscript, Yale University 150*.

Atkin, D., A. K. Khandelwal, and A. Osman (2017). Exporting and Firm Performance: Evidence from a Randomized Experiment. *Quarterly Journal of Economics 132*(2), 551–615.

Austin, G. (2009). Cash Crops and Freedom: Export Agriculture and the Decline of Slavery in Colonial West Africa. *International Review of Social History 54*(1), 1–37.

Austin, G. (2014). Vent for Surplus or Productivity Breakthrough? The Ghanian Cocoa Take-Off, c. 1890–1936. *Economic History Review 67*(4), 1035–1064.

Baiardi, A. (2025). The Persistent Effect of Gender Division of Labour: African American Women After Slavery. Working Paper.

Banks, N. (2013). Female Employment in Dhaka, Bangladesh: Participation, Perceptions and Pressures. *Environment and Urbanization 25*(1), 95–109.

Bardach, J., B. Lesnodorski, and M. Pietrzak (1987). *Historia Państwa i Prawa Polskiego*. Warsaw: Państwowe Wydawnictwo Naukowe.

Bartholomew, J. G. and G. C. Brooke (1918). *A Literary and Historical Atlas of Africa and Australasia*. JM Dent & Sons.

Baten, J., M. de Haas, E. Kempter, and F. M. zu Selhausen (2021). Educational Gender Inequality in Sub-saharan Africa: An Long-term Perspective. *Population and Development Review 47*(3), 813–849.

Bates, R. H. (1983). *Essays on the Political Economy of Rural Africa*. Cambridge University Press.

Baum-Snow, N. (2007). Did Highways Cause Suburbanization? *Quarterly Journal of Economics 122*(2), 775–805.

Baum-Snow, N., L. Brandt, J. V. Henderson, M. A. Turner, and Q. Zhang (2017). Roads, Railroads, and Decentralization of Chinese Cities. *Review of Economics and Statistics 99*(3), 435–448.

Baumann, H. (1928). The Division of Work According to Sex in African Hoe Culture. *Africa 1*(3), 289–319.

Beach, H. P. (1903). *A Geography and Atlas of Protestant Missions: Their Environment, Forces, Distribution, Methods, Problems, Results and Prospects at the Opening of the Twentieth Century*, Volume 2. Student Volunteer Movement for Foreign Missions.

Beach, H. P. and C. H. Fahs (1925). *World Missionary Atlas*. Institute for Social and Religious Research.

Becker, A. (2019). On the Economic Origins of Restrictions on Women's Sexuality. *CESifo Working Paper Series* (7770).

Becker, B. and F. Meier zu Selhausen (2023). Women on a Mission: Protestant Legacies of Gender Equality in Africa? Working Paper 72, African Economic History Network.

Becker, G. S. (1981). *A Treatise on the Family*. Cambridge, MA: Harvard University Press.

Becker, S. O. and L. Woessmann (2008). Luther and the Girls: Religious Denomination and the Female Education Gap in 19th Century Prussia. *The Scandinavian Journal of Economics 110*(4), 777–805.

Bernard, A. B., S. J. Redding, and P. K. Schott (2010). Multiple-product Firms and Product Switching. *American Economic Review 100*(1), 70–97.

Berry, L. (1971). *Tanzania in Maps*. London: University of London Press.

Berry, S. (1975). *Cocoa, Custom and Socio-economic Change in Rural Western Nigeria*. Oxford, Clarendon Press.

Besley, T. and T. Persson (2010). State Capacity, Conflict, and Development. *Econometrica 78*(1), 1–34.

Besley, T. and M. Reynal-Querol (2014). The Legacy of Historical Conflict: Evidence from Africa. *American Political Science Review 108*(2), 319–336.

Bezner Kerr, R. (2010). Groundnuts as 'Economic Crop' or 'Wife of the Home'? Gendered Struggles Over Africa's First Cash Crop in Northern Nyasaland. *Journal of Historical Geography 36*(1), 79–89.

Bisin, A. and T. Verdier (2024). On the Joint Evolution of Culture and Political Institutions: Elites and Civil Society. *Journal of Political Economy 132*(5), 1485–1564.

Biskup, M. (1991). Etniczno-demograficzne Przemiany Prus Krzyżackich w Rozwoju Osadnictwa w Sredniowieczu [Ethnic and Demographic Changes in the Teutonic Prussian State during the Development of Settlement in the Middle Ages]. *Institute of History of the Polish Academy of Sciences*.

Blaydes, L. and E. Chaney (2013). The Feudal Revolution and Europe's Rise: Political Divergence of the Christian West and the Muslim World Before 1500 CE. *American Political Science Review 107*(1), 16–34.

Bordalo, P., N. Gennaioli, Y. Ma, and A. Shleifer (2020). Overreaction in Macroeconomic Expectations. *American Economic Review 110*(9), 2748–2782.

Bordalo, P., N. Gennaioli, and A. Shleifer (2018). Diagnostic Expectations and Credit Cycles. *Journal of Finance 73*(1), 199–227.

Borker, G., J. Eeckhout, N. Luke, S. Minz, K. Munshi, and S. Swaminathan (2026, April). Wealth, Marriage, and Sex Selection. *American Economic Journal: Applied Economics 18*(2), 107–46.

Boserup, E. (1970). *Women's Role in Economic Development*. London, George Allen and Unwin Ltd.

Bosshart, L. and J. Dittmar (2021). Pandemic Shock and Economic Divergence: Political Economy Before and After the Black Death. *CEP Discussion Papers dp1805*.

Brambor, T., A. Goenaga, J. Lindvall, and J. Teorell (2020). The Lay of the Land: Information Capacity and the Modern State. *Comparative Political Studies 53*(2), 175–213.

Brecke, P. (1999). Violent Conflicts 1400 AD to the Present in Different Regions of the World. *Paper presented at the Annual Meeting of the Peace Science Society (International), Ann Arbor, MI, October 1999*.

Bruhn, M. and F. A. Gallego (2012). Good, Bad, and Ugly Colonial Activities: Do They Matter for Economic Development? *The Review of Economics and Statistics 94*(2), 433–461.

Bryceson, D. (1990). *Food Insecurity and the Social Division of Labour in Tanzania, 1919-85*. Springer.

Brülhart, M., M. Koethenbuerger, M. Krapf, R. Parchet, K. Schmidheiny, and D. Staubli (2023). Competition, Harmonization and Redistribution: Corporate Taxes in Switzerland. *NBER Working Paper Series* (31830).

