Political fragmentation and the spatial allocation of human capital

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Abstract

The uniquely poly-centric history of Europe's political system is considered to be one of the important reasons of the its economic success, hallmarked as the 'Great Divergence'. At the same time, political borders are widely known to be barriers to economic integration. This paper tackles this conundrum by showing how Europe's many borders indeed acted as a barrier to the migration of upper-tail human capital. We present causal evidence that the latter shaped the economic success of European regions. As such, we show that Europe's history of political fragmentation should not only be seen as plausible reason for Europe's economic success relative to other world regions, but also determined the spatial allocation of prosperity within the continent.

Keywords: political fragmentation, borders, human capital mobility, agglomeration effects, economic growth, regional trade

JEL codes: F14, F15, F22

1 Introduction

The uniquely poly-centric nature of Europe's political constellation has been considered as a key reason for the its historical economic success and the so-called 'Great Divergence'.[1] This fragmented political system may not only have induced competition between states in the provision of public goods, but might also have created a market for ideas that gave rise to the Industrial Revolution. A key mechanism in these theories is that past political borders shaped the migration of upper-tail human capital, thereby influencing the cultural and institutional setting for innovation.

At the same time, there are also reasons why an economic system characterized by many political borders has drawbacks. Not only did political fragmentation in Europe potentially lead to many war-induced casualties (e.g., Dincecco & Onorato, 2016; Gennaioli & Voth, 2015; Voigtländer & Voth, 2013), it may also have had economic costs. For instance, there is overwhelming contemporary evidence that political borders can act as barriers to trade (e.g., Redding & Sturm, 2008; Santamaría et al., 2023) and migration (e.g., Caliendo et al., 2021; Desmet et al., 2018).[2] It is therefore conceivable that such barriers were even more pronounced in a pre-modern context, when institutional harmonization and state capacity were far more limited.

This paper examines how Europe's history of political fragmentation and the subsequent barriers to integration shaped patterns of economic development that persist to the present day. In particular, we bring a long-standing argument—that historical borders shaped past migration of upper-tail human capital—to the data, and show how it affected historical urban development at the time and the spatial allocation of economic activity today. As such, we show that political fragmentation may not only helps explain Europe's rise in the global economic hierarchy, but also co-determined the contemporary spatial allocation of economic development *within* the Continent.

To this end, we construct a novel integrated database that combines information on the historical membership of European regions in historical realms, their urban population histories, migration flows of upper-tail human capital between regions, and contemporary trade flows.[3] Several features of our dataset stand out. First, a central component of our analysis is a historical dataset on notable people assembled by Laouenan et al. (2022), from which we subsample people in a range of creative-productive occupations which we con-

[1] This literature has a long tradition, going back to the work of David Hume, and includes — among others — important contributions by Jones (2003), Landes (1998), Mokyr (2016), and Scheidel (2019). In Appendix A, we provide a more in-depth discussion. We also refer to Cabello (2026) for a discussion and an empirical appraisal of these arguments.

[2] Indeed, in present-day Europe, the lack of a unified market has potentially resulted in more fragmented goods markets (e.g., Beck et al., 2020; Hoste & Verboven, 2025), less labor mobility (e.g., House et al., 2025) and has been identified as a prime policy concern.

[3] European regions are defined at the NUTS2 level. For more information on what constitutes a realm or state, we refer to Section 2.1.

sider to be the most significant form of upper-tail human capital at that time.[4] This dataset records the birth and death place of notable individuals for a significant portion of the world, including Western Europe, and extends back to the Early Middle Ages. Leveraging this information, we construct a migration matrix of upper tail human capital between European regions between 1500-1800. As such, our dataset spans the period of the onset of the Great Divergence, allowing us to contribute to our understanding of its roots, and the period before the industrial revolution after which the relative importance of various production factors potentially changes. Second, in contrast to a large strand of the literature, we do not superimpose contemporary borders on historical data (e.g., D'Arcy et al., 2024; Putterman & Weil, 2010). Instead, we document and exploit the rich history of border shifts in Europe, allowing us to estimate how migration patterns of notables adjusted in response to shifts in the borders of historical realms. Finally, by building a spatially disaggregated dataset that links historical conditions to contemporary outcomes, we provide evidence that Europe's historical political fragmentation may have had persistent effects on today's spatial allocation of activity. To facilitate this comparison, we harmonize all historical data to the current NUTS2 nomenclature, thereby enabling a direct and consistent mapping between historical and modern regional outcomes.

We start by providing two pieces of evidence that throughout European history, political borders inhibited migration. First, we study the determinants of notable migration using a reduced-form gravity model of migration. This exercise provides two insights. On the one hand, even though we infer migration from the birth and death of notable people, we recover the typical cross-sectional migration patterns: migration is more likely between populous places and decreases strongly with distance between the origin and destination. On the other hand, we find that migration is on average 172% larger when the origin and the destination market belong to the same historical realm. Additionally, with increasing mobility in more recent centuries, the realm effect becomes stronger, implying that later borders where seemingly more punitive.

Second, we exploit the rich historical time variation in the borders of historical realms to estimate how the migration of notable people changed in response to the shifting topography of historical realms. Using a difference-in-difference design, we show that when two regions become part of the same realm, migration of notables between them increases persistently. After 50 years, migration between a pair of two integrated regions rises by a little over 40%, and by 90% after a century, relative to migration between fragmented pairs. Importantly, before the border change, migration flows between newly integrated region pairs and still fragmented region pairs evolve identically. This suggests that a substantial part of the common realm coefficient as estimated in the gravity equation is driven by migration frictions.

[4]We base this on the work of Mokyr (2016) who has often considered creative elites to be the driving force of economic growth. Consistent with this view, Squicciarini and Voigtländer (2015) study how subscriptions to the Encyclopédie fostered growth in France in the 18^{th} century and Dittmar and Meisenzahl (2020) assess the role of attracting upper-tail human capital, in the form of notable people, as a key channel through which legal institutions foster urban development.

By shaping migration flows of notables, political fragmentation may have affected historical urban development in Europe. More specifically, we show that a higher stock of notables in a given region leads to stronger urban growth of that region. Establishing this relationship is challenging as notables may be choosing to migrate to high-growth places. To overcome this identification concern, we construct migration-based instruments that shift the stock of notables in a given location. Across different specification, we find that a 10% increase in the stock of notables is associated with approximately a 2% increase in urban growth.

We provide suggestive evidence that a plausibly exogenously larger stock of notables leads to urban development because notables may have brought useful knowledge. First, we find that only a higher stock of notables associated with useful knowledge, i.e. academics, artists, clergy, inventors and merchants, leads to urban development. In contrast, a higher stock of nobles, statespersons, or soldiers, *does not* cause more urban development. Second, we show that a plausibly exogenous higher stock of artists, clergy, inventors and merchants in a regions leads to more academic human capital production, more academics, and a higher level of human capital production per academic in that same region. Although directly measuring the level of useful knowledge embodied in notables is difficult, if academic human capital is a suitable measure of latent useful knowledge, this is consistent with notables embodying useful knowledge.

The historical determination of urban development still seems to affect outcomes today through a combination of persistent spatial population patterns and local agglomeration effects. We establish this final empirical result in three steps. First, using contemporary trade flows and a standard structural gravity model, we obtain a measure of contemporary export potential at the regional level. Crucially, once one conditions on wages, this measure of export potential maps to a region's productivity level. Second, we show that higher levels of historical urban development predict higher productivity today. However, controlling for contemporary population makes the effect disappear, implying that the persistency is mediated by the effect of past urban development on contemporary population. Finally, with this in mind, we provide evidence of local agglomeration effects, that is, places with higher levels of contemporary population are also characterized by higher levels of productivity. In particular, building on the second result, that is, instrumenting contemporary population levels with historical urban development uncovers local agglomeration effects in line with estimates in the urban literature.

Related literature. This paper contributes to three strands of literature. First, we add to the emerging literature on the drivers and consequences of historical political fragmentation. Europe's unique topography (Diamond, 1997) and spatial composition of land productivity (Fernández-Villaverde et al., 2023) have been credited as key drivers of its polycentric politic system. Together with creating a market for ideas (Cabello, 2026; Mokyr, 2016; Scheidel, 2019), Europe's political fragmented has also been cited to induce incremental investments in state capacity to conduct war (e.g., Becker et al., 2025; Gennaioli & Voth, 2015).

We study an alternative consequence of Europe's history of political fragmentation: its effect on the migration of upper-tail human capital. We find that the large number of country borders shaped the mobility of upper-tail human capital. The latter in turn drove historical urban development and had a persistent effect on spatial patterns of economic activity today through a combination of persistency in population and local agglomeration forces.

Second, we contribute to the literature on the economic effects of international migration, by focusing on the long-term effects of upper-tail human capital migration. In particular, we take inspiration from and add to the broad literature which leverages historical records on 'notable' individuals in history. This line of research has been encouraged by the publication of large-scale databases (Cummins, 2017; de la Croix & Licandro, 2015; Laouenan et al., 2022; Schich et al., 2014). This paper shows how one of these recent databases on 'notable people' (Laouenan et al., 2022) allows us to chart bilateral migration patterns of Europe's upper-tail human capital at a disaggregated regional level for a long period of Europe's history. Several papers have leveraged historical experiments to showcase how the inflow of skilled migrants positively affects a wide range of phenomena connected to economic growth such as technology adoption (Hornung, 2014), innovation (Moser et al., 2014) and urban development (Dittmar & Meisenzahl, 2020; Link, 2024). We add to this literature by explaining mobility patterns of human capital through shifts in political borders. In doing so, we also contribute to an important strand of literature documenting the importance of upper-human capital for economic growth (Mokyr, 2002, 2016; Squicciarini & Voigtländer, 2015). More specifically, we provide empirical evidence for how political institutions can foster, or deter the build-up of a culture of knowledge through fragmentation.

Finally, our work also connects to the broad literature on persistent effects of historical events (for discussions, see Maseland, 2025; Voth, 2021). Becker et al. (2016) argue that the potency of Habsburg empire has resulted in better trust in political institutions today. Relatedly, Michaels and Rauch (2018) and Flückiger et al. (2022) argue that path dependence and persistency of the transportation network since Roman times still affect the location of economic activity and investment today. We add to this literature by showing how historical political fragmentation, while potentially conducive to the onset of the industrial revolution, may have also reduced the mobility of upper-tail human capital. We postulate that through the particular persistence of population and through local agglomeration effects, historical political fragmentation has left its traces on the contemporary European economy.

Outline. The remainder of this paper is structured as follows. First, Section 2 introduces the data, including those on historical borders and the migration of human capital in the form of so-called 'notable' individuals. In Section 3, we bring the hypothesis that political fragmentation drove the migration of human capital to the data. Section 4 documents how the presence of notables contributed to European comparative urban development, which, as we show in Section 5, still matters for today's economic geography. Finally, Section 6 concludes.

2 Data

This section briefly introduces our data sources and describes their compilation in an integrated database. The geographical unit of analysis is the NUTS2 level (2013 classification), which ensures ensures consistent spatial units over time. This choice allows us to map regions' historical experiences of political fragmentation and upper-tail human capital to contemporary measures of economic activity and bilateral trade. Moreover, NUTS2 is the most disaggregated geographical level at which most relevant contemporary variables are available. Additional details on data sources and sample construction are provided in Appendix B.

2.1 Historical realms

To reconstruct historical realm membership, we make use of the database by Abramson (2017). This database and its underlying sources have enjoyed widespread use predominantly in political sciences, but also in economics, and are generally highly regarded as data sources (for examples and a discussion, see Kitamura and Lagerlöf, 2020; Lehmann-Hasemeyer and Wahl, 2023). We assign every region in a time period t to the historical realm which covers the majority of the region's surface in that time period. Moving to a bilateral measure, common statehood is defined as two regions sharing the same realm membership.

An important question is what constitutes a 'border', as it is difficult to come up with a legal definition which is not anachronistic for most of European history. We draw from Abramson (2017)'s definition of a state, who empirically defines a state through the presence of direct military power, capacity to tax, and the presence of a common executive. These dimensions directly match into our definition of an economic border, in which institutional barriers such as military and fiscal hurdles shape economic integration. Conceptually, this concept of a state is close to a Weberian notion of statehood, which is defined through the monopoly of legitimized use of violence in a given territory, and closely aligns to commonly used definitions of statehood in both economics and economic history (Alesina and Spolaore, 2003, p. 11[5]; Hoffman, 2015, p. 307; Abramson, 2017, pp. 100–101). The borders of these territories is what our database takes as a starting point.

2.2 Mobility of human capital

Our starting point is the repository of 'notable' people in the database by Laouenan et al. (2022).[6] The latter is a cross-verified database, sourced from various language-editions of Wikipedia and Wikidata. One thus attains 'notable status' if one's life is recorded in more than one source, so that one's life course can be cross-validated. Aside from a validation

[5]In their important work on the size of nations, Alesina and Spolaore (2003, p. 11) define states as following:

> "[...] *a political organization that concentrates in its government a relatively large and important number of policy functions, including defense and monopoly of coercion*".

[6]Despite using different sources, Koch et al. (2024b) and Serafinelli and Tabellini (2022) provide insightful illustrations of the potential of similar types of data sources to analyze migration patterns of notable people in European history.

check, this also mitigates an Anglo-Saxon bias, as the English-language Wikipedia database is by far the largest.

Among many other variables, the authors of this database use the biographical information in these sources to determine the dates and locations of the notables' birth and death. We leverage this information, which also includes geolocalisation, to reconstruct migration flows of European notables across the time period of 1500-1800. We infer one's migration status from being born in one NUTS2 region and passing away in another NUTS2 region. Naturally, the source does not record the precise timing of migration. As a baseline approach, we simply assign the migration year to the midpoint of the notable's life course, and allocate these migration events to the bilateral migration matrix at the nearest 50-yearly cross-section. This procedure allows us to reconstruct European migration patterns at a highly disaggregated geographical and historical scale. It is worth noting that the authors of the database themselves are confident in such applications of their data.[7] In Appendix B.2, we provide further evidence on the credibility and limitations of this source, as well as provide some descriptives.