Byfield, J. A. (2018). African Women in Colonial Economies. In *The Palgrave Handbook of African Colonial and Postcolonial History*, pp. 145–170. Springer.

Calonico, S., M. D. Cattaneo, M. H. Farrell, and R. Titiunik (2017). Rdrobust: Software for Regression-discontinuity Designs. *The Stata Journal 17*(2), 372–404.

Calonico, S., M. D. Cattaneo, and R. Titiunik (2014). Robust nonparametric confidence intervals for regression-discontinuity designs. *Econometrica 82*(6), 2295–2326.

Calvi, R. (2020). Why Are Older Women Missing in India? The Age Profile of Bargaining Power and Poverty. *Journal of Political Economy 128*(7), 2453–2501.

Campa, P. and M. Serafinelli (2019). Politico-economic Regimes and Attitudes: Female Workers under State-socialism. *Review of Economics and Statistics 101*(2), 233–248.

Campante, F. and D. Yanagizawa-Drott (2018). Long-range Growth: Economic Development in the Global Network of Air Links. *Quarterly Journal of Economics 133*(3), 1395–1458.

Cantoni, D., J. Dittmar, and N. Yuchtman (2018). Religious Competition and Reallocation: The Political Economy of Secularization in the protestant Reformation. *Quarterly Journal of Economics 133*, 2037–2096.

Cantoni, D., C. Mohr, and M. Weigand (2020). *Princes and Townspeople: A Collection of Historical Statistics on german Territories and Cities. 3: Town Charters and First Mentions*. Harvard Dataverse.

Cantoni, D., C. Mohr, and M. Weigand (2024). The Rise of Fiscal Capacity: Administration and State Consolidation in the Holy Roman Empire. *Econometrica 92*(5), 1439–1472.

Cappelli, G. and J. Baten (2021). Numeracy Development in Africa: New Evidence from a Long-term Perspective (1730–1970). *Journal of Development Economics 150*.

Caselli, F. and G. Michaels (2013). Do Oil Windfalls Improve Living Standards? Evidence from Brazil. *American Economic Journal: Applied Economics 5*(1), 208–38.

Cervellati, M., E. Esposito, and U. Sunde (2017). Long-term Exposure to Malaria and Development: Disaggregate Evidence for Contemporaneous Africa. *Journal of Demographic Economics 83*(1), 129–148.

Chong, A. and E. La Ferrara (2009). Television and Divorce: Evidence from Brazilian Novelas. *Journal of the European Economic Association 7*(2-3), 458–468.

Christiansen, E. (1980). *The Northern Crusades: The Baltic and the Catholic Frontier, 1100-1525* (2 ed.). New Studies in Medieval History. Macmillan.

Cogley, T. and T. J. Sargent (2005). The Conquest of U.S. Inflation: Learning and Robustness to Model Uncertainty. *European Central Bank: Working Paper Series 478*.

Cogneau, D. and R. Jedwab (2012). Commodity Price Shocks and Child Outcomes: The 1990 Cocoa Crisis in Cote d'Ivoire. *Economic Development and Cultural Change 60*(3), 507–534.

Comin, D. and B. Hobijn (2004). Cross-country Technology Adoption: Making the Theories Face the Facts. *Journal of Monetary Economics 51*(1), 39–83.

Comin, D. and M. Mestieri (2018). If Technology Has Arrived Everywhere, Why Has Income Diverged? *American Economic Journal: Macroeconomics 10*(3), 137–178.

Conley, T. G. (1999). GMM Estimation with Cross Sectional Dependence. *Journal of Econometrics 92*(1), 1–45.

Conley, T. G. (2010). Spatial Econometrics. In S. N. Durlauf and L. E. Blume (Eds.), *Microeconometrics*, pp. 303–313. London: Palgrave Macmillan UK.

Cools, A., R. Fernández, and E. Patacchini (2022). The Asymmetric Gender Effects of High Flyers. *Labour Economics 79*, 102287.

Coquery-Vidrovitch, C. (1997). *African Women: A Modern History*. Boulder, CO: Westview Press.

Cox, G. W., M. Dincecco, and M. G. Onorato (2025). Warfare, Fiscal Gridlock, and State Formation During Europe's Military Revolution. *Journal of Politics 87*(4), 1450–1464.

Czaja, R. and A. Radziminski (2016). *The Teutonic Order in Prussia and Livonia: The Political and Ecclesiastical Structures 13th-16th Century* (1 ed.). Bohlau Verlag.

Dalton, J. T. and T. C. Leung (2014). Why Is Polygyny More Prevalent in Western Africa? An African Slave Trade Perspective. *Economic Development and Cultural Change 62*(4), 599–632.

D'Arcy, M. and M. Nistotskaya (2017). State First, Then Democracy: Using Cadastral Records to Explain Governmental Performance in Public Goods Provision. *Governance 30*(2), 193–209.

Davies, N. (2005). *God's Playground. Vol. 1, the Origins to 1795*. New York: Columbia University Press.

Davison, J. (1988). *Agriculture, Women, and Land: The African Experience*. Boulder, CO: Westview Press.

De Haas, M. and E. Frankema (2018). Gender, Ethnicity, and Unequal Opportunity in Colonial Uganda: European Influences, African Realities, and the Pitfalls of Parish Register Data. *Economic History Review 71*(3), 965–994.

De Haas, M. and E. Travieso (2022). Cash-crop Migration Systems in East and West Africa: Rise, Endurance, Decline. In M. Haas and E. Frankema (Eds.), *Migration in Africa: Shifting Patterns of Mobility, 19th to 21st Centuries*, pp. 231–255. Routledge.

Dell, M. (2010). The Persistent Effects of Peru's Mining Mita. *Econometrica 78*(6), 1863–1903.

Dell, M., N. Lane, and P. Querubin (2018). The Historical State, Local Collective Action, and Economic Development in Vietnam. *Econometrica 86*(6), 2083–2121.

Devenow, A. and I. Welch (1996). Rational Herding in Financial Economics. *European Economic Review 40*(3–5), 603–615.

Dhamija, G., P. Roychowdhury, and B. Shankar (2023). Urbanization and Women Empowerment: Evidence from India. *Global Labor Organization (GLO) Discussion Paper Series* (1323).

Dhar, D., T. Jain, and S. Jayachandran (2019). Intergenerational Transmission of Gender Attitudes: Evidence from India. *Journal of Development Studies 55*(12), 2572–2592.

Dincecco, M. (2023). New Perspectives on State Formation. *Perspectives on Politics 21*(4), 1447–1452.

Dincecco, M., J. Fenske, B. Gupta, and A. Menon (2024). Conflict and Gender Norms. *The Warwick Economics Research Paper Series (TWERPS)* (1491).

Dincecco, M. and G. Katz (2016). State Capacity and Long-run Economic Performance. *Economic Journal 126*(590), 189–218.

Dittmar, J. E. and R. R. Meisenzahl (2020). Public Goods Institutions, Human Capital, and Growth: Evidence from German History. *Review of Economic Studies 87*(2), 959–996.

Doepke, M., M. Tertilt, and A. Voena (2012). The Economics and Politics of Women's Rights. *Annual Review of Economics 4*(1), 339–372.

Donaldson, D. (2018). Railroads of the Raj: Estimating the Impact of Transportation Infrastructure. *American Economic Review 108*(4-5), 899–934.

Donaldson, D. and R. Hornbeck (2016). Railroads and American Economic Growth: A "Market Access" Approach. *Quarterly Journal of Economics 131*(2), 799–858.

Doraszelski, U., G. Lewis, and A. Pakes (2018). Just Starting Out: Learning and Equilibrium in a New Market. *American Economic Review 108*(3), 565–615.

Doucette, J. S. (2026). *How Settlers Shaped Eastern Europe and Scandinavia: Economic Development, Regime Change, and State Formation, 800–1800*. Elements in Political Economy. Cambridge University Press.

Duflo, E. (2012). Women Empowerment and Economic Development. *Journal of Economic Literature 50*(4), 1051–79.

Eble, A. and H. Feng (2022). Gendered Beliefs about Mathematics Ability Transmit across Generations Through Children's Peers. *Nature Human Behaviour 6*(6), 868–879.

Edlund, L. and H. Ku (2011). The African Slave Trade and the Curious Case of General Polygyny. *MPRA Working Paper* (52735).

Ekdahl, S. (2002). *The Strategic Organization of the Commanderies of the Teutonic Order in Prussia and Livonia*, pp. 219–242. Paris: Comité des Travaux Historiques et Scientifiques.

Eli, S., J. K. Hausman, and P. W. Rhode (2022). Transportation Revolution: The Car in the 1920s. *AEA Papers and Proceedings 112*, 219–223.

Eli, S., J. K. Hausman, and P. W. Rhode (2025). The Model T. *Journal of Economic History 85*(1), 110–151.

Epstein, S. R. (2000). *Freedom and Growth: The Rise of States and Markets in Europe, 1300-1750* (1 ed.). Routledge.

Erlen, P. (1992). *Europäischer Landesausbau Und Mittelalterliche Deutsche Ostsiedlung: Ein Struktureller Vergleich Zwischen Südwestfrankreich, den Niederlanden dnd dem Ordensland Preussen [European Territorial Expansion and the Medieval German Eastward Settlement: A Structural Comparison Between Southwestern France, the Netherlands, and the Teutonic Order's Prussian State.]*, Volume 9 of *Historische und landeskundliche Ostmitteleuropa-Studien*. Marburg/Lahn: J.G. Herder-Institut.

Etienne, M. (1977). Women and Men, Cloth and Colonization: The Transformation of Production-distribution Relations Among the Baule (Ivory Coast). *Cahiers D'études Africaines*, 41–64.

European Environment Agency (EEA), and Copernicus Land Monitoring Service (2019a). EU-DEM V1.1 –digital Elevation Model, Version 1.1. *Copernicus Programme*.

European Environment Agency (EEA), and Copernicus Land Monitoring Service (2019b). EU-hydro – River Network Database, Version 1.3. *Copernicus Programme*.

Evans, G. W. and S. Honkapohja (2001). *Learning and Expectations in Macroeconomics*. Princeton University Press.

Evans, G. W. and S. Honkapohja (2011). Learning as a Rational Foundation for Macroeconomics and Finance. *Bank of Finland: Research Discussion Papers 8/2011*.

Faber, B. (2014). Trade Integration, Market Size, and Industrialization: Evidence from China's National Trunk Highway System. *Review of Economic Studies 81*(3), 1046–1070.

Faber, B. and C. Gaubert (2019). Tourism and Economic Development: Evidence from Mexico's Coastline. *American Economic Review 109*(6), 2245–2293.

Falola, T. and M. Heaton (2008). *A History of Nigeria*. Cambridge University Press.

Fatima, A. and H. Sultana (2009). Tracing Out the U-shape Relationship between Female Labor Force Participation Rate and Economic Development for Pakistan. *International Journal of Social Economics 36*(1/2), 182–198.

Federal Office of Topography (1845–1865). The Dufour Map of Switzerland. *Historical Topographic Maps of Switzerland*. Topographic map series at 1:100000 scale.

Federal Office of Topography (1870–1926). The Siegfried Map (Topographic Atlas of Switzerland). *Historical Topographic Maps of Switzerland*. Topographic Atlas at 1:25000 and 1:50000 scale.

Feld, L. P. and J. G. Matsusaka (2003). Budget Referendums and Government Spending: Evidence from Swiss Cantons. *Journal of Public Economics 87*(12), 2703–2724.

Fenske, J. (2013). Does Land Abundance Explain African Institutions? *The Economic Journal 123*(573), 1363–1390.

Fenske, J. (2014). Ecology, Trade, and States in Pre-colonial Africa. *Journal of the European Economic Association 12*(3), 612–640.

Fenske, J. (2015). African Polygamy: Past and Present. *Journal of Development Economics 117*, 58–73.

Fernández, R. (2007). Women, Work, and Culture. *Journal of the European Economic Association 5*(2-3), 305–332.

Fernández, R., A. Fogli, and C. Olivetti (2004). Mothers and Sons: Preference Formation and Female Labor Force Dynamics. *Quarterly Journal of Economics 119*(4), 1249–1299.

Ferrara, E. L., A. Chong, and S. Duryea (2012). Soap Operas and Fertility: Evidence from Brazil. *American Economic Journal: Applied Economics 4*(4), 1–31.

Food and Agriculture Organization (FAO), and International Institute for Applied Systems Analysis (IIASA) (2021). Global Agro Ecological Zones Version 4 (GAEZ V4), Data Downloaded: 29/09/2021.