We interpret the presence of a particular subgroup of these 'notables' as a measure of upper-tail human capital. Table 1 documents a breakdown of our sample over both occupations and time. The occupational composition of our sample is relatively stable over time.[8] We select notables with a wide range of professions, ranging from 'academics' and 'inventors' to 'merchants' and 'artists', whom we view as key carriers of productive human capital. This definition of human capital implies that we capture both propositional ('*why* things work') and prescriptive ('*how* things work') types of knowledge respectively. This fits the historical setting we are studying, as the distinction between both was often muddled in Early Modern Europe (Mokyr, 2016, p. 139). In other words, a wide range of artisans and scholars contributed to the thriving intellectual and cultural scene of a region, and our measure reflects this breadth.

In inferring human capital from the main professional activities of notable people and encyclopedic sources, we also follow a growing tradition in economics. As one measure of upper-tail human capital, Squicciarini and Voigtländer (2015, p. 1867) reconstruct the number of individuals with a scientific profession in the *Index Bio-Bibliographicus Notorum Hominum* from de la Croix and Licandro (2015). Dittmar and Meisenzahl (2020) follow a similar strategy for human capital in Germany in the early modern period using a Germany-specific biographical source. They, however, take a broader approach to upper-tail human

[7] Laouenan et al. (2022, p. 13) discuss the high potential of their geolocalisation work as following:

> "*The higher granularity of our database allows us to cover less explored destinations or smaller geographical divisions. Going from the 150,000 individuals in earlier studies to 2.3 million individuals in our case allows us to cover migration outflows of, e.g. artists who left Italy to emigrate in numbers to South America, or scientists who left the UK to live in North America. We can also represent intra-Asian migration flows which is mostly within countries contrary to inter-country European flows.*"

We take up on this suggestion, and push migration patterns back in time for the area the best-covered in the database, Europe.

[8] One exception is the rise of state- and administration-related occupations in 1800. This is partly explained by nobility being increasingly considered as professional politicians in the source data. This discrepancy, however, is not relevant for our analysis as both groups of notables are dropped in the main analysis.

capital and also include occupations from governmental and clerical careers. Finally, Serafinelli and Tabellini (2022) quantify the presence of European creative elites from `freebase.com` (Schich et al., 2014), which is built largely on Wikipedia similarly to the data used in this paper. Like Serafinelli and Tabellini (2022), we adopt a relatively broad conception of upper-tail human capital, encompassing business entrepreneurs alongside artists and scientists.

Table 1: **Coverage of sample on notables by occupation, 1500–1800**

	1500		**1600**		**1700**		**1800**	
Occupation	**Freq.**	%	**Freq.**	%	**Freq.**	%	**Freq.**	%
Academic	763	22.50%	1163	17.95%	1694	20.44%	5823	18.83%
Artist	984	29.02%	2382	36.77%	2989	36.06%	9589	31.01%
Clergy	604	17.81%	1098	16.95%	975	11.76%	1405	4.54%
Inventor	47	1.39%	57	0.88%	53	0.64%	508	1.64%
Merchant	105	3.10%	152	2.35%	406	4.90%	1430	4.62%
Nobility	460	13.57%	700	10.81%	768	9.27%	794	2.57%
Soldier	82	2.42%	262	4.04%	562	6.78%	2740	8.86%
Statesperson	346	10.20%	664	10.25%	841	10.15%	8630	27.91%
Total	3391		6478		8288		30919	

Notes: Reported are the frequencies, by main occupation, of the notables covered by the Laouenan et al. (2022) database. This table only reports notables for which we were able to geolocate their birth and death place in a NUTS2 code region. The occupations with a green background are those which we consider to be indicators of upper-tail human capital in our main sample.

2.3 Other variables

Urban population. Historical urban population at NUTS2 level is reconstructed using the Buringh (2021) data, which is an updated version of the well-known and often-used Bairoch et al. (1988) dataset. Our selected data from the Buringh (2021) database tracks urban population from 1500 to 1800 at 50-year intervals.

Academic human capital. The database of Curtis et al. (2025) provides us with city-level measures of academic human capital presence. At the core of this data is the *Repertorium Eruditorum Totius Europae* (RETE), which is compiled from an impressive range of sources on European academics. A distinct feature of this data compared to sources using information on all notables, such as the sources described in Section 2.2, is the focus on a well-defined subdomain of knowledge creation: academia. The authors construct city-level measures by aggregating individual-level measures of human capital. To account for heterogeneity in the quality of European academics, they reconstruct individual-level human capital using VIAF (bibliometric measures of scholarly output and impact) and Wikipedia (length of an academic's page, as well as number of translations available).[9]

We aggregate the resulting city-level stock measures of academic human capital to the NUTS2 level at the bi-centennial level by considering the total level of human capital present

[9]Importantly, selection into RETE is not contingent on the 'notability' status as in Laouenan et al. (2022). Hence, endogenous correlation of the academic capital index with our data based on notables is of little concern. Especially, because the Wikipedia data receives a small weight in their academic human capital measure.

within the 50-year range. Figure A.8 plots the spatial distribution of human capital for a 50-year span around 1500, 1600, 1700 and 1800. Consistent with the historical narrative, these maps illustrate how the core of academic activity shifted from Northern Italy in 1500 to England, France and Germany in 1700 and 1800.

Regional trade. To investigate the persistent effects of historical human capital mobility, we rely on domestic and international trade data across European countries. Following Santamaría et al. (2023), we make use of the microdata underlying the European Road Freight Transport Survey (ERFT). In each quarter, a representative sample of road freight companies based in one of the 24 countries of the European Common Market is sampled to provide detailed information for a subset of their itineraries during that quarter. Based on this information, a high-quality estimate of goods flows between 269 NUTS2-pairs can be constructed.

While the data is available for multiple years from 2011 until 2024, we follow Santamaría et al. (2023) and focus on 2013 for two reasons. First, they report that the matrix of goods flows is very stable across years. Second, whereas the survey reports goods flows in terms of physical quantities, a structural gravity model requires denoting trade flows in terms of values. To this end, we rely on their 2013 mapping from physical quantities to values.

Control variables. Throughout the analyses, we include various sets of control variables. First, institutional characteristics have been shown to correlate with urban development. For this reason, we rely on Bosker et al. (2013) and control for whether the region is the host of the realm's capital, the seat of bishop, whether cities in the region are communes in that they have participative political institutions and the number of universities it hosts.

Second, when estimating regional export potential based on the regional trade data, we control for geographic determinants of export potential. In particular, we construct for each NUTS2 region remoteness as the average geodesic distance from all possible NUTS2 destinations. We compute the average ruggedness of a NUTS2 region from the raster data collected in Nunn and Puga (2012). We control for the presence of a large river using shape files from the HydroSHEDS project (Lehner et al., 2006). We additionally account for a region's agricultural productivity, as proxied for using soil quality for producing barley from the FAO GAEZ project (Fischer et al., 2012). Finally, when we have to control for the wage in a region, we take Eurostat's compensation of employees divided by population at the NUTS2 level.[10]

3 Historical borders matter for migration

In this section, we provide evidence that Europe's political fragmentation may have shaped the movement of notables. To build confidence in leveraging information birth and death to proxy for migration, we start by describing the migration data and by illustrating that migration between places was higher if they were part of the same realm. We then show that migration patterns also shift in response to a change in country borders.

[10]More specifically, we take compensation of employees by NUTS2 as specified by code `nama_10r_2coe`.

3.1 A migration gravity equation

Specification. To describe migration patterns of notables, we model migration flows using a gravity equation as in Beine et al. (2016). This approach is micro-founded by a random utility model, which is frequently used to model migration decisions of upper-tail human capital both in contemporary (Akcigit et al., 2016) and historical (de la Croix et al., 2024; Serafinelli & Tabellini, 2022) settings. In particular, let $M_{od,t}$ denote the flow of notables from origin region o to destination region d in moment t (every 25 years for the sample period).[11] The magnitude of these flows depends on bilateral distance D_{od} and on a vector of — possibly time-varying — origin and destination characteristics $\mathbf{X}_{od,t}$. Formally,

$$M_{od,t} = \exp\left(\beta_0 + \beta_1 \ln D_{od} + \beta_2 R_{od,t} + \boldsymbol{X}_{od,t}^{\intercal}\boldsymbol{\gamma}\right)\eta_{od,t}, \tag{1}$$

where $R_{od,t} \equiv \mathbf{1}\left[\text{Realm}(o,t) = \text{Realm}(d,t)\right]$ is an indicator for o and d belonging to the same realm at time t. Unlike most of the literature on gravity models for trade or migration, we do not only rely on cross-sectional variation to identify border effects, but exploit the long panel dimension of our data as well.[12] In our most saturated specification, $\mathbf{X}_{od,t}$ includes origin, destination, and century fixed effects. The parameters of interest are identified under the conditional mean restriction $\mathbb{E}\left[\eta_{od,t} \mid D_{od}, R_{od,t}, \boldsymbol{X}_{od,t}\right] = 1$.

In analogy with gravity equations for trade, $\beta_1 = \frac{\partial \ln M_{od,t}}{\partial \ln D_{od}}$ captures the elasticity of migration with respect to distance. This coefficient is expected to be negative: the further apart the origin and the destination are, the lower migration flows between will be. The coefficient $\beta_2 = \frac{\partial \ln M_{od,t}}{\partial R_{od,t}}$, our main parameter of interest, measures the semi-elasticity of migration flows with respect to belonging to the same realm. A positive estimate of β_2 indicates that migration flows are higher within a common realm which would point to the presence of a border effect on migration. To estimate this parameter, we exploit the long span of our data and include origin and destination fixed effects, which absorb time-invariant confounders such as climatic amenities or soil quality. In addition, we control for location-specific, time-varying characteristics such as university, commune, bishop, and capital status. These effects are therefore identified from within-location variation over time.

Results. Table 2 reports our estimates when we estimate Equation (1) using Poisson Pseudo Maximum Likelihood (PPML) to accommodate the large number of zero migration flows (Silva & Tenreyro, 2006). Migration of notables exhibits a clear gravity structure. Distance has a large and precisely estimated negative effect throughout all specifications: a 1% increase in bilateral distance reduces migration by roughly 1.4 to 1.8%. This strong negative effect of distance is, for instance, quantitatively very much in line with de la Croix et al. (2024) who find that a 1% increase in bilateral distance reduces migration of academics by roughly 1.78%. At the same time, larger origin and destination population significantly increases migration flows, with elasticities close to unity once origin, destination, and century

[11] Throughout this section, we restrict attention to pairs (o, d) with $o \neq d$ in order to focus on actual migration flows.

[12] A notable exception is Wolf et al. (2011), who examine the impact of post–World War I border changes on trade.

fixed effects are included.

Importantly, sharing a common political realm is associated with a substantial increase in bilateral migration flows. Once fixed effects are included, entering the same realm raises migration by approximately one log point, corresponding to a proportional increase of 172% (i.e., $100 \times (\exp(\widehat{\beta}_2) - 1)$). Moreover, Column (5) shows that this effect increases monotonically over time, rising from approximately 144% in the sixteenth century to about 200% in the eighteenth century.[13] This suggests that political integration becomes progressively more relevant for the mobility of notables with upper-tail human capital. This pattern is consistent with the growing importance of state capacity, administrative integration, and internal mobility within realms over the early modern period.

As shown by Serafinelli and Tabellini (2022), institutional and urban characteristics, such as whether the region was home to the realm's capital, whether it had participative political institutions in the form of a commune, or whether it held the seat of a bishop, influenced the movement of notables. Controlling for these at both origin and destination leaves the realm coefficients virtually unchanged. Capitals strongly attract and send notables, while communes at the destination increase inflows and bishoprics reduce them. Universities, by contrast, have no robust independent effect once fixed effects are included.

Our estimates provide strong evidence of an association between migration flows and political borders. However, a causal interpretation is not warranted if there is unobserved pairwise heterogeneity that drives the estimated border effects.[14] In particular, our estimates may capture other factors that vary along borders, such as natural and ethnolinguistic geography or institutions. In the next section, we therefore provide quasi-experimental evidence using changes in political borders.

3.2 Dynamic treatment effects

Do migration flows of notables increase when two regions are incorporated into the same realm? Ideally, one would compare the flow $M_{od,t}$ at time t for a given origin–destination pair (o, d) when the two regions become part of a common realm with the flows that they would have obtained had they instead laid in distinct realms. The difference in these two sets of flows would then identify the causal effect of borders on migration. More specifically, evidence of a positive effect would provide strong support for the view that political borders generate frictions to the mobility of notables. However, in the data we never observe identical region pairs at the same time both within and outside a common realm.

However, given the panel nature of our data, a natural way to address this question is to use a difference-in-differences (DiD) design: comparing a treatment group, i.e. pairs of NUTS2 regions that enter the same realm, with a control group, that is, pairs of NUTS2 regions that remain in separate realms, before and after treatment. Appendix B.1 documents

[13] While seemingly large, this estimate is quantitatively comparable to those found for historical migration of notables (Serafinelli & Tabellini, 2022) and for contemporary border effects on intra-EU trade (Santamaría et al., 2023).

[14] Another concern is reverse causality, whereby migration flows themselves might shape the spatial distribution of borders. We consider this possibility unlikely in our context.

Table 2: **Migration patterns of notables**

			$M_{od,t}$		
	(1)	(2)	(3)	(4)	(5)
$\ln D_{od}$	-1.53***	-1.38***	-1.84***	-1.84***	-1.84***
	(0.07)	(0.07)	(0.05)	(0.05)	(0.05)
$\ln L_{o,t}$	0.53***	0.50***	0.90***	0.89***	0.88***
	(0.03)	(0.03)	(0.06)	(0.06)	(0.06)
$\ln L_{d,t}$	0.78***	0.76***	0.92***	0.88***	0.86***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
$R_{od,t}$		0.60***	1.04***	1.04***	
		(0.08)	(0.05)	(0.05)	
$R_{od,t} \times (1500 - 1600)$					0.89***
					(0.07)
$R_{od,t} \times (1600 - 1700)$					1.01***
					(0.06)
$R_{od,t} \times (1700 - 1800)$					1.10***
					(0.06)
$University_{o,t}$				0.10	0.11
				(0.08)	(0.08)
$Commune_{o,t}$				-0.08	-0.08
				(0.08)	(0.08)
$Bishop_{o,t}$				-0.13	-0.15
				(0.10)	(0.10)
$Capital_{o,t}$				0.58***	0.57***
				(0.13)	(0.13)
$University_{d,t}$				-0.07	-0.06
				(0.08)	(0.09)
$Commune_{d,t}$				0.18***	0.18***
				(0.06)	(0.06)
$Bishop_{d,t}$				-0.19**	-0.21***
				(0.08)	(0.08)
$Capital_{d,t}$				0.24**	0.23**
				(0.10)	(0.10)
Origin FE			✓	✓	✓
Destination FE			✓	✓	✓
Century FE			✓	✓	✓
Observations	192,908	192,908	190,592	190,592	190,592
Pseudo R^2	0.25	0.26	0.43	0.43	0.43

Notes: Standard errors are clustered at the NUTS-pair level.

substantial variation in treatment status across pairs and over time. Still, two conceptual challenges arise for identifying treatment effects with this design. First, borders shift at different times across region pairs, creating a staggered treatment. Second, treatment is non-absorbing: borders can revert, so region pairs may enter and exit 'same-realm treatment' status multiple times.