Frankema, E. (2011). Colonial Taxation and Government Spending in British Africa, 1880-1940: Maximizing Revenue or Minimizing Effort? *Explorations in Economic History 48*(1), 136–149.

Frankema, E. H. P. and M. van Waijenburg (2013). Endogenous Colonial Institutions: Lessons From Fiscal Capacity Building in british and French Africa, 1880-1940. African Economic History Network Working Paper No. 11.

Friedrich Bruns, H. W. (1875). *Hansische Handelsstrassen: Quellen und Darstellungen zur Hansischen Geschichte [Hanseatic Trade Routes: Sources and Descriptions of Hanseatic History]* (1 ed.). H. Böhlaus Nachfolger.

Galor, O., O. Moav, and D. Vollrath (2009). Inequality in Landownership, the Emergence of Human-Capital Promoting Institutions, and the Great Divergence. *The Review of Economic Studies 76*(1), 143–179.

Galor, O. and Ö. Özak (2016). The Agricultural Origins of Time Preference. *American Economic Review 106*(10), 3064–3103.

Gardner, L. A. (2012). *Taxing Colonial Africa: The Political Economy of British Imperialism*. Oxford University Press.

Garfias, F. (2018). Elite Competition and State Capacity Development: Theory and Evidence from Post-revolutionary Mexico. *American Political Science Review 112*(2), 339–357.

Garras, F. and E. A. Sellars (2024). State Building. In *Oxford Handbook of Historical Political Economy*, pp. 209–236. Oxford University Press.

Gennaioli, N. and H.-J. Voth (2011). State Capacity and Military Conflict. *Review of Economic Studies 82*(4), 1409–1448.

Gingerich, D. W. and J. P. Vogler (2021). Pandemics and Political Development: The Electoral Legacy of the Black Death in Germany. *World Politics 73*(3), 393–440.

Gloger, Z. (1900). *Encyklopedia Staropolska [Encyclopedia of Old Polish Culture], T. III*. Druk P. Laskauera i W. Babickiego.

Goldin, C. (1995). The U-shaped Female Labor Force Function in Economic Development and Economic History. In T. P. Schultz (Ed.), *Investment in Women's Human Capital and Economic Development*, pp. 61–90. University of Chicago Press.

Goldin, C. and C. Olivetti (2013). Shocking Labor Supply: A Reassessment of the Role of World War II on Women's Labor Supply. *American Economic Review 103*(3), 257–62.

Goldstein, D. A. N. and Y. Magiya (2024). Bargaining Over State Building in the Shadow of War. *Working Paper*.

Goody, J. (1973). Polygyny, Economy, and the Role of Women. In *The Character of Kinship*, pp. 175–190. Cambridge University Press Cambridge.

Grier, B. (1992). Pawns, Porters, and Petty Traders: Women in the Transition to Cash Crop Agriculture in Colonial Ghana. *Signs: Journal of Women in Culture and Society 17*(2), 304–328.

Grigg, D. B. (1975). The World's Agricultural Labour Force 1800-1970. *Geography 60*(3), 194–202.

Grosfeld, I. and E. Zhuravskaya (2015). Cultural vs. Economic Legacies of Empires: Evidence from the Partition of Poland. *Journal of Comparative Economics 43*(1), 55–75.

Grosjean, P. and R. Khattar (2018). It's Raining Men! Hallelujah? The Long-Run Consequences of Male-biased Sex Ratios. *Review of Economic Studies 86*(2), 723–754.

Gross, D. P. and B. N. Sampa (2023). America, Jump-started: World War II R&D and the Takeoff of the US Innovation System. *American Economic Review 113*(12), 3323–3356.

Guyer, J. I. (1980). Food, Cocoa, and the Division of Labour by Sex in Two West African Societies. *Comparative Studies in Society and History 22*(3), 355–373.

Guzowski, P. (2018). Economic Geography of Poland in the Period of Growth (14–16th Century) in the Polish Historical Study. *Studia Geohistorica - Rocznik Historyczno-geograficzny 06*.

Górski, K. (1977). *Zakon Krzyżacki a Powstanie Państwa Pruskiego [The Teutonic Order and the Establishment of the Prussian State]*. Zakład Narodowy im. Ossolińskich.

Hailey, W. M. and L. Hailey (1957). *An African Survey Revised 1956. A Study of Problems Arising in Africa South of the Sahara*. Oxford University Press.

Hance, W., A. V. Kotschar, and R. J. Peterec (1961). Source Areas of Export Production in Tropical Africa. *Geographical Review 51*(4), 487–499.

Hansen, C. W., P. S. Jensen, and C. V. Skovsgaard (2015). Modern Gender Roles and Agricultural History: The Neolithic Inheritance. *Journal of Economic Growth 20*(4), 365–404.

Harreld, D. J. (2015). *A Companion to the Hanseatic League* (1 ed.). Leiden, The Netherlands: Brill.

Hart, K. et al. (1982). *The Political Economy of West African Agriculture.* Cambridge University Press.

Heath, R. and X. Tan (2020). Intrahousehold Bargaining, Female Autonomy, and Labor Supply: Theory and Evidence from India. *Journal of the European Economic Association 18*(4), 1928–1968.

Heldring, L. (2025). The Origins of Government and the State. *Annual Review of Economics 17*(17), 77–97.

Henderson, M. and W. Whatley (2014). Pacification and Gender in Colonial Africa: Evidence from the Ethnographic Atlas. *MPRA Working Paper No. 61203*.

Hill, P. (1963). *The Migrant Cocoa-farmers of Southern Ghana: An Study in Rural Capitalism.* London: Cambridge University Press.

Hollinger, S. (2018). *Graubünden und das Auto: Kontroversen um den Automobilverkehr 1900-1925 [Graubünden and the Automobile: Controversies over Motor Traffic, 1900–1925]*, Volume 19 of *Sources and Research on Graubünden's History.* Chur: Graubünden State Archives, Kommissionsverlag Desertina.

Holterman, B., M. C. Dengg, M. A.B., P. Jensen, A. Ludorff, V. Möller, S. Harritz, C. S. Andersen, L. van Prooije, A. de Mars, N. Rudolph, and A. de Vreese (2021). Viabundus Pre-modern Street Map 1.0, Released: 19/04/2021.