Panel-matching DiD approach. We address both challenges using the panel-matching framework of Imai et al. (2023). This approach accommodates staggered and non-absorbing treatments while preserving a causal interpretation under standard parallel-trends assumptions. It offers two advantages over two-way fixed effects (TWFE) approaches (e.g., see Callaway & Sant'Anna, 2021; Goodman-Bacon, 2021; Sun & Abraham, 2021). First, TWFE methods are less suitable in our setting because the data feature a large number of idiosyncratic cohorts, arising from extensive staggering in both treatment adoption and exit. Moreover, some pairs experience treatment multiple times, further complicating the application and interpretation of TWFE estimators.[15] Second, the panel-matching approach allows us to construct counterfactuals using pairs that share the same pre-treatment treatment history, rather than relying on never-treated pairs as the reference group. Arguably, this yields a more relevant and credible comparison group in our context.

The panel-matching approach proceeds in three steps (see Appendix C.2 for more details): (i) For each treated pair, we construct a set of control pairs with identical treatment histories over the past L periods. Past treatments are important confounders to account for as they are likely to affect current treatments and outcomes. (ii) We reweight matched controls to achieve covariate balance, thereby mitigating confounding on observables. Treatment and control pairs are matched using the Mahalanobis distance, controlling for the populations of the origin and destination regions as well as their geographical distance. (iii) We apply a DiD estimator within the matched sets to net out common time trends, such that our objects of interest are average treatment effects among the treated (ATT).

Our outcome of interest is the bilateral migration flow $M_{od,t}$ from origin o to destination d at time t. The treatment is based on whether o and d belong to the same political realm at time t, denoted $R_{od,t} \in \{0,1\}$. Formally, for every lead period F, define the potential outcome

$$M_{od,t+F}(a,b) \equiv M_{od,t+F}\left(R_{od,t}=a, R_{od,t-1}=b, \{R_{od,t-\ell}\}_{\ell=2}^{L}\right), \quad a,b \in \{0,1\}.$$

That is, $M_{od,t+F}(a,b)$ is the migration flow from o to d at time $t+F$ that would obtain if the realm-membership indicator equaled b at time $t-1$ and a at time t, given the realized treatment history $\{R_{od,t-\ell}\}_{\ell=2}^{L}$ for earlier periods. The causal object of interest is the ATT

$$ATT_L(F) \equiv \mathbb{E}\left[M_{od,t+F}(1,0) - M_{od,t+F}(0,0) | R_{od,t}=1, R_{od,t-1}=0\right].$$

The estimand $ATT_L(F)$ captures the causal effect of entering a common realm at time t for origin–destination pairs that were untreated at $t-1$, on migration flows at time $t+F$, relative to the counterfactual in which those same pairs had remained untreated.[16] It is consistently estimated using a DiD estimator under the condition that the parallel trends assumption,

$$\begin{aligned}&\mathbb{E}\left[M_{od,t+F}(0,0) - M_{od,t-1} \mid R_{od,t}=1, R_{od,t-1}=0, \{R_{od,t-\ell}, M_{od,t-\ell}\}_{\ell=2}^{L}\right] \\ &\quad = \mathbb{E}\left[M_{od,t+F}(0,0) - M_{od,t-1} \mid R_{od,t}=0, R_{od,t-1}=0, \{R_{od,t-\ell}, M_{od,t-\ell}\}_{\ell=2}^{L}\right],\end{aligned}$$

is satisfied (Imai et al., 2023). This assumption precludes the possibility of unobserved time-

[15] For instance, the approach proposed by Wooldridge (2023) would require the estimation of a very large number of interaction effects relative to the available sample size.

[16] Notice that $ATT_L(F)$ allows for future treatment reversal: i.e., it is permitted that $R_{od,t+\ell}=0$ for $1 \le \ell \le F$.

varying confounders.

Taking logs of the migration outcome would be preferable for ease of interpretation, but the prevalence of zero outcomes makes this undesirable both in terms of sample size and potential bias (Chen & Roth, 2023). We therefore estimate the model in levels and normalize the resulting estimates to facilitate a meaningful interpretation of effect magnitudes. Specifically, we normalize the estimated ATTs relative to the average outcome of the control group in the period immediately preceding treatment (i.e., $\mathbb{E}[M_{od,t-1} \mid R_{od,t} = 0, R_{od,t-1} = 0]$).

Results. Figure 1 reports the DiD estimates of $ATT_3(F)$ across event times, beginning in the treatment year and extending four years thereafter, together with placebo estimates for the pre-treatment periods. We find a steadily increasing pattern. While the instantaneous effect is modest (4.06%) and not statistically significant, the effect rises to a statistically significant 43.10% after 25 years and further increases to 73.78% after 75 years. After a century, the cumulative treatment effect reaches 91.19%. That is, after a century, a pair of NUTS2 regions that has entered the same realm experiences an increase in the migration of notables with upper-tail human capital that is almost equal to the level of migration observed in the control group at $t-1$. Crucially, the placebo estimates exhibit no discernible pre-trends, supporting the parallel trends assumption.

Even though these percentage effect sizes are already sizable, it is important to note that even a single border change typically alters the common-realm status of many region pairs simultaneously. As a result, the aggregate impact of political borders on the migration patterns of notables with upper-tail human capital may be substantial.

4 Migration matters for urban development

4.1 Notables and urban development

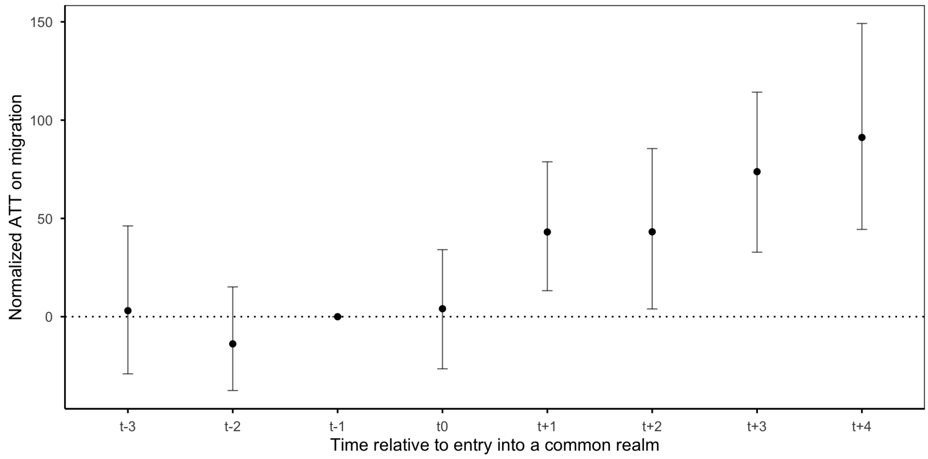
Having shown that political fragmentation shaped historical migration *flows* of notables, we now ask whether the presence of these notables shaped relative urban development in Europe. In other words, do changes in the *stock* of notables affect urban development? We shift from a *flow* to a *stock* measure of notables, because we aim to assess the causal effect of overall upper-tail human capital on comparative urban development. However, we predict a strong relationship between flow and stock measures of human capital because of two observations. First, we know from qualitative evidence that Europe's creative elite was very mobile.[17] Second, our data confirms a strong relationship between migration flows and total levels of notables.[18]

To investigate the relationship between upper-tail human capital and comparative development, we estimate the following specification linking urban population to the presence

[17]This saliently described by Mokyr (2014, p. 175), who states that European intellectual innovators were "footloose, moving easily from court to court and from town to town".

[18]It is exactly this relationship that we will leverage in our identification strategy. We refer to the first-stage regressions reported below, in Tables 3– 5.

Figure 1: **Dynamic treatment effects of borders on migration of notables**



Notes: Event–study estimates of the ATT on migration of notables with upper-tail human capital at the NUTS2-pair level relative to the time of treatment (measured in 25-year intervals). Estimates are in percentages and normalized relative to the average outcome of the control group at $t-1$. A pair is coded as treated in an interval if both regions belong to the same realm. Treatment and control pairs are matched using the Mahalanobis distance, controlling for the populations of the origin and destination regions as well as their geographical distance. The estimation sample excludes observations in which origin and destination coincide. Dots denote point estimates, vertical bars represent 95% confidence intervals, and the dashed horizontal line at zero indicates no effect relative to $t-1$. Confidence intervals are based on 200 block-bootstrap replications, sampling NUTS2-pairs with replacement. The estimates are based on the panel matching methods introduced by Imai et al. (2023) and implemented using an adaptation of the `PanelMatch` package (Rauh et al., 2025).

of notables:

$$\ln L_{d,t} = \beta_0 + \beta_1 \ln N_{d,t} + \beta_2 \ln L_{d,t-1} + \boldsymbol{X}_{d,t}^{\intercal}\gamma + \varepsilon_{d,t}. \qquad (2)$$

Here, $L_{d,t}$ denotes the urban population of location d at time t, and $N_{d,t}$ denotes the stock of notables in that location and period, with observations taken at 50-year intervals.[19] To capture long-run dynamics and possibly account for mean reversion, we include lagged urban population measured one period (i.e., half a century) earlier. Equation (2) also includes a vector of control variables, $\boldsymbol{X}_{d,t}$. Our baseline specification includes location and time fixed effects, which absorb time-invariant determinants of development such as agricultural potential and geography, which have been shown to be important (Bosker & Buringh, 2017), as well as common shocks over time. Finally, $\varepsilon_{d,t}$ denotes the error term.

OLS results. Table 3 reports the results from estimating Equation (2) using OLS. Column (1) presents the unconditional relationship between urban development and the stock of notables. The estimates indicate that locations with a 10% larger stock of notables have, on average, a 5.3% larger urban population. Column (2) adds lagged urban population to account for initial size and persistence. While part of the correlation in Column (1) likely reflects the fact that larger cities can sustain a larger stock of notables, the results show that, conditional on prior urban population, locations with a larger stock of notables experience faster subsequent urban growth. Column (3) further includes location and time fixed effects.

[19] We work at a lower frequency due to constraints on the availability of historical urban population data.

Although the estimated coefficient declines in magnitude, the relationship between urban population and the stock of notables remains statistically and economically significant. This suggests that the observed associates is not fully driven by time-invariant characteristics of destinations, such as land productivity, nor solely by common time trends, including increases in mobility in later centuries.

Table 3: **Urban development and notables**

	$\ln L_{d,t}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.53***	0.34***	0.15***	0.20***	0.25***	0.20***
	(0.03)	(0.02)	(0.02)	(0.05)	(0.06)	(0.04)
$\ln L_{d,t-1}$		0.48***	0.11***	0.05**	0.05*	0.05**
		(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Constant	2.10***	0.88***				
	(0.09)	(0.08)				
Destination FE			✓	✓	✓	✓
Time FE			✓	✓	✓	✓
Observations	1,608	1,596	1,596	1,331	1,330	1,330
R^2	0.37	0.65	0.96	0.97	0.97	0.97
Within R^2			0.16	0.10	0.05	0.10
Wald (1st stage), $\ln N_{d,t}$				93.60	42.53	50.23
Sargan						1.52
Sargan, p-value						0.22
First stage: Distance x Push IV	-	-	-	0.89***	-	0.8***
				(0.092)		(0.098)
First stage: Push x Pull IV	-	-	-	-	0.15***	0.047**
					(0.023)	(0.022)

Notes: Standard errors are clustered at the destination level.

Instrumental variables. The inclusion of fixed effects is, however, unlikely to address all endogeneity concerns. A key identification challenge is reverse causality: higher rates of urban development may sustain more notables, either because higher income spurs demands for creatives or because notables deliberately migrate to highly productive places. In addition, location–time–varying unobserved shocks that affect both urban development and the stock of notables may also bias our estimates. This endogeneity challenge is also saliently illustrated by work which uses the stock of notables in a region to infer historical GDP estimates (Koch et al., 2024a).[20]

To address these concerns, we adopt an instrumental-variables (IV) strategy. Specifically, we instrument the stock of notables in destination d using distance-weighted out-migration from all other regions that is not directed toward d:

$$(\text{Distance} \times \text{Push})_{d,t} \equiv \sum_{o} \frac{1}{D_{od}} \sum_{d' \neq d} M_{od',t}.$$

Here, $\sum_{d' \neq d} M_{od',t}$ denotes the total out-migration originating from region o to all destinations d' other than d, while D_{od} is the distance between regions o and d. The intuition behind this instrument follows a well-established literature on the effects of high-skilled migration on economic development, which exploits plausibly exogenous push factors in origin regions to instrument for migration into destination regions. For example, Hornung (2014) studies the migration of Huguenots towards Prussia following persecution in seventeenth-century France, while Moser et al. (2014) exploit Jewish migration from Nazi Germany to the United States. Our instrument captures a similar logic. By excluding all migration flows from o to d, the instrument isolates out-migration shocks from origin regions that are plausibly exogenous to conditions in destination d. At the same time, weighting these outflows by the inverse distance between o and d ensures that out-migration occurring closer to d has greater predictive power for migration into d, and thus for the stock of notables located there.

Column (4) in Table 3 reports the results from estimating Equation (2) using an IV approach, where the stock of notables is instrumented with $(\text{Distance x Push})_{d,t}$. The KP first-stage F-statistic exceeds 93, well above conventional thresholds, indicating that the instrument is strong. Consistent with the proposed mechanism, the first-stage estimates show that destinations closer to regions experiencing large out-migration have a larger stock of notables. Turning to the second stage, the results indicate that a higher stock of notables has a positive and statistically significant effect on urban growth. Specifically, regions with a 10% larger stock of notables experience, on average, a 2% higher increase in urban development.

Alternative IV strategy. To reinforce the causal interpretation of the result in Column (4), we consider an alternative IV strategy that also exploits information on historical realms. This approach draws on the literature that studies the effect of inward migration on labor market outcomes (e.g., Card, 2001; Tabellini, 2020) and firm-level networks (Burchardi et al., 2019). Specifically, we define $\text{Push}_{od,t} \equiv \sum_{d \in R(d)} M_{od,t} - M_{od,t}$ as total out-migration from origin region o to all destinations within the realm to which region d belongs at time t, excluding migration to d itself. Analogously, we define $\text{Pull}_{od,t} \equiv \sum_{o \in R(o)} M_{od,t} - M_{od,t}$ as

[20] Another related identification concern is sample selection. It is not unlikely that places with higher urban populations also made it more likely that information on the existence of notables survived through time. We deal with this concern by controlling for population size, as well as through our IV strategy. On the one hand, conditioning on population size makes us compare places where this selection issue is arguably equally at play. On the other hand, the construction of our instruments exploit variation in the migration of notables from other origins to places other than destination d. So, the ultimate variation we use in the stock of notables in these specifications does not rely on notables being observed in destination d, only movement in notables that has predictive power for notables in d.

total in-migration to destination region d from all origins within the realm to which region o belongs, excluding migration from o. Using these components, we construct the alternative instrument

$$(\text{Push} \times \text{Pull})_{d,t} \equiv \sum_{o} \text{Push}_{od,t} \times \text{Pull}_{od,t}.$$

A key distinction relative to (Distance x Push)$_{d,t}$ is that the relevance of (Push x Pull)$_{d,t}$ does not depend on the geographic proximity of origin and destination regions, but instead on how attractive the realm to which region d belongs is as a destination for migrants originating from the realm of o. As a result, the two instruments rely on different sources of identifying variation and are subject to different threats to identification. While (Distance x Push)$_{d,t}$ may be sensitive to spatially correlated shocks, (Distance x Push)$_{d,t}$ could be affected by shocks that simultaneously raise the attractiveness of all regions within the realm of d and the productivity of d itself.

This motivates examining whether our results are robust across alternative instruments. Column (5) in Table 3 reports estimates where the stock of notables is instrumented using (Push x Pull)$_{d,t}$. In line with our intuition, stronger inward migration into the realm of d predicts a higher stock of notables in d. The instrument is strong, with a KP first-stage F-statistic slightly above 42. The estimated elasticity is very similar to our baseline IV results: a 10% increase in the stock of notables leads to an approximate 2.5% increase in urban development.

Finally, Column (6) presents results from a specification that includes both instruments jointly. The estimated elasticity of urban population with respect to the stock of notables closely matches the estimate in Column (4). The instruments continue to provide sufficient identifying variation, with a KP F-statistic of 50. Inspection of the first-stage coefficients indicates that both instruments remain statistically significant when included together, suggesting they capture distinct sources of variation in the stock of notables. Moreover, an overidentification test fails to reject the null hypothesis that the instruments are uncorrelated with the second-stage residuals at the 5% level.

4.2 Mechanism

In this section, we present supporting evidence on the mechanism through which a higher stock of notables fosters urban development. We provide evidence consistent with the view that a larger stock of notables reflects more useful knowledge which in turns leads to more urban development. At the same time, we do not find evidence that a higher stock of notables leads to the establishment of more inclusive political institutions, nor that it merely reflects inward population flows.

Useful knowledge. We provide two pieces of evidence to support the claim that the stock of notables reflects useful knowledge and contributes to urban development. First, only the stock associated with useful knowledge affects urban development. Second, a higher stock of such notables is associated with greater accumulation of academic human capital.

As discussed in Section 2.2, our data distinguish not only notables who plausibly embody useful knowledge, but also individuals such as nobles, soldiers, and statespersons whose activities are less directly related to knowledge transmission or productivity-enhancing skills. If the results presented in Table 3 indeed capture the causal effect of useful knowledge on urban development, then notables that are *not* associated with useful knowledge should not exert a comparable effect.

To test this implication, we re-estimate Equation (2) after redefining the stock of notables to include nobles, soldiers and statespersons. The results of this placebo exercise are reported in Table 4. Columns (1)–(3) reveal a positive correlation between urban development and this alternative stock of notables. As before, however, such correlations may reflect reverse causality, whereby these individuals are attracted to locations experiencing rising productivity. We therefore instrument for this alternative stock of notables using the same strategy as in the baseline analysis. Column (4) uses $(\text{Distance} \times \text{Push})_{d,t}$ as an instrument, Column (5) uses $(\text{Push} \times \text{Pull})_{d,t}$, and Column (6) includes both instruments jointly. In all cases, the instruments display strong and independent predictive power for the stock of notables. Crucially, once instrumented the estimated effect on urban development becomes statistically indistinguishable from zero: we cannot reject the null hypothesis that this stock of notables has no effect on urban development. Taken together, these results support a causal interpretation in which only notables associated with useful knowledge contribute to urban development, whereas notables whose activities are unrelated to knowledge transmission do not.

Second, although directly measuring the amount of useful knowledge embodied in the stock of notables is challenging, recent work has produced detailed measures of academic human capital. In particular, a series of papers by Curtis et al. (2025) and de la Croix et al. (2024) has constructed the most extensive dataset on the spatial distribution of academics and associated human capital production between 1200 and 1800. If notables indeed carried useful knowledge, and if academic human capital is a suitable proxy of latent useful knowledge, then locations with larger stocks of notables should exhibit higher levels of academic human capital.[21]

To test this hypothesis, we construct three destination-specific measures associated with academic human capital: total human capital, $H_{d,t}$; the number of academics, $Aca_{d,t}$; and human capital production per academic, $H_{d,t}/Aca_{d,t}$.[22] We then estimate the following specification:

$$\ln Y_{d,t} = \beta_0 + \beta_1 \ln N^A_{d,t} + \beta_2 \ln L_{d,t} + \boldsymbol{X}^\intercal_{d,t}\gamma + \varepsilon_{d,t}, \tag{3}$$

where $Y_{d,t} = \{H_{d,t}, Aca_{d,t}, H_{d,t}/Aca_{d,t}\}$. Apart from the outcome variable of interest, Equation (3) differs from Equation (2) in two important respects. First, we exclude academics from the stock of notables and denote this alternative measure as $N^A_{d,t}$. This ensures that the estimated effects are not merely the result of a mechanical correlation between outcomes related to academic human capital and a stock of notables that includes academics themselves.

[21] On the question whether academic human capital in particular caused urban growth, we refer to Zanardello (2024).

[22] As we are interested in the productivity of academics, provided that there was an institute they could work at present in the region, we take logs and only look at regions with universities and academies.

Table 4: **Urban development and notables, placebo**

	$\ln L_{d,t}$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.45***	0.28***	0.06***	0.05	0.06	0.05
	(0.03)	(0.02)	(0.02)	(0.04)	(0.06)	(0.04)
$\ln L_{d,t-1}$		0.54***	0.24***	0.11***	0.11***	0.11***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	2.60***	0.98***				
	(0.09)	(0.08)				
Destination FE			✓	✓	✓	✓
Time FE			✓	✓	✓	✓
Observations	1,446	1,444	1,444	1,189	1,186	1,185
R^2	0.24	0.63	0.96	0.97	0.97	0.97
Within R^2			0.10	0.05	0.05	0.05
Wald (1st stage), $\ln N_{d,t}$				98.92	42.08	55.66
Sargan						0.06
Sargan, p-value						0.81
First stage: Distance x Push IV	-	-	-	0.98***	-	0.9***
				(0.099)		(0.1)
First stage: Push x Pull IV	-	-	-	-	0.17***	0.061***
					(0.027)	(0.023)

Notes: Standard errors are clustered at the destination level.

Second, whereas Equation (2) controls for lagged urban population, $L_{d,t-1}$, we instead control for contemporaneous urban population, $L_{d,t}$, to ensure that the higher levels of academic human capital do not simply reflect a size effect.

Table 5 reports the results. Columns (1)–(3) present OLS estimates, while Columns (4)–(6) report IV estimates in which we instrument for the stock of notables using $(\text{Distance} \times \text{Push})_{d,t}$, in Columns (4)–(6).[23] The OLS estimates indicate a positive association between the stock of notables and both total human capital and human capital per academic, but not with the number of academics. Once we instrument for the stock of notables, however, we find that larger stocks of notables leads to higher total human capital, a greater number of academics and higher human capital per academic. Quantitatively, a 10% increase in the stock of notables leads to a 5.4% increase in the human capital produced per academic, consistent with the interpretation that notables transmitted productivity-enhancing knowledge rather than merely attracting scholars mechanically.

Political institutions. An alternative mechanism through which the presence of notables could have spurred urban growth and development, is via political institutions. In partic-

[23] We present the results with $(\text{Push} \times \text{Pull})_{d,t}$ in Table A.2 and with both in Table A.3 and find qualitatively very similar results.

Table 5: **Academic human capital and notables**

	OLS			IV		
	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln\left(\frac{H}{Aca}\right)_{d,t}$	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln\left(\frac{H}{Aca}\right)_{d,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.31***	0.11	0.16**	1.09***	0.70**	0.54**
	(0.11)	(0.09)	(0.07)	(0.33)	(0.29)	(0.22)
$\ln L_{d,t}$	0.52**	0.35*	0.35*	-0.29	-0.26	-0.11
	(0.24)	(0.20)	(0.18)	(0.43)	(0.35)	(0.32)
Destination FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Observations	627	616	604	524	516	508
R^2	0.73	0.74	0.74	0.70	0.70	0.74
Within R^2	0.06	0.02	0.04	-0.09	-0.11	-0.03
Wald (1st stage), $\ln N_{d,t}$				22.29	24.00	21.26
First stage: Distance x Push IV	-	-	-	0.74***	0.75***	0.73***
				(0.16)	(0.15)	(0.16)

Notes: Standard errors are clustered at the destination level.

ular, notables may have pushed for institutional constraints against the absolutist executive (for example, in the vein of De Long and Shleifer, 1993). Inclusive forms of local government have frequently been identified as a key determinant of rapid urban growth, and as such could explain our results in Section 4.1. To assess this channel, we examine whether the presence of notables is significantly correlated with the emergence of urban centers which enjoyed 'commune status' in the form of self-governing municipal institutions following Bosker et al. (2013). This exercise is particularly relevant in light of the result shown in Table 2, which shows that notables tended to migrate towards destinations with pre-existing inclusive institutions. As in the previous analyses, We estimate both OLS and IV specifications. The results are reported in Appendix C.3 (Table A.4). Overall, we find little evidence that an increase in a region's notables' presence affected the likelihood of developing more inclusive institutions. Although both of our instruments remain powerful in predicting the stock of notables, the IV-estimates are small and not statistically significant. We therefore conclude that changes in local political institutions are unlikely to be the primary mechanism underlying our main results.

Population flows. A final mechanism we consider is whether the migration patterns of notables documented in our dataset merely proxy for broader population movements. If so, the positive effects of notable presence and inflows could reflect a 'mechanical' effect of large-scale migration, rather than the causal influence of upper-tail human capital.

We view this interpretation as unlikely for several reasons. First, Tables 3 and 4 show that a larger stock of notables associated with useful knowledge leads to urban development, but a larger stock of other notables does not. For general population flows to explain the discrepancy between these results, only movements by notables in human-capital-related professions had to be tightly correlated with large-scale population flows, but not with other notables. There is little reason to expect such systematically different correlations across groups of notables, which we interpret as evidence against this mechanism.

Second, by focusing on the period 1500-1800, we study pre-industrial Europe, which is often modeled as operating under a Malthusian regime (e.g., Bouscasse et al., 2025). In such a setting, regions that are able to support a larger urban population must have been more productive as inputs are subject to diminishing returns to labor. For this reason, mechanical flows of low-skilled people are more likely to be the consequence rather than the cause of higher urban growth.

Finally, qualitative evidence on both large-scale migration and the movement of upper-tail human capital suggests that a strong overlap between the two is unlikely. This is because while notables often traveled to faraway places, low-skilled people likely tended to migrate to closer-by places.[24] An illustrative example is the fall of Antwerp in 1585.[25] Contemporary accounts indicate that while a substantial share of the general population fled to nearby Zeeland following the city's capture by Spanish forces, many notables relocated to the more distant province of Holland (Briels, 1985, pp. 218–221). Taken together, these arguments suggest that the migration of notables does not simply proxy for broader population flows, but instead captures the movement of upper-tail human capital with distinct and economically meaningful consequences for urban development.

5 Historical urban development and agglomeration

In this section, we show that historical patterns of urban development are not only relevant for past economic outcomes but continue to shape contemporary allocations. Specifically, we argue that regions with higher levels of urban development in the past exhibit greater export potential today, thereby influencing present-day spatial patterns of economic activity across Europe. To establish this relationship, we take a two-step approach. First, using contemporary data on goods trade and a standard gravity framework, we construct a measure of regional export potential that depends on the local productivity level. Second, we show this measure of export potential positively correlates with past levels of urban development. Finally, we argue that the effect of past urban development operates through its impact on contemporaneous current levels, and we exploit this channel to provide evidence of agglomeration forces, or aggregate increasing returns to scale, at the regional level.

Export potential. Two strands in the literature attempt to establish the presence of agglomeration effects (Koster & Thisse, 2024; Puga, 2010). One strand primarily leverages variation in wages (Glaeser & Maré, 2001; Henderson, 1986; Sveikauskas, 1975) or rents (Drennan & Kelly, 2011). A second strand exploits the structure of spatial equilibrium models to estimate the magnitude of agglomeration forces directly (Ahlfeldt et al., 2015; Heblich et al., 2020).

[24] The average migration distance by notables in our sample period is consistently between 350 and 375km.
[25] For more information on this case study, we refer to Appendix B.2.