Hornung, E. (2014). Immigration and the Diffusion of Technology: The Huguenot Diaspora in Prussia. *American Economic Review 104*(1), 84–122.

Hornung, E. (2015). Railroads and Growth in Prussia. *Journal of the European Economic Association 13*(4), 699–736.

ICF (2023). The DHS Program: Demographic and Health Surveys. `https://dhsprogram.com`. Available from: `https://dhsprogram.com`.

IHPAN (1985-2014). *Urzędnicy Dawnej Rzeczypospolitej XII-XVIII Wieku [Officials of the Former Polish–lithuanian Commonwealth from the 12th to the 18th Century].* Instytut Historii im. Tadeusza Manteuffla PAN.

IHPAN (2021). Polish Lands of the Crown in the 16th Century - Spatial Database, Updated: 13.12.2021. *Instytut Historii Im. Tadeusza Manteuffla Polskiej Akademii Nauk (IHPAN) [The Tadeusz Manteuffel Institute of History of the Polish Academy of Sciences]*, accessed: 01/06/2021.

Imbens, G. and K. Kalyanaraman (2012). Optimal Bandwidth Choice for the Regression Discontinuity Estimator. *Review of Economic Studies 79*(3), 933–959.

Imbens, G. W. and T. Lemieux (2008). Regression Discontinuity Designs: a Guide to Practice. *Journal of Econometrics 142*(2), 615–635. The regression discontinuity design: Theory and applications.

Imbens, G. W. and J. M. Wooldridge (2009). Recent Developments in the Econometrics of Program Evaluation. *Journal of Economic Literature 47*(1), 5–86.

Instytut Historii im. Tadeusza Manteuffla PAN (2021). *Historical Atlas of Poland / Polish Academy of Sciences. Institute of History ; Collective Edition*. Publishing Department of Institute of History Polish Academy of Sciences (PAS).

International Monetary Fund, Organisation for Economic Co-operation and Development, International Labour Organization, and International Statistical Committee of the CIS (2002). *Measuring the Non-observed Economy: A Handbook*. Washington, DC: International Monetary Fund.

Izama, M. P. (2014). Muslim Education in Africa: Trends and Attitudes Toward Faith-based Schools. *Review of Faith and International Affairs 12*(2), 38–50.

Izdebski, A., P. Guzowski, R. Poniat, L. Masci, J. Palli, C. Vignola, M. Bauch, C. Cocozza, R. Fernandes, F. C. Ljungqvist, T. Newfield, A. Seim, D. Abel-Schaad, F. Alba-Sánchez, L. Björkman, A. Brauer, A. Brown, S. Czerwiński, A. Ejarque, M. Fiłoc, A. Florenzano, E. D. Fredh, R. Fyfe, N. Jasiunas, P. Kołaczek, K. Kouli, R. Kozáková, M. Kupryjanowicz, P. Lagerås, M. Lamentowicz, M. Lindbladh, J. A. López-Sáez, R. Luelmo-Lautenschlaeger, K. Marcisz, F. Mazier, S. Mensing, A. M. Mercuri, K. Milecka, Y. Miras, A. M. Noryśkiewicz, E. Novenko, M. Obremska, S. Panajiotidis, M. L. Papadopoulou, A. Pędziszewska, S. Pérez-Díaz, G. Piovesan, A. Pluskowski, P. Pokorny, A. Poska, T. Reitalu, M. Rösch, L. Sadori, C. S. Ferreira, D. Sebag, M. Słowiński, M. Stančikaitė, N. Stivrins, I. Tunno, S. Veski, A. Wacnik, and A. Masi (2022). Palaeoecological Data Indicates Land-use Changes Across Europe Linked to Spatial Heterogeneity in Mortality During the Black Death Pandemic. *Nature Ecology Evolution 6*(3), 297–306.

Jacobsen, G. and D. P. Parker (2016). The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West. *Economic Journal 126*(593), 1092–1128.

Jayachandran, S. (2021). Social Norms as a Barrier to Women's Employment in Developing Countries. *IMF Economic Review 69*(3), 576–595.

Jedwab, R. and A. Moradi (2016). The Permanent Effects of Transportation Revolutions in Poor Countries: evidence from Africa. *Review of Economics and Statistics 98*(2), 268–284.

Jedwab, R., F. M. zu Selhausen, and A. Moradi (2018). The Economics of Missionary Expansion: Evidence from Africa and Implications for Development. CSAE Working Paper No. WPS/2018-07.

Jensen, R. and E. Oster (2009). The Power of TV: Cable Television and Women's Status in India. *Quarterly Journal of Economics 124*(3), 1057–1094.

Juhász, R., N. Lane, and D. Rodrik (2024). The New Economics of Industrial Policy. *Annual Review of Economics 16*(1), 213–242.

Juhász, R., M. P. Squicciarini, and N. Voigtländer (2024). Technology Adoption and Productivity Growth: Evidence from Industrialization in France. *Journal of Political Economy 132*(10), 3215–3259.

Kagy, G. (2014). Female Labor Market Opportunities, Household Decision-making Power, and Domestic Violence: Evidence from the Bangladesh Garment Industry. *Working Paper 14*(09).

Kalinga, O. J. (1993, 07). The Master Farmers' Scheme in Nyasaland, 1950–1962: An Study of a Failed Attempt to Create a 'Yeoman' Class. *African Affairs 92*(368), 367–388.

Kiszewski, A., A. Mellinger, A. Spielman, P. Malaney, S. E. Sachs, and J. Sachs (2004). A Global Index Representing the Stability of Malaria Transmission. *The American Journal of Tropical Medicine and Hygiene 70*(5), 486–498.

Klasen, S. and J. Pieters (2015). What Explains the Stagnation of Female Labor Force Participation in Urban India? *The World Bank Economic Review 29*(3), 449–478.

Klein, M. A. (1980). *Peasants in Africa: Historical and Contemporary Perspectives*. Beverly Hills, CA (USA) Sage Publications.

Klein Goldewijk, K., A. Beusen, J. Doelman, and E. Stehfest (2017). Anthropogenic Land Use Estimates for the Holocene – HYDE 3.2. *Earth System Science Data 9*(2), 927–953.

Korieh, C. J. (2001). The Invisible Farmer? Women, Gender, and Colonial Agricultural Policy in the Igbo Region of Nigeria, c. 1913-1954. *African Economic History* (29), 117–162.