Our approach falls within the second strand. However, rather than specifying a fully fledged spatial equilibrium model, we rely only on a gravity equation for goods trade. We assume that goods are differentiated by origin of productions à la Armington (1969) but the same relations would also arise in models of comparative advantage like Eaton and Kortum (2002). Households decide on consumption and is governed by a constant elasticity of substitution utility function and solve the following problem:

$$\max_{C_{od}} C_d = \left(\sum_o \left(\xi_{od} C_{od} \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$
$$\sum_o C_{od} P_{od} = Y_d = W_d L_d,$$

where C_{od} denotes consumption in destination d of goods produced in origin o, P_{od} is the corresponding delivered price, and ξ_{od} captures bilateral preference shifters. Solving the utility maximization problems yields the standard CES demand system,

$$C_{od} = \xi_{od}^{\sigma} \left(\frac{P_{od}}{P_d} \right)^{-\sigma} C_d, \qquad P_d \equiv \left(\sum_o \left(\xi_{od} P_{od} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}},$$

where P_d denotes the CES price index in destination d. Multiplying both sides with P_{od} yields bilateral trade flows,

$$X_{od} \equiv C_{od} P_{od} = \xi_{od}^{\sigma} \left(\frac{P_{od}}{P_d} \right)^{1-\sigma} Y_d,$$

where we have used that $Y_d = C_d P_d$ by homotheticity of preferences. Assume iceberg trade costs that increase with distance D_{od},

$$\tau_{od} = \xi_{od} D_{od}^{\gamma}.$$

Combining this with the expression for the destination-specific price index yields a model-implied gravity equation for destination-specific import shares,

$$s_{od} = \exp \left[\gamma(1-\sigma) \log D_{od} + \underbrace{(1-\sigma) \log \frac{w_o}{\overline{z}_o L_o^{\alpha}}}_{\equiv \theta_o} + \underbrace{(1-\sigma) \log \frac{1}{p_d}}_{\equiv \theta_d} \right] \xi_{od}^{1-\sigma}, \tag{4}$$

where, following Allen and Donaldson (2022) and Heblich et al. (2020), we assume that regional productivity takes the form $z_o = \overline{z}_o L_o^{\alpha}$.

The destination fixed effect θ_d captures the inverse of the regional price index and is commonly interpreted as consumer market access (Redding & Turner, 2015). The origin fixed effect θ_o captures the discrepancy between local wages and productivity. Crucially, allowing local productivity to be a function of local population, we can use variation in the origin fixed effect, conditional on local wages, to understand whether regional productivity increases in local population. In this sense, θ_o provides a measure of regional export potential that is informative about the presence of agglomeration forces. Finally, under the assumption that $\mathbb{E}\left[\xi_{od}^{1-\sigma} \mid D_{od}, \theta_o, \theta_d\right] = 1$, Equation (4) can be consistently estimated using PPML.

Persistence. To assess whether historical urban potential is persistently correlated with contemporary export potential, we estimate the following regression:

$$\widehat{\theta}_{o,2011} = \beta \ln L_{o,t} + \boldsymbol{X}_{o,2011}^{\intercal} \gamma + \varepsilon_{o,2011}. \tag{5}$$

Here, $\widehat{\theta}_o$ denotes the estimated export potential from the gravity equation, $\ln L_{o,t}$ is the log of urban population in century t at the regional level, $\boldsymbol{X}_o$ is a vector of control variables, and ε_o is an error term. To ensure that the correlation between current export potential and past urban population is not driven by persistent determinants of export potential, we control for a region's proximity to a large river, terrain ruggedness and remoteness.

Columns (1)–(4) of Table 6 report the results from estimating Equation (5) using various measures of historical urban population. Column (1) relates contemporary export potential to region-specific urban population in 1900 and shows that for every 10% increase in past urban population, a region export potential today is 2.2% larger. Column (2) additionally includes contemporary country fixed effects. In this specification, the elasticity of export potential to historic urban population rises to 2.4% which ensures that the effect is not driven by country-level differences in delineating NUTS2 regions. Finally, Columns (3) and (4) consider whether the result in Column (2) is specific to urban population in 1900 by replacing this measure with urban population in 1800 and 1700. While the elasticity slightly falls to 0.21 and 0.2 respectively, the results remain qualitatively very similar.

Agglomeration. Why does historical urban population continue to matter for export potential today? We argue that this persistence arises because population patterns are highly persistent and because the European economy is characterized by agglomeration forces, or aggregate increasing returns to scale, at the regional level.

To corroborate this mechanism, Column (5) of Table 6 reports results from augmenting Equation (5) with contemporary regional population, in addition to urban population in 1900. Once current population is included, the coefficient on historical urban population becomes small and statistically insignificant, while contemporary population fully accounts for the observed variation in export potential.[26] This pattern suggests that the effect of historical urban development operates primarily through the persistence of population over time.

Second, to directly assess the presence of agglomeration forces, we follow the recent literature on spatial agglomeration (Ahlfeldt et al., 2015; Allen & Donaldson, 2022; Heblich et al., 2020) and assume that local productivity depends on population size according to $z_o = \bar{z}_o L_o^{\alpha}$. Under this assumption, we estimate different versions of the following regression:

$$\widehat{\theta}_{o,2011} = \beta \ln L_{o,2011} + \boldsymbol{X}_{o,2011}^{\intercal} \gamma + \varepsilon_{o,2011}. \tag{6}$$

Here, $\ln L_{o,2011}$ is log regional population today or urban population such that the coefficient β indicates whether there are aggregate increasing returns to scale or agglomeration forces at the regional level. This is because, conditional on local wages, the only way in which a region's export potential in Equation (4) depends on regional population is because the pro-

[26] We obtain the same qualitative result when using urban population in 1800 or 1700 instead of 1900.

ductivity shifter z_o depends on regional population. Finally, $\boldsymbol{X}_o$ is again a vector of control variables, including local wages on top of the persistent geographic forces that give rise to higher export potential. ε_o represents the error term.

A key challenge in identifying agglomeration effects is that, apart from the persistent geographical features that lead to higher export potential, other reasons for higher regional productivity may drive both high export potential and make people sort into productive cities. To address this concern, we follow the literature on agglomeration effects and instrument contemporary regional population with past urban population (Ciccone & Hall, 1996; Combes et al., 2019). Doing so in Column (6), we estimate the effect of contemporary regional population on regional export potential while instrumenting for contemporary population with urban population in 1900. In line with Column (5), urban population in 1900 is a strong instrument for contemporary population and we estimate that a 10% rise in regional population induces an increase in export potential by 4.3%, which is slightly lower than the OLS estimate in Column (5).

While urban population in 1900 does explain export potential beyond its effect through contemporary population builds some confidence that exclusion restriction is satisfied, there is a remaining concern that persistent unobserved productivity shocks may have driven both urban population in 1900 and export potential today. To address this concern, we consider urban population in 1800 and urban population in 1700 as alternative instruments. By considering instruments for which today's drivers of productivity are likely to differ more and more from the ones in the past, it becomes more likely that the exclusion restriction holds (Combes et al., 2010). Columns (7) and (8) show that although using urban population dating back further in time reduces the power of the instruments somewhat, the estimated elasticities are quantitatively very stable and remain precisely estimated.

6 Conclusion

Europe's history of political fragmentation is often raised as a key driver of the Great Divergence, and thus prominently features in narratives comparing economic development *across* continents. At the same time, little is known about how this salient feature of European historical institutions shaped comparative development *within* the Continent. A deeper understanding of this question is particularly important in light of growing concerns that Europe's Single Market may be less integrated than commonly assumed.

This paper argues that historical borders shaped the reallocation of upper-tail human capital during the early modern period, the era that was arguably foundational for Europe's takeoff to modern economic growth fueled by the formation of the intellectual culture. More specifically, we show that political fragmentation shaped the mobility of upper-tail human capital. In turn, the spatial allocation of this human capital determined the urban development of regions in Europe as a higher stock of notables spurred growth in urban development. We provide suggestive evidence that one reason for this is that notables brought useful knowledge and these patterns of urban development have left persistent traces in the spatial allocation of activity today. Taken together, these results serve as a salient policy re-

Table 6: **Persistence and agglomeration**

	$\hat{\theta}_o$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\ln L_{d,2011}$					0.49***	0.43***	0.40***	0.41***
					(0.06)	(0.04)	(0.05)	(0.04)
$\ln L_{d,1900}$	0.22***	0.24***			-0.03			
	(0.02)	(0.03)			(0.04)			
$\ln L_{d,1800}$			0.21***					
			(0.04)					
$\ln L_{d,1700}$				0.20***				
				(0.03)				
Country FE		✓	✓	✓	✓	✓	✓	✓
Controls: Wage	✓	✓	✓	✓	✓	✓	✓	✓
Controls: Geography	✓	✓	✓	✓	✓	✓	✓	✓
Controls: Geology	✓	✓	✓	✓	✓	✓	✓	✓
Observations	216	216	216	216	216	216	216	216
Wald (1st stage), $\ln L_{d,2011}$						79.08	41.75	39.92
R^2	0.49	0.62	0.57	0.57	0.76	0.76	0.76	0.76
Within R^2		0.44	0.37	0.36	0.64	0.64	0.64	0.64

Notes: Standard errors are clustered at the country level.

minder of how institutional constraints shape the propagation of human capital across time and space.

One promising avenue for future research is the formal modeling of the historical border changes exploited in this paper to identify their effects on the allocation of human capital. Recent work has begun to model the interplay between geographic fundamentals and micro-economic foundations regarding span of control, public good provision and transportation technology (Allen, 2023). Our findings underscore the importance of accounting for the endogenous responses of human capital to political transformations, as well as the persistent effects of such responses on patterns of economic development within Europe.

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Appendices

Table of contents

A Additional literature

A broader discussion on the economic effects of political fragmentation The broad socio-economic consequences of political fragmentation and poly-centrism in Europe have been a prominent topic of discussion in scholarship, especially in work trying to explain the Great Divergence. Early works on Europe's economic history seem to have largely highlighted the positive consequences of this distinct feature of the Continent. Such positive appraisals typically center around the idea that institutional competition between the Contintent's many states fostered efficiency in public goods provision. For instance, in his seminal description of what he dubbed *The European Miracle*, Jones (2003, pp. 123–124) considered a central role for "competitiveness and 'genetic variety' of the states system" (describing it not as a "sufficient" but a "necessary" cause of economic development). In a similar fashion, Landes (1998, p. 38) claimed that "fragmentation was the strongest brake on wilful, oppressive behavior", as "political rivalry and the right of exit made all the difference". More recently, Scheidel (2019, p. 15) argues for fragmentation as an important precondition for European development and strongly claims: "without polycentrism, no modernity".

On the other hand, scholars have also highlighted more the negative consequences of political fragmentation in pre-industrial Europe. In their careful comparative political history of China and Europe, Rosenthal and Wong (2011, p. 229) view "European political competition less as the source of economic virtue and more as a vice that reduced the possibility of economic growth", emphasizing the distortive effects of Europe's many wars on long-distance trade and public spending. Earlier, Epstein (2000, p. 15) also already highlighted the coordination problems that arose from Europe's heavily fragmented jurisdictions, considering it the "main source of the institutional inefficiency" that the era of 'absolutism' inflicted upon Europe before the nineteenth century.

Mokyr (2002, pp. 278–282) concludes that state fragmentation and technological creativity are correlated, but the former should not be considered nor a sufficient nor a necessary condition for technological progress.[I] Point-in-case is the variable nature of what one might consider the 'optimal' size of the state, as evidenced by the rise and decline of European city-states (this theme is also central to the work of Alesina and Spolaore, 2003). In sum, the benefits (institutional diversity, freedom of ideas) and costs (uncertainty and damages related to state competition and wars) should be considered in balance.

What is common to both positive and negative appraisals of the effects of poly-centrism on economic prosperity, however, is the potentially important effects of shifting political allegiances on the spatial (re)allocation of human capital. Jones (2003, pp. 119–123) vividly describes how refugee flows during Europe's long history of inter-state conflicts shaped the diffusion of culture, science, technology and commercial practice. Mokyr (2002, p. 279)

[I] In later work, Mokyr (2016, pp. 165–178) takes a more explicit stance in favor of a positive appraisal of the consequences of state fragmentation, underlining its importance in shaping cultural pluralism and ensuring protection from conservative forces against innovation. In a recent empirical paper, Cabello (2026) finds support for this thesis, showing that creativity growth in cities (as measured with Wikipedia entries per urban population) in politically fragmented areas was more robust to times of geopolitical and religious conflict.

considers how, in the presence of political diversity, creative minds could relocate to other realms more hospitable to their new ideas. The importance of migration to propagate innovations was already highlighted by Cipolla (1972, p. 48), who stated that "through the ages, the main channel for the diffusion of innovations has been the migration of people." This was supported by the observation that the European intellectual innovators showcased high levels of geographic mobility (Mokyr, 2014, p. 175).

It goes without saying that such international[II] flows of human capital likely had a marked impact on the distribution of economic prosperity in current-day Europe. Putting this theory to the test is the main object of study of our paper.

[II] It is worth emphasizing that the literature has mostly emphasized international (cross-border) migration rather than intranational migration flows. Our analysis considers both.

B Data

B.1 Borders

In this Section, we describe some characteristics of the historical border dataset used in the main analysis (Abramson, 2017). Figure documents the number of realm changes that a NUTS2 region underwent throughout the long period of European state formation from 1500 to 1800. The pattern which emerges closely fits the narrative reconstructed by earlier work (Abramson et al., 2022; Kitamura & Lagerlöf, 2020). This can be best appreciated by retaking Charles Tilly's description of the European state system ca. 1490 in his seminal work (1990, pp. 40–43). At this time, a "broken circle of larger states", which constituted of larger territories consolidated by a single ruler such as regions in Spain, France, England and Scandinavia, surrounded vast parts of Europe which "remained a land of intensely fragmented sovereignty" (Tilly, 1990, p. 41). It is indeed in the latter central area, which spanned from Northern Italy to Flanders, that we see the highest level of border insecurity, as the subsequent long process of state formation and consolidation especially took hold there. Case-in-points are the NUTS2 regions which were covered by the former Holy Roman Empire (HRE). A key characteristic of the HRE was the "fluidity of the Empire's borders and the patchwork character of its internal subdivisions" (Wilson, 2016, p. 1).[III] Important to our analysis, however, is that border changes were not unique to regions affected by the HRE. The Italian peninsula, for instance, with its long history of city states also stands out as a historical case of poly-centrism.

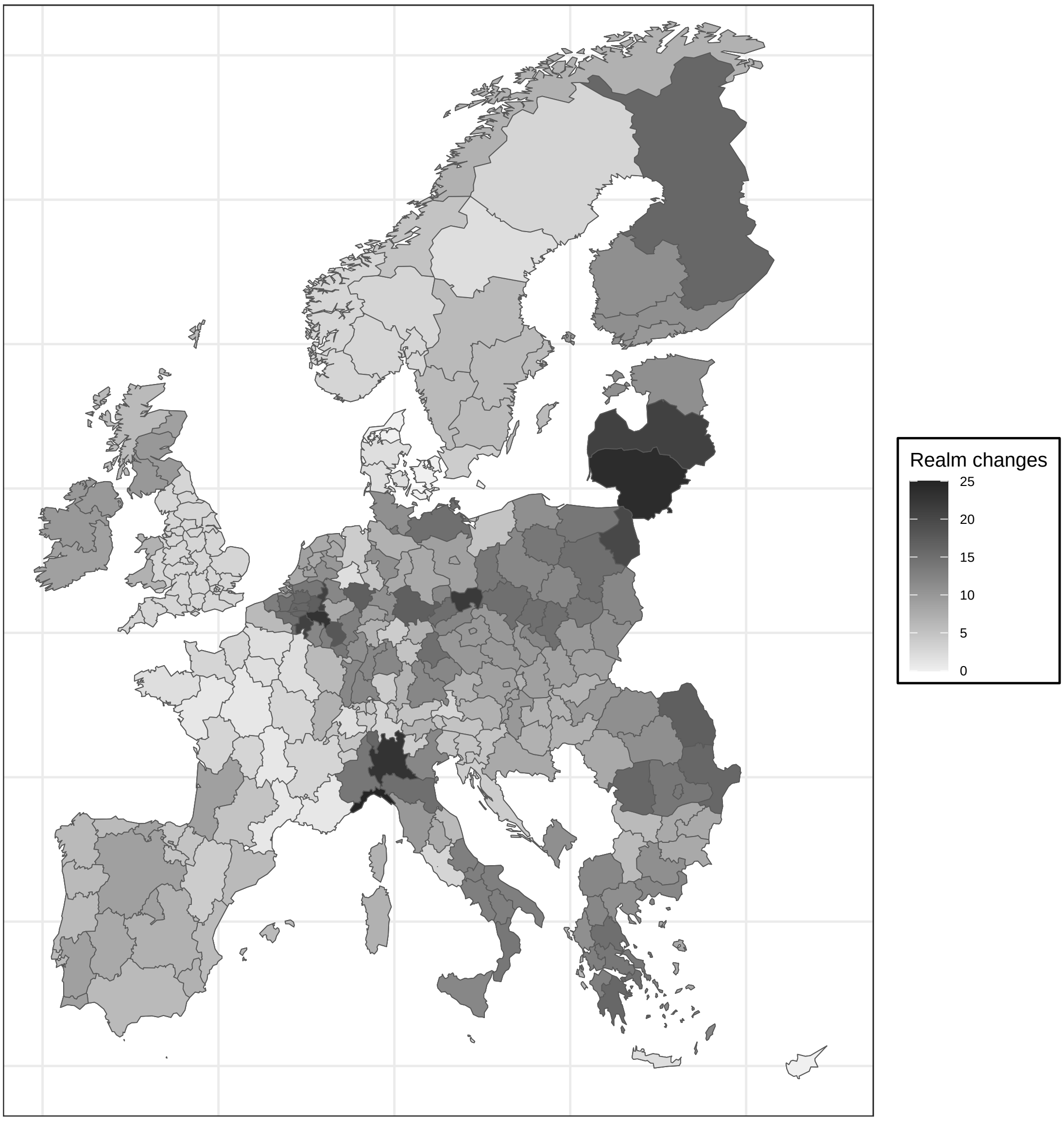
These border changes naturally also affected the bilateral 'common realm' status of the NUTS2 regions in our database. Figure A.2 shows the treatment variation plot, which shows which NUTS2 region pairs were treated (in the same realm) or untreated (in different realms). As expected, a sizeable share of NUTS2 regions never were part of the same political realm, while a smaller but persistent share of pairs were always part of the same state. Importantly, a significant group of region pairs were treated in a staggered and non-absorbing manner. This group guides our choice for the panel-matching DiD identification strategy.

B.2 Migration

In this Section, we illustrate the use of data on 'notable people' (Laouenan et al., 2022) to reconstruct historical migration flows of upper-tail human capital. We do so by examining what this data can tell us about some of the more noteworthy and well-documented migration episodes in European history. The purpose of these illustrations is not to argue in favor (or against) the proposed mechanism of political borders shifts driving migration, but

[III] A natural question is why the HRE is not considered to be one political entity. Abramson (2017, pp. 104–106) discusses this issue in depth. The answer to this question is indeed connected to the HRE's high levels of political fragmentation, as the patchwork of sub-entities of the HRE maintained de facto independence and full jurisdiction over economic decisions. Considering political entities within the HRE as independent also follows other empirical work on state fragmentation (Abramson et al., 2022; Kitamura & Lagerlöf, 2020).

Figure A.1: **Number of realm changes per NUTS2 region: 1500-1800**



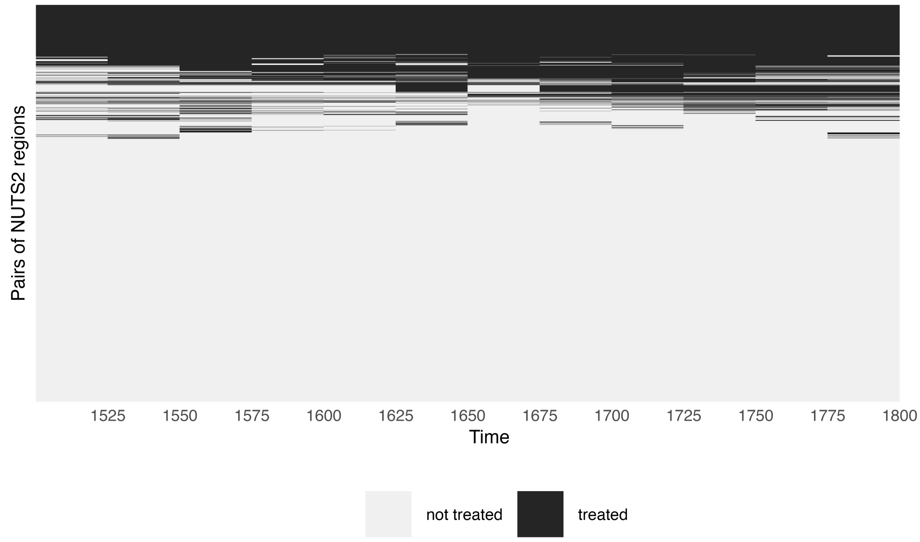
Notes: This map plots the number of time the historical realm to which a contemporary NUTS2 region belonged. To assign membership to a particular realm we take the realm with which the NUTS2 region has the greatest geographic overlap.

rather to merely illustrate the potential of the Laouenan et al. (2022) data to track regional movements during salient historical migration events.

We consider three historical episodes. The first one is situated in the Early Modern Period — during the earliest stages of our sample period — showcasing the potential of our data even for a data-poor historical environment. Second, we consider the English case, as it might be the most familiar to readers. Third, we also consider a case study beyond the scope of our main analysis, but nonetheless important to acknowledge the limitations of the source material.

Finally, we also consider a comparison of the (Laouenan et al., 2022) with data from `freebase.com`, as the latter source has been used by earlier empirical research to infer mi-

Figure A.2: **Treatment status of pairs of NUTS2 regions**



Notes: The figure plots treatment status for each pair of NUTS2 regions across 25-year intervals. A pair is coded as treated in an interval if both regions belong to the same realm.

gration patterns by notables.

B.2.1 The fall of Antwerp and the Dutch Revolt

Emigration from the (Southern) Netherlands is typically considered to be one of the "great west-European migrations of early modern times" (Israel, 1998, p. 308).[IV] During the Eighty Years' War (1566/1568–1648), Habsburg Netherlands broadly fell apart into the Southern Netherlands – which remained part of Habsburg Spain and later Habsburg Austria – and the Northern Netherlands, which went on to form the Dutch Republic. Reasons for the Dutch Revolt were likely manyfold (including unhappiness with fiscal pressure from the Spanish Crown), but tensions resulting from Catholic repression of Protestant locals stand out as a key driver (Israel, 1998, pp. 169–170).[V]

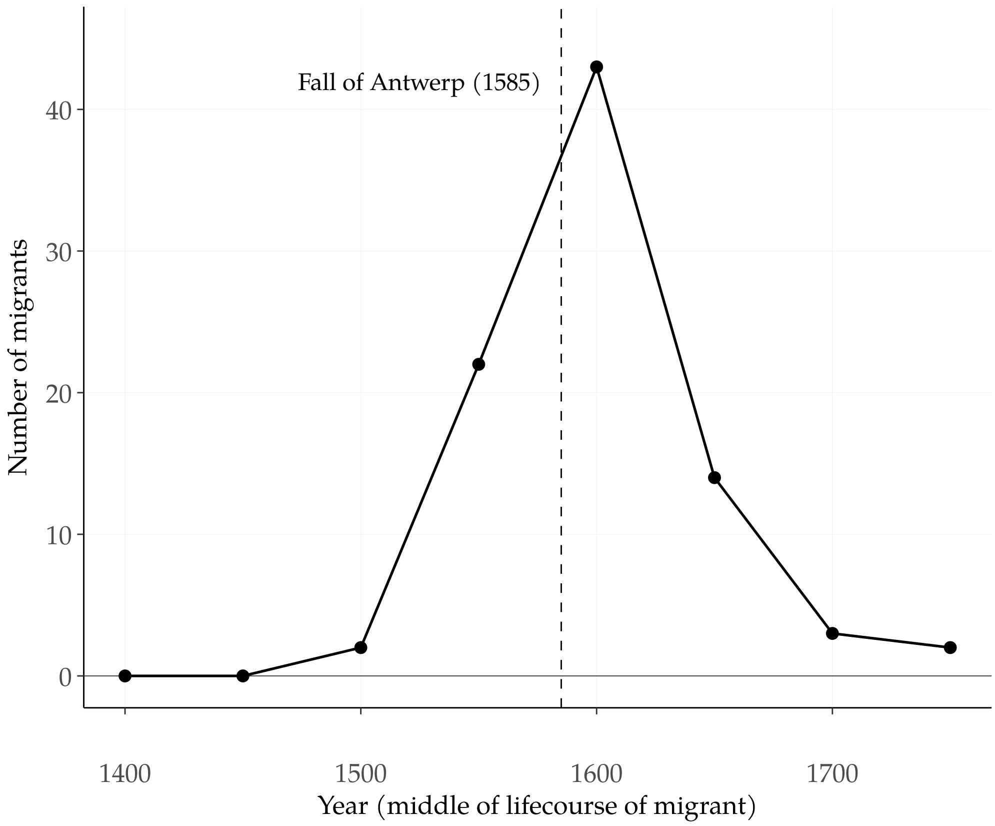
A particularly symbolic event during the war between the Habsburgers and the Dutch revolutionaries was the fall of Antwerp in 1585. Not only did it constitute the final major success of the Spanish armies, laying the seeds for the later demarcation between the Northern and the Southern Netherlands, it also signified one of the cultural and economic capitals of Northwestern Europe (again) falling under Habsburg rule. Importantly for our context, the Fall of Antwerp is symbolically connected to an emigration wave of the city's economic and cultural elite, who gravitated towards the Northern parts of the Netherlands. In reality, however, northwards migration already picked up pace in the early stages of the Eighty Years'

[IV]The others being the late-17th-century exodus of the Huguenots from France and the expulsion of the Jews from Spain (following the the Alhambra Decree of 1492.

[V]Cabello (2025) presents a quantitative assessment of the effects of Spanish Counter-Reformation on the production of scientists.

War, but indeed culminated in the years following the fall of the city (Briels, 1985, pp. 76–81). An important question is now, whether our data is able to reflect these patterns of emigration from Antwerp to regions in current-day Netherlands. The pattern in Figure A.3 confirms that this is the case. Migration between Antwerp and the Netherlands is relatively large while being part of the same realm, but strongly drops once Antwerp becomes part of the Habsburg empire, closely fitting the aforementioned historical narrative.

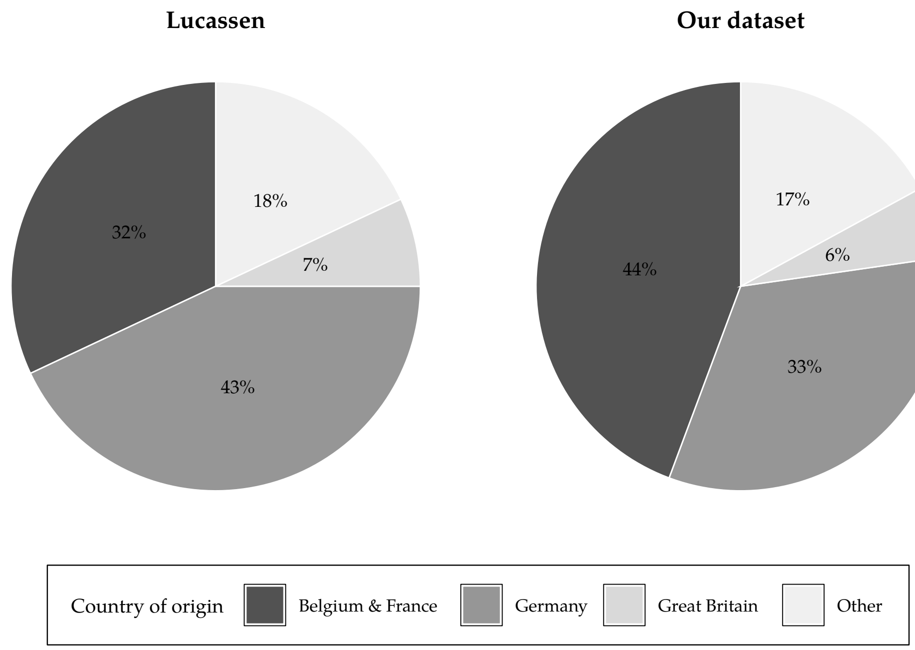
Figure A.3: **Migration of notables from Antwerp to the Netherlands: 1400-1750**



Notes: We quantify migration from Antwerp to current-day Netherlands, as migration from NUTS2 code "BE21" to any region starting with "NL".

If we disaggregate the migration data underlying Figure A.3 further at the regional level, it is apparent that most Belgian notables moving to the Netherlands settled in North and South Holland. This region is indeed considered to be the epicenter of South-Dutch immigration (Briels, 1985, p. 105). Prior historical research, primarily based on marriage documents of Dutch urbanites (for a discussion, see Lucassen, 2002, p. 19), also allows us to reconstruct the composition of immigrants in Holland during that era. Is the share of Belgian migration we measure in our data representative for general trends of migration as measured in these sources? In Figure A.4 we compare the immigration shares in the Laouenan et al. (2022) data with migration shares reconstructed by Dutch historians. This comparison seems satisfactory. Both datasets confirm that Belgian, French and German migrants constituted a major share of urban migration to Holland. Our dataset gives a higher weight to the former two groups. This is, however, to be expected as our sample only concerns notables' migration, and the Lucassen (2002) sample contains all layers of society. Quantitative research has confirmed that the migrants from the southern Netherlands and France were particularly skilled (Van Lottum, 2007, pp. 68–69), and hence more likely to be included in our sample.