Kyei, T. and J. Allman (2001). *Our Days Dwindle: Memories of My Childhood Days in Asante*. ABC-CLIO, LLC.

Lee, D. S. and T. Lemieux (2010). Regression Discontinuity Designs in Economics. *Journal of Economic Literature 48*(2), 281–355.

Lee, M. M. and N. Zhang (2017). Legibility and the Informational Foundations of State Capacity. *Journal of Politics 79*(1), 118–132.

Leight, J. (2021). Like Father, Like Son, Like Mother, Like Daughter: Intergenerational Transmission of Intrahousehold Gender Attitudes in Ethiopia. *World Development 142*.

Leyaro, V., P. Selaya, N. Trifkovic, et al. (2017). Fishermen's Wives: On the Cultural Origins of Violence Against Women. WIDER Working Paper No. 2017/205.

Linares, O. F. (1985). Cash Crops and Gender Constructs: the Jola of Senegal. *Ethnology 24*(2), 83–93.

Livi-Bacci, M. (2007). *A Concise History of World Population*. Oxford: Blackwell Publishing.

Lujala, P., N. P. Gleditsch, and E. Gilmore (2005). A Diamond Curse? Civil War and a Lootable Resource. *Journal of Conflict Resolution 49*(4), 538–562.

Lundberg, S. (2024). The Economics of Gender Norms. *Scottish Journal of Political Economy 72*(2), e12407.

Lück, H. (2018, 07). Urban Law: The Law of Saxony and Magdeburg. In *The Oxford Handbook of European Legal History*. Oxford University Press.

Maddison, A. and O. Centre (2001). *The World Economy: A Millennial Perspective*. Development Centre seminars. Development Centre of the Organisation for Economic Co-operation and Development.

Maier, D. J. (2009). Precolonial Palm Oil Production and Gender Division of Labor in Nineteenth-century Gold Coast and Togoland. *African Economic History 37*(1), 1–32.

Majlesi, K. (2016). Labor Market Opportunities and Women's Decision Making Power Within Households. *Journal of Development Economics 119*, 34–47.

Malinowski, M. (2016). Serfs and the City: Market Conditions, Surplus Extraction Institutions, and Urban Growth in Early Modern Poland. *European Review of Economic History 20*(2), 123–146.

Mammen, K. and C. Paxson (2000). Women's Work and Economic Development. *Journal of Economic Perspectives 14*(4), 141–164.

Mandala, E. C. (1990). *Work and Control in a Peasant Economy: A History of the Lower Tchiri Valley in Malawi, 1859-1960*. University of Wisconsin Press.

Mangini, M.-D. and C. Petroff (2022). Conflict Technology as a Catalyst of State Formation. *Working Paper*.

Martin, S. M. (2006). *Palm Oil and Protest: An Economic History of the Ngwa Region, South-eastern Nigeria, 1800-1980*, Volume 59 of *African Studies Series*. Cambridge University Press.

Masera, F. and M. Rosenberg (2025). Slavocracy: Economic Elite and the Support for Slavery. Conditionally Accepted at the Journal of the European Economic Association.

Mayshar, J., O. Moav, and L. Pascali (2022). The Origin of the State: Land Productivity or Appropriability? *Journal of Political Economy 130*(4).

Meier zu Selhausen, F. (2015). Women's Empowerment in Uganda: Colonial Roots and Contemporary Efforts, 1894-2012. Doctoral thesis, Utrecht University.

Meier zu Selhausen, F. and J. Weisdorf (2016). A Colonial Legacy of African Gender Inequality? Evidence from Christian Kampala, 1895–2011. *Economic History Review 69*(1), 229–257.

Merki, C. M. (1998). Der Umstieg von der Postkutsche Aufs Postauto: Zur Motorisierung des Öffentlichen Überlandverkehrs in der Schweiz [The Transition from the Stagecoach to the Postal Bus: On the Motorization of Public Interurban Transport in Switzerland]. *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte 85*(1), 94–112.

Merki, C. M. (2002). *Der Holprige Siegeszug des Automobils 1895–1930. Zur Motorisierung des Straßenverkehrs in Frankreich, Deutschland und der Schweiz [The Bumpy Triumph of the Automobile, 1895–1930: On the Motorisation of Road Traffic in France, Germany, and*

Switzerland]. Wien, Köln, Weimar: Böhlau Verlag. Habilitationsschrift, Universität Bern, 2001.

Michalopoulos, S. (2012). The Origins of Ethnolinguistic Diversity. *American Economic Review 102*(4), 1508–1539.

Michalopoulos, S., L. Putterman, and D. N. Weil (2019). The Influence of Ancestral Lifeways on Individual Economic Outcomes in Sub-Saharan Africa. *Journal of the European Economic Association 17*(4), 1186–1231.

Mitchell, B. R. (1998). *International Historical Statistics: Europe, 1750–1993* (Fourth ed.). Macmillan Reference; Stockton Press.

Mitra, A. (2019). Women's Work in Response to Urbanization: Evidence from Odisha. *ANTYA-JAA: Indian Journal of Women and Social Change 4*(1), 92–106.

Miyata, S. and H. Yamada (2016). Do Female Gender Role Attitudes Affect Labour Market Participation in Egypt? *Journal of Development Studies 52*(6), 876–894.

Mokyr, J., A. Sarid, and K. van der Beek (2022). The Wheels of Change: Technology Adoption, Millwrights and the Persistence in Britain's Industrialisation. *Economic Journal 132*(645), 1894–1926.

Molina, T. and M. Tanaka (2023). Globalization and Female Empowerment: Evidence from Myanmar. *Economic Development and Cultural Change 71*(2), 519–565.

Moser, P., A. Voena, and F. Waldinger (2014). German Jewish Émigrés and US Invention. *American Economic Review 104*(10), 3222–3255.

Muller-Crepon, C. (2020). Indirect Rule, Cash Crop Production, and Development in Africa. *Working Paper*.

Murdock, G. P. (1959). *Africa: Its Peoples and Their Culture History*. McGraw-Hill.

Murdock, G. P. (1967). *Ethnographic Atlas*. University of Pittsburgh Press.

Najgrakowski, M. (2009). *Miasta polski Do Początku XXI Wieku: Podstawowe Informacje o Datach Założenia i Likwidacji [Cities of Poland Until the Beginning of the 21st Century: Basic Information on the Dates of Foundation and Liquidation]* (1 ed.). Warszawa: Stanisław Leszczycki Institute of Geography and Spatial Organization Polish Academy of Sciences (IGSO PAS).

Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage] (2020a). Rejestr Zabytków Archeologicznych [Register of Archeological Monuments], Data Downloaded: 16/12/2020.

Narodowy Instytut Dziedzictwa [National Institute of Cultural Heritage] (2020b). Rejestr Zabytków Nieruchomych [Register of Immovable Monuments], Data Downloaded: 16/12/2020.

Neubert, M. and S. Nikolić (2026). Why Railways Fail: Colonial Railways and Economic Development in Habsburg Bosnia-Herzegovina. *Journal of Development Economics 181*, 103747.

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance* (1 ed.). Political Economy of Institutions and Decisions. Cambridge University Press.

Norton, S. W. and A. Tomal (2009). Religion and Female Educational Attainment. *Journal of Money, Credit and Banking 41*(5), 961–986.

Nunn, N. (2008). The Long-term Effects of Africa's Slave Trades. *Quarterly Journal of Economics 123*(1), 139–176.

Nunn, N. (2014). Gender and Missionary Influence in Colonial Africa. In *African Development in Historical Perspective*, pp. 489–512. New York: Cambridge University Press.

Nunn, N. (2020). The Historical Roots of Economic Development. *Science 367*(6485).

Nunn, N. and D. Puga (2012). Ruggedness: The Blessing of Bad Geography in africa. *Review of Economics and Statistics 94*(1), 20–36.

Nunn, N. and N. Qian (2011). The Potato's Contribution to Population and Urbanization: Evidence From a Historical Experiment. *Quarterly Journal of Economics 126*(2), 593–650.

Nunn, N. and L. Wantchekon (2011). The Slave Trade and the Origins of Mistrust in Africa. *The American Economic Review 101*(7), 3221–3252.

Ochonu, M. E. (2018). Africans and the Colonial Economy. In *The Palgrave Handbook of African Colonial and Postcolonial History*, pp. 123–143. Springer.

Olczak, E., G. Ajdacki, and B. Banach (2006). *Atlas Historii Polski: Mapy i Komentarze [Historical Atlas of Poland: Maps and Comments]* (1 ed.). Warszawa: Demart.

Olivetti, C. (2014). The Female Labor Force and Long-run Development: The American Experience in Comparative Perspective. In *Human Capital in History: The American Record*, pp. 161–197. University of Chicago Press.

Olson, J. S. (1996). *The Peoples of Africa: An Ethnohistorical Dictionary*. Greenwood Publishing Group.

Olsson, O. and L. Mayoral (2019). Pharaoh's Cage Environmental Circumscription and Appropriability. *Working Papers, Barcelona School of Economics* (1136).

Oto-Peralías, D. and D. Romero-Ávila (2017). Historical Frontiers and the Rise of Inequality: The Case of the Frontier of Granada. *Journal of the European Economic Association 15*(1), 54–98.

Paik, C. and J. Vechbanyongratana (2019). Path to Centralization and Development: Evidence from Siam. *World Politics 71*(2), 289–331.

Panagos, P., M. V. Liedekerke, A. Jones, and L. Montanarella (2012). European Soil Data Centre: Response to European Policy Support and Public Data Requirements. *Land Use Policy 29*(2), 329–338.

Papite, L. T. (2017). The Historical Determinants of Gender Roles in Africa. In *PhD Dissertation: Culture, Gender and Development in Sub-Saharan Africa*, pp. 1–62. Université de Montréal: Département de Sciences Economiques, Faculté des Arts et Sciences.

Paravicini, W. (1989). *Die Preußenreisen Des Europäischen Adels [The Prussian Journeys of the European Nobility]* (1 ed.). Thorbecke, Sigmaringen.

Pascali, L. (2017). The Wind of Change: Maritime Technology, Trade, and Economic Development. *American Economic Review 107*(9), 2821–2854.

Pengl, Y. I., P. Roessler, and V. Rueda (2022). Cash Crops, Print Technologies, and the Politicization of Ethnicity in Africa. *American Political Science Review 116*(1), 181–199.

Pergamon world atlas (1968). *Pergamon World Atlas*. Poland and Pergamon Press (Oxford and England).

Perlbach, M. (1890). *Die Statuten des Deutschen Ordens [The Statutes of the Teutonic Order]* (1 ed.). Halle A.S.

Peters, B. L. and J. E. Peters (1998). Women and Land Tenure Dynamics in Pre-colonial, Colonial, and Post-colonial Zimbabwe. *Journal of Public and International Affairs 9*, 183–208.

Pluskowski, A. (2012). *The Archaeology of the Prussian Crusade: Holy War and Colonisation* (1 ed.). Routledge, London.

Pluskowski, A. (2024). *The Teutonic Knights: Rise and Fall of a Religious Corporation*. Reaktion Books, Limited.

Querengasser, A. (2021). *Before the Military Revolution: European Warfare and the Rise of the Early Modern State 1300-1490* (1 ed.). Oxbow Books.

Ramankutty, N., J. A. Foley, J. Norman, and K. McSweeney (2002). The Global Distribution of Cultivable Lands: Current Patterns and Sensitivity to Possible Climate Change. *Global Ecology and Biogeography 11*(5), 377–392.

Raster, T. (2019). Serfs and the Market : Second Serfdom and the East-west Goods Exchange, 1579-1857. *Master of Science Thesis, Submitted at the Paris School of Economics, 2019*.

Robinson, J. A., R. Torvik, and T. Verdier (2006). Political Foundations of the Resource Curse. *Journal of Development Economics 79*(2), 447–468.

Rodney, W. (1972). *How Europe Underdeveloped Africa*. London: Bogle-L'Ouverture.

Roessler, P., Y. I. Pengl, R. Marty, K. S. Titlow, and N. van de Walle (2022). The Cash Crop Revolution, Colonialism and Economic Reorganization in Africa. *World Development 158*, 105934.

Rogowski, J. C. (2018). Reconstruction and the State: The Political and Economic Consequences of the Freedmen's Bureau. *Harvard University, Working Paper*.

Roome, W. J. W. (1925). *Ethnographic Survey of Africa. Showing the Tribes and Languages; Also the Stations of Missionary Societies*. London, Edward Stanford Limited.

Royal Swedish Academy of Sciences (2025). *Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2025: Sustained economic growth through technological progress*. Stockholm: The Royal Swedish Academy of Sciences.