Figure A.4: **Migration to Holland: ca. 1650**



Notes: Data from the left panel is from Lucassen (2002), as adapted in Van Lottum (2007, p. 65). The 'other' group mainly constitutes of migrants with Scandinavian roots.

To fully tackle the issue of disentangling upper-tail human capital from mass migration (see also our discussion in Section 4.2), it is arguably more sensible to compare our migration data to a more representative dataset for highly-skilled individuals only. We do so by comparing the destination of the notables migrating away from Antwerp during the Dutch Revolt with figures from a detailed study on destination decisions by Antwerp painters (Vermeylen, 2014). In his prosopographical study, Vermeylen considers the following main migration destinations of Antwerp painters in the turbulent period of 1560-1590: Germany was the prime choice, followed by England, France and Italy. For instance, London was a prime destination due to its religious tolerance for protestants as well as due to the strong commercial ties between the two regions. Such patterns indeed show up in our data on the destinations of artists leaving Antwerp. As such, we confirm further that our data is not only able to show time shifts in migration trends (as illustrated in Figure A.3), but also speaks relatively accurately on the bilateral nature of historical migration patterns. At the same time, this exercise also points to a caveat of inferring migratory patterns from birth and death place. Another noteworthy destination was the German city of Frankenthal, where Flemish emigrees crucially contributed to the so-called 'Frankenthal school of painting'. Gillis van Coninxloo (1544-1606) was one of the School's most prominent artists. In 1595, however, he relocated to Amsterdam. As such, this connection is absent in our database.

B.2.2 Migration to England

In Figure A.5, we show the inflow of notables to England from several key sender countries throughout England's history over the period from 1500 to 1900. Belgian-Dutch, and in particular Flemish, migration to England had a long history, with both regions' economic fates being unmistakably intertwined through their textile activities already in the Middle Ages (for example, see Pajic, 2023). At the same time, cultural exchange between the two regions was frequent (Murray, 1957). For our period, this long history of economic and cultural exchange translates into a significant flow of notables from Belgium to England, primarily in the form of painters linked to Early Netherlandish painting (Flemish Primitives), during the 16th and 17th centuries.

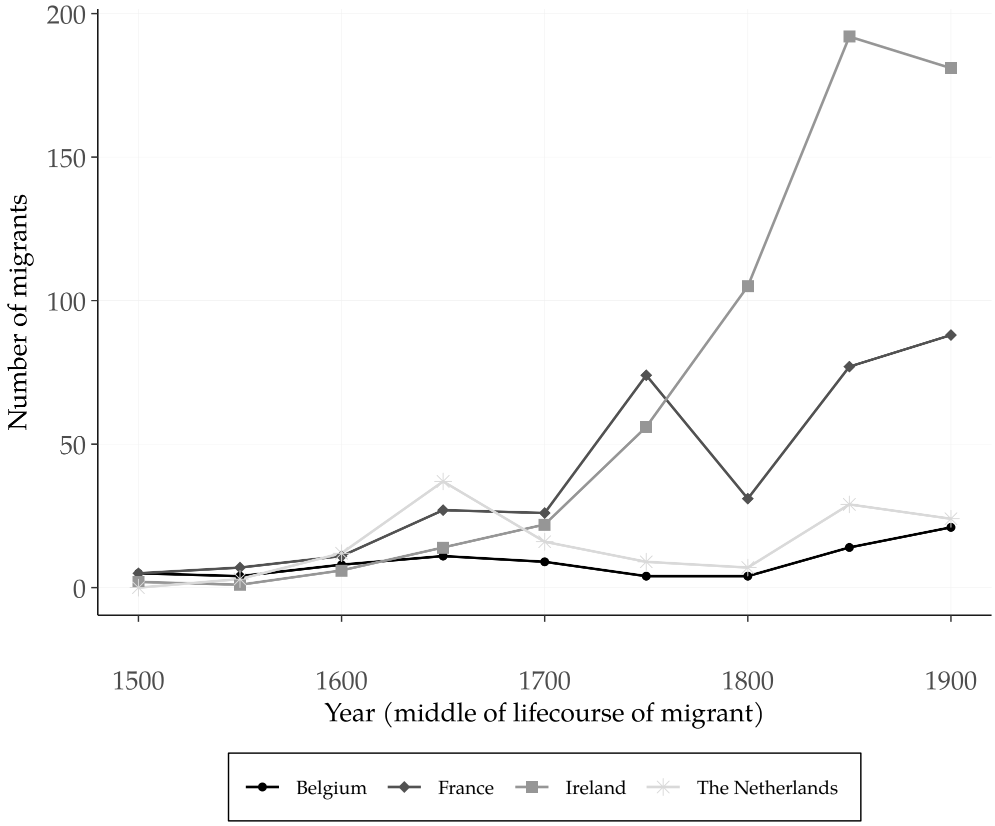
Another source of immigration of notables was unmistakably France. Just like Belgium, geographical proximity, with merely the Channel separating England from these two countries on the Continent, was a key driver of such intense migration. At the same time, both countries had a common cultural and, at times, political history. Two evolutions during the long history of notables' migration across the Channel stand out. First, we see a remarkable increase in French notables moving to England throughout the 17th to 18th centuries. This trend can be explained by the repression of the French Huguenots during the (contra-)Reformation. Indeed, many migrations in our dataset of this era were notables of Huguenot descent looking for safer territories in England. Examples in our dataset include mathematician Abraham de Moivre (1667 – 1754) and mezzotint engraver Jean Simon (ca. 1675–1751). Second, we observe a pronounced drop in French immigration ca. 1800. This should be situated in the context of the French Revolutionary and Napoleonic Wars, the last major conflict to be fought out between these two broad political entities. This observation is also a nice illustration of the claim that political borders were a key driver in shaping the allocation of notables across Europe (see Section 3).

Finally, it is worth highlighting that, for Irish immigration, we see strong increases in the notables being born in Ireland moving to England throughout the 18th century. This trend accelerates following the 1801 Acts of the Union, formally incorporating Ireland into the United Kingdom. This further showcases the effect that political unification can have on the geographic movements of the notables in the Laouenan et al. (2022) database.

B.2.3 The fall of Constantinople

So far, we have illustrated the potential of the Laouenan et al. (2022) data to infer migratory movements of Europe's notables. We end this section by also highlighting some of the limitations of this database. We do so by focusing on another pivotal moment in history, the Fall of

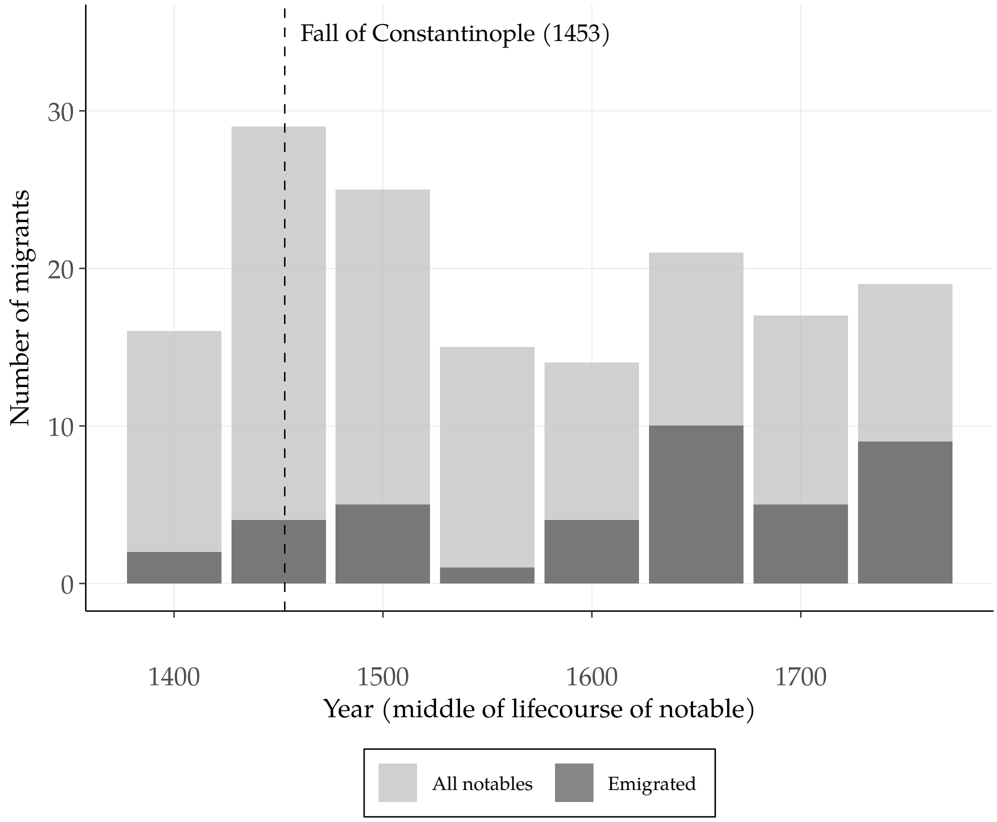
Figure A.5: **Migration of notables to England: 1500-1900**



Notes: England is defined using the following NUTS2 codes: "UKC", "UKD", "UKE", "UKF", "UKG", "UKH", "UKI", "UKJ".

Constantinople in 1453, which has been connected with the migration of Byzantine Greeks to the West. In Figure A.6, we assess this event through the eyes of the notables data. We reconstruct (i) the number of notables in Constantinople and surroundings (ii) the number of notables which we can identify as emigrant. Two observations stand out. First, the number of notables in Constantinople was already relatively low, considering the city's cultural heritage, but declined even further following its incorporation into the Ottoman Empire. Second, the database documents relatively few people migrating to Western Europe. These observations speak to two limitations in the data. First, there appears to be a Western bias. This is a well-known limitation of Wikipedia, and the authors of the database acknowledge that some bias might remain despite their best efforts of collating multiple language-versions of Wikipedia (Laouenan et al., 2022, p. 17). Second, the coverage of the data before 1500 becomes scarce. Given that our study focuses on a later period, and predominantly concerns Europe, we argue that these concerns are unlikely to bias our results. Nonetheless, we deem it an important caveat worth highlighting. To study the Fall of Constantinople, alternative and more specialized sources are necessary, as illustrated by Link (2024).

Figure A.6: **Notables in Constantinople and surroundings: 1400-1800**



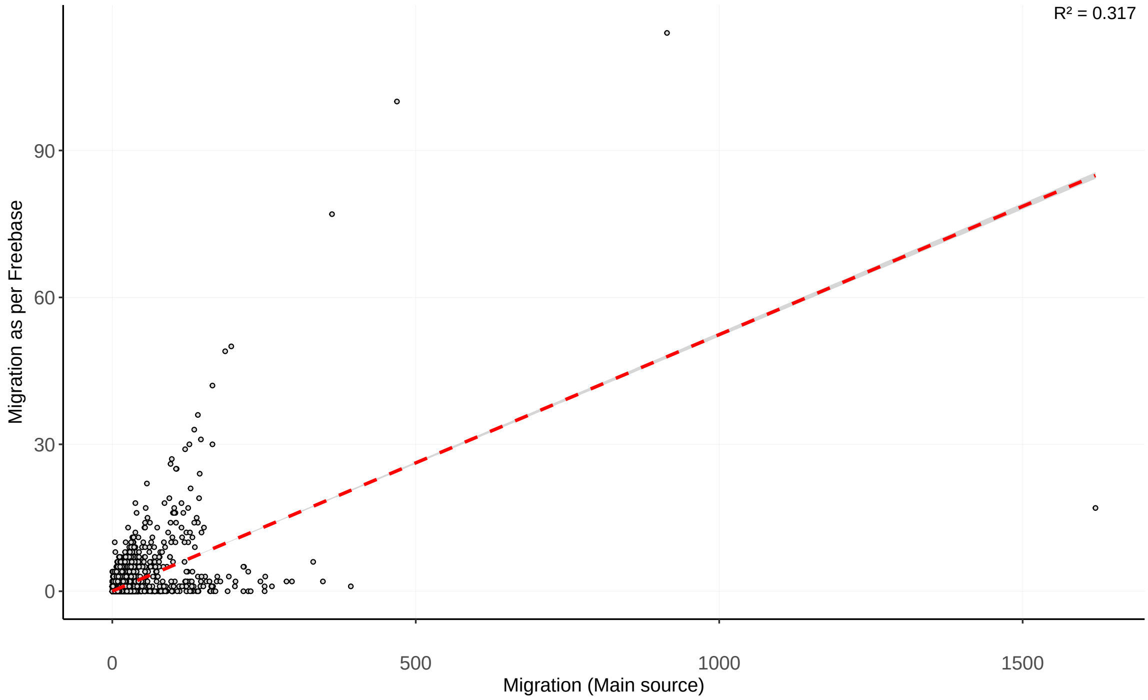
Notes: Constantinople and surroundings is defined as being part of contemporary Turkey.

B.2.4 Comparison with `freebase.com` data

A final step to illustrate the potential of the notables data in reconstructing notables' migration is by comparing our data to a dataset sourced from `freebase.com` (Schich et al., 2014). The result of this comparison can be found in Figure A.7. In essence, the main database under study in this paper draws mostly from the same range of sources (`Wikipedia.org`), and hence, overlap between the data used in this analysis and the `freebase.com` data is largely mechanical. Be that as it may, we argue this comparison is still worth reporting, the `freebase.com` data has been used successfully in earlier analyses (Serafinelli & Tabellini, 2022), and hence a comparison illuminates the comparability of our results with earlier work.

Two observations emerge in the comparison in Figure A.7. First, there seems to be a significant amount of positive correlation between the migration flows as gauged through the two different databases. Second, gauging the absolute sizes of migration flows, it becomes apparent that the data used in this paper is built using a much later, and hence more complete, cross-section of crowd-sourced knowledge on notable individuals. This underlines the improved coverage of the database by Laouenan et al. (2022). Gauging the absolute difference across countries of origin, it is mostly the improved coverage of French notables that stands out.