Ruf, F. (1995). *Booms Et Crises du Cacao: Les Vertiges de l'Or Brun*. Economie et développement. Karthala.

Runfola, D., E. Anderson, H. Baier, M. Crittenden, S. Dowker, R. Edsall, J. Getman, A. J. Leidner, A. Peppin, J. Squires, J. Tuttle, and D. Wrathall (2020). Geoboundaries: An Global Database of Political Administrative Boundaries. *Plos One 15*(4), e0231866.

Sánchez de la Sierra, R. (2020). On the Origins of the State: Stationary Bandits and Taxation in Eastern Congo. *Journal of Political Economy 128*(1), 32–74.

Sarnowsky, J. (1993). *Die Wirtschaftsführung des Deutschen Ordens in Preussen (1382-1454) [The Economic Administration of the Teutonic Order in Prussia (1382–1454)]*. Preussischer Kulturbesitz: Veröffentlichungen aus den Archiven Preußischer Kulturbesitz. Böhlau Verlag.

Schönholzer, D. and P. Francois (2023). Environmental Circumscription and the Origins of the State. *Working Paper*.

Sederberg, P. C. (1971). The Gold Coast under Colonial Rule: An Expenditure Analysis. *African Studies Review 14*(2), 179–204.

Sheldon, K. (2017). *African Women: Early History to the 21st Century*. Indiana University Press.

Statistisches Amt der Stadt Zürich (1925). Das Automobil in Stadt und Kanton Zürich [The Automobile in the City and Canton of Zurich]. *Zürcher Statistische Nachrichten [Zurich Statistical Reports] 2*(2), 41–49. April/Juni-Ausgabe.

Statistisches Amt der Stadt Zürich (1929). Motorfahrzeuge in Zürich 1928 [Motorvehicles in Zurich, 1928]. *Zürcher Statistische Nachrichten [Zurich Statistical Reports] 6*(2), 59–80. April/Juni-Ausgabe.

Streit, K. (1929). *Atlas Hierarchicus: Descriptio Geographica et Statistica Sanctae Romanae Ecclesiae [Hierarchical Atlas: A Geographic and Statistical Description of the Holy Roman Church]*. Typographia Bonifaciana.

Stutzer, A. and B. S. Frey (2006). Political Participation and Procedural Utility: An Empirical Study. *European Journal of Political Research 45*(3), 391–418.

Suryanarayan, P. (2021). Status Politics Hollows Out the State: Evidence from Colonial India. *Working Paper*.

Suryanarayan, P. and S. White (2021). Slavery, Reconstruction, and Bureaucratic Capacity in the American South. *American Political Science Review 115*(2), 568–584.

Sánchez-Talanquer, M. (2020). One-eyed State: The Politics of Legibility and Property Taxation. *Latin American Politics and Society 62*(3), 65–93.

Tertilt, M. (2005). Polygyny, Fertility, and Savings. *Journal of Political Economy 113*(6), 1341–1371.

Teso, E. (2018). The Long-term Effect of Demographic Shocks on the Evolution of Gender Roles: Evidence from the Transatlantic Slave Trade. *Journal of the European Economic Association 17*(2), 497–534.

ThemaKart (2021). *Geometriedatensätze Themakart: Basisgeometrien (k4) der Schweiz für Kleinmassstäbige Statistisch-thematische Karten [Geometric Datasets Thematic Map: Base Geometries (k4) of Switzerland for Small-Scale Statistical-Thematic Maps]*. Number 15784602. Neuchâtel: Bundesamt für Statistik (BFS).

Thornton, J. (1983). Sexual Demography: The Impact of the Slave Trade on Family Structure. In *Women and Slavery in Africa*, pp. 39–48. University of Wisconsin Press Madison, WI.

Tilly, C. (1975). Reflections on the History of European State-Making. In *The Formation of National States in Western Europe*, Volume 38, pp. 3–83. Princeton University Press.

Tilly, C. (1985). War Making and State Making as Organized Crime. In *Bringing the State Back In*, pp. 169–191. Cambridge University Press.

Tilly, C. (1990). *Coercion, Capital, and European States, AD 990-1992* (1 ed.). Blackwell.

Urban, W. L. (2003). *The Teutonic Knights: A Military History* (1 ed.). Greenhill.

Usoro, E. J. (1977). Colonial Economic Development Strategy in Nigeria 1919-1939: An Appraisal. *The Nigerian Journal of Economic and Social Studies 19*(1), 121–141.

Vakulabharanam, V. and S. Motiram (2023). Gender and Work Patterns in Indian Cities: An Socio-spatial Analysis. *Feminist Economics 29*(2), 64–95.

Voigtlander, N. and H. J. Voth (2012). Persecution Perpetuated: The Medieval Origins of Anti-semitic Violence in Nazi Germany. *Quarterly Journal of Economics 127*(3), 1339–1392.

Voigtlander, N. and H. J. Voth (2013). How the West "Invented" Fertility Restriction. *American Economic Review 103*(6), 2227–2264.

Voigtländer, N. and H. J. Voth (2014). the Three Horsemen of Riches: Plague, War, and Urbanization in Early Modern Europe. *Review of Economic Studies 80*(2), 774–811.

Wenskus, R. (2017). The Teutonic Order and the Non-german Population of Prussia. In *The North-eastern Frontiers of Medieval Europe*, pp. 307–328. Routledge.

White, F. (1983). *The Vegetation of Africa, a Descriptive Memoir to Accompany the UNESC/AETFAT/UNSO Vegetation Map of Africa*. UNESCO, Natural Resoural Resources 20, 1–356.

Wrigley, C. C. (1959). *Crops and Wealth in Uganda: A Short Agrarian History.* Kampala: East African Institute of Social Research.

Wycliff, S. (2022). Groundnut Production in the Colonial Economy and Society of Kilba District of Adamawa Province in Northern Nigeria, 1904–1960. *African Journal of Management and Business Research 4*(1), 65–82.

Xue, M. M. (2018). High-value Work and the Rise of Women: The Cotton Revolution and Gender Equality in China. MPRA Working Paper No. 91100.

Zentrum Für Mittelalterausstellungen Am Kulturhistorischen Museum Magdeburg [Center for Medieval Exhibitions at the Cultural History Museum in Magdeburg] (2020). Magdeburg Law: a Building Block in Modern europe.