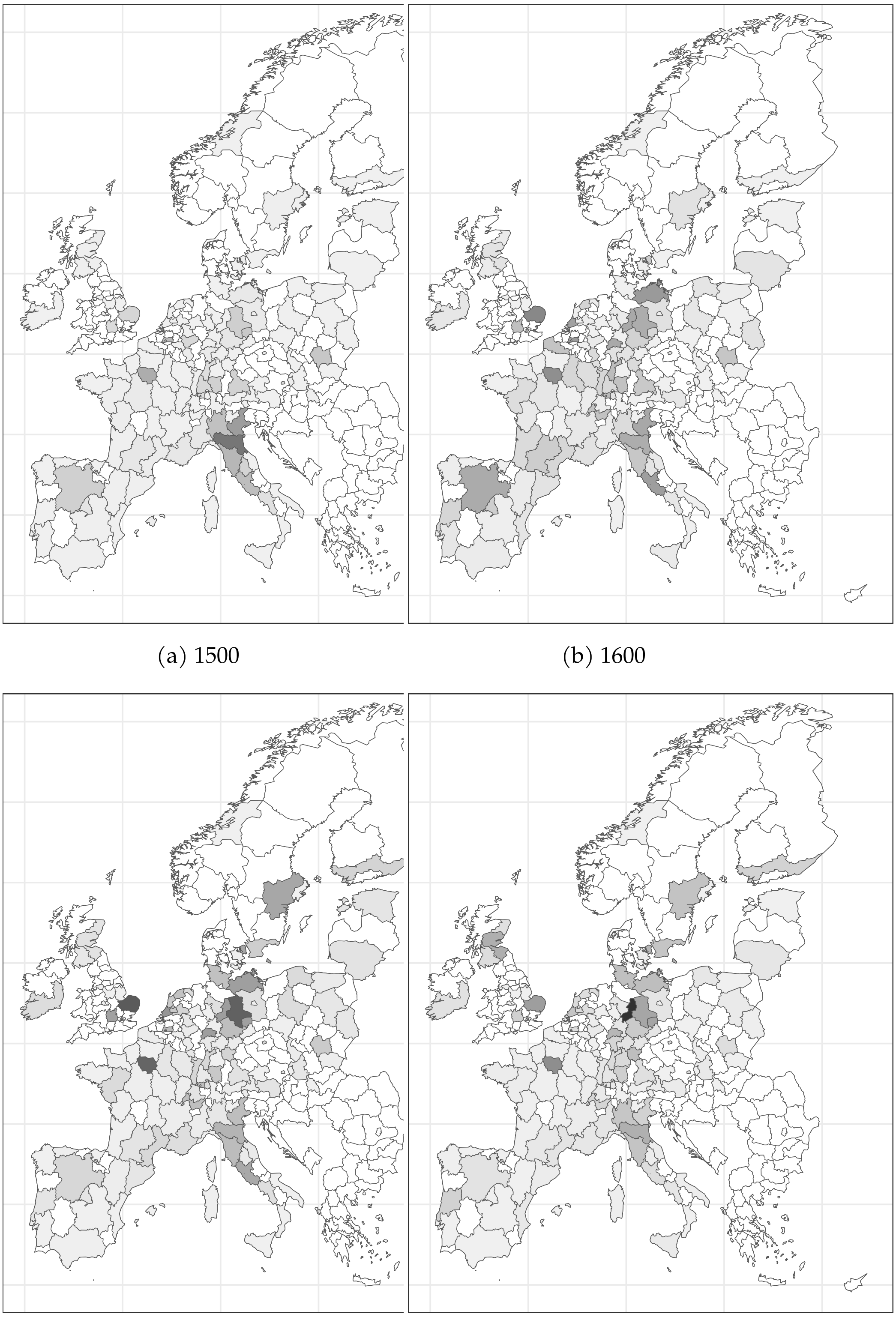
Figure A.7: **Comparison of bilateral migration flows between NUTS2 regions: 1500-1800**



Notes: This figure reports bilateral migration flows in absolute numbers between NUTS2 regions as per Laouenan et al. (2022, horizontal axis) and as per Schich et al. (2014, vertical axis) respectively, at 50-year intervals.

B.3 Human capital index

Figure A.8: **Human capital index over time**



(a) 1500

(b) 1600

(c) 1700

(d) 1800

Notes: This figure plots the total human capital in each contemporary NUTS2 region in 1500, 1600, 1700 and 1800, respectively. Total human capital is derived from the data constructed in Curtis et al. (2025) and computed as the sum of over cities within each NUTS2 region and the period spanning 25 year before and 25 years after the indicated year. The value of the human capital index ranges from zero to 16,000 with darker colours indicating higher levels of the human capital index.

C Robustness checks and additional results

C.1 Sample sizes

Table A.1: **Overview of sample sizes across different models in main text and appendix**

Model	**Number of observations** (N)	
a) Main text		
Table 2	192,908-190,592	od: NUTS2 × NUTS2; t: 25y
Table 3	1,608-1,330	d: NUTS2; t: 50y
Table 4	1,446-1,185	d: NUTS2; t: 50y
Table 5	627-508	d: Academic town; t: 50y
Table 6	216	d: NUTS2
b) Appendix (robustness)		
Table A.2	627-507	d: Academic town; t: 50y
Table A.3	627-507	d: Academic town; t: 50y
Table A.4	719-517	d: NUTS2; t: 100y

Notes: Observations are dropped as more variables are added to the models in the respective Tables. The subscripts o, d and i are consistent with the notation of the main text. t indicates whether the sample is at the 25, 50 or 100-yearly level.

C.2 Historical borders and migration

We further detail our implementation of the panel-matching framework of Imai et al. (2023). As detailed in the main text, the approach proceeds in three steps:

1. For each treated pair, we construct a set of control pairs with identical treatment histories over the past L periods.

2. We reweight matched controls to achieve covariate balance, thereby mitigating confounding on observables.

3. We apply a DiD estimator within the matched sets to net out common time trends.

For notational simplicity, a unit i represents a origin-destination pair od. Let $\mathbf{X}_{i,t}$ denote a vector of covariates, potentially time-varying, for which we wish to adjust. In particular, $\mathbf{X}_{i,t}$ includes the populations of the origin and destination regions, as well as the geographical distance between them.

Steps 1 and 2: Matching and covariance balance. For each treated observation (i,t), we construct a matched set $\mathcal{M}_{i,t}$ of control pairs i' with identical treatment histories $\{R_{i',t-\ell}\}_{\ell=1}^{L}$.[VI] To adjust for time-specific confounders, the matched sets only include observations from the same time period. Observations with empty matched sets are precluded from the analysis.

The matched sets are then further refined to account for potentially time-varying covariates $\mathbf{X}_{i,t}$. We compute the Mahalanobis distance between the treated observation i and each control i', averaged over the past L periods:

$$D_{i,t}^{M}(i') = \frac{1}{L}\sum_{\ell=1}^{L}\sqrt{(\mathbf{X}_{i,t-\ell}-\mathbf{X}_{i',t-\ell})^{\intercal}\mathbf{\Sigma}_{i,t-\ell}^{-1}(\mathbf{X}_{i,t-\ell}-\mathbf{X}_{i',t-\ell})}, \quad i' \in \mathcal{M}_{it},$$

where $\mathbf{\Sigma}_{i,t'}$ is the sample covariance matrix of $\mathbf{X}_{i,t'}$. The refined set consists of those elements in the matched set that are closest in terms of their distance $D_{i,t}^{M}(i')$.

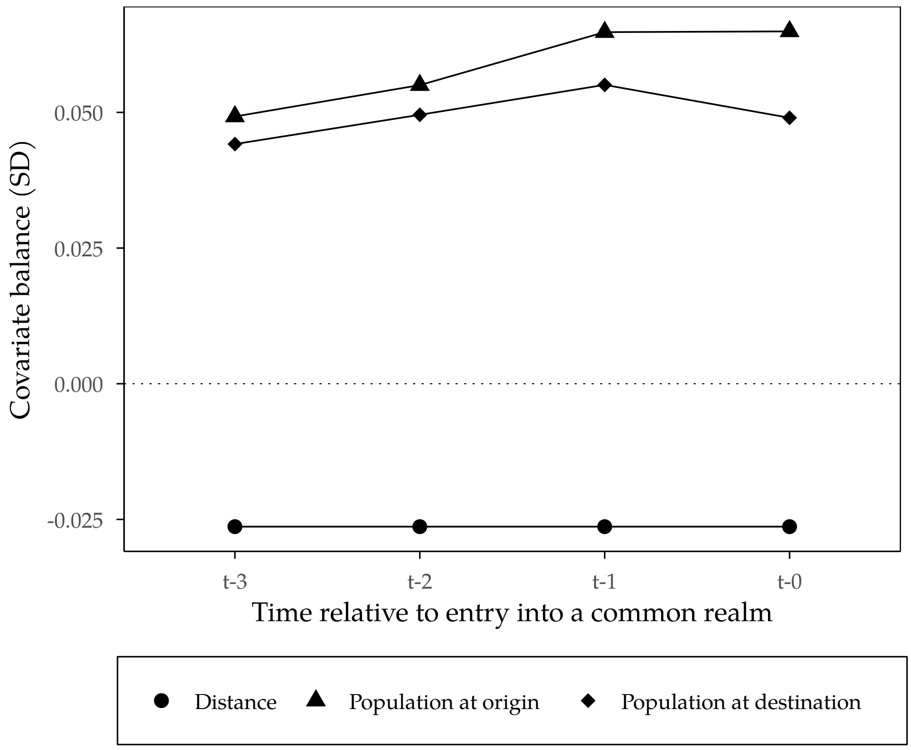
Figure A.9 reports covariate balance between the treatment and control groups after refinement of the matched sets. Assessing covariate balance allows us to evaluate whether treated units and their matched controls are comparable with respect to observed confounders. Across all covariates, standardized imbalances are below 0.07, comfortably within commonly recommended thresholds (Imai et al., 2023; Rauh et al., 2025).

Step 3: Estimation and normalization. We now describe the implementation of the DiD estimator with staggered treatment adoption and exit. Define $Q_{i,t} \equiv R_{i,t}(1-R_{i,t-1})\mathbb{I}[|\mathcal{M}_{i,t}| > 0]$.[VII] Following Imai et al. (2023), we estimate the causal estimand $ATT_L(F)$ using the esti-

[VI] The choice of L reflects a bias–variance trade-off: larger values of increase the plausibility of the parallel trends assumption but reduce the size of the matched sets. We set $L = 3$; alternative values yield quantitatively similar results.

[VII] We let $\mathbb{I}[\cdot]$ denote the indicator function.

Figure A.9: **Dynamic treatment effects of borders on migration of notables: balance**



Notes: Treatment and control pairs are matched using the Mahalanobis distance, controlling for the populations of the origin and destination regions as well as their geographical distance. The calculations are based on the panel matching methods introduced by Imai et al. (2023) and implemented using the `PanelMatch` package Rauh et al. (2025).

mator

$$\widehat{ATT}_L(F) \equiv \frac{1}{\sum_{i=1}^{N}\sum_{t=L+1}^{T-F} Q_{i,t}} \sum_{i=1}^{N}\sum_{t=L+1}^{T-F} Q_{i,t} \left[(M_{i,t+F} - M_{i,t-1}) - \sum_{i' \in \mathcal{M}_{i,t}} w_{i,t}^{i'} \left(M_{i',t+F} - M_{i',t-1} \right) \right].$$

To obtain the normalized estimator, we divide $\widehat{ATT}_L(F)$ by an estimate of the mean outcome for the control group in the pre-treatment period $t-1$:

$$\frac{\widehat{ATT}_L(F)}{\frac{1}{\sum_{i=1}^{N}\sum_{t=L+1}^{T-F} Q_{i,t}} \sum_{i=1}^{N}\sum_{t=L+1}^{T-F} Q_{i,t} \sum_{i' \in \mathcal{M}_{i,t}} w_{i,t}^{i'} M_{i',t-1}}.$$

Confidence intervals for this ratio are based on block-bootstrap replications, sampling NUTS2-pairs with replacement. To ensure valid inference, the refined matching weights are fixed across bootstrapped samples (Imai et al., 2023, p. 598).

C.3 Tests for mechanisms

Table A.2: **Urban development and notables**

	OLS			IV		
	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln \left(\frac{H}{Aca}\right)_{d,t}$	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln \left(\frac{H}{Aca}\right)_{d,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.31***	0.11	0.16**	1.84**	1.37***	0.49
	(0.11)	(0.09)	(0.07)	(0.72)	(0.51)	(0.35)
$\ln L_{d,t}$	0.52**	0.35*	0.35*	-1.05	-0.93	-0.05
	(0.24)	(0.20)	(0.18)	(0.85)	(0.60)	(0.43)
Destination FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Observations	627	616	604	523	515	507
R^2	0.73	0.74	0.74	0.60	0.58	0.74
Within R^2	0.06	0.02	0.04	-0.48	-0.60	-0.01
Wald (1st stage), $\ln N_{d,t}$				10.78	16.59	17.21
First stage: Distance x Push IV	-	-	-	0.12***	0.14***	0.13***
				(0.035)	(0.034)	(0.032)

Notes: Standard errors are clustered at the destination level.

Table A.3: **Academic human capital and notables: alternative IV approach**

	OLS			IV		
	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln\left(\frac{H}{Aca}\right)_{d,t}$	$\ln H_{d,t}$	$\ln Aca_{d,t}$	$\ln\left(\frac{H}{Aca}\right)_{d,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.31***	0.11	0.16**	1.09***	0.74**	0.53**
	(0.11)	(0.09)	(0.07)	(0.33)	(0.29)	(0.22)
$\ln L_{d,t}$	0.52**	0.35*	0.35*	-0.27	-0.28	-0.10
	(0.24)	(0.20)	(0.18)	(0.43)	(0.35)	(0.32)
Destination FE	✓	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓	✓
Observations	627	616	604	523	515	507
R^2	0.73	0.74	0.74	0.70	0.70	0.74
Within R^2	0.06	0.02	0.04	-0.09	-0.13	-0.02
Wald (1st stage), $\ln N_{d,t}$				12.00	13.81	12.75
Sargan				4.27	7.76	0.03
Sargan, p-value				0.04	0.01	0.85
First stage: Distance x Push IV	-	-	-	0.71***	0.69***	0.66***
				(0.18)	(0.17)	(0.18)
First stage: Push x Pull IV	-	-	-	0.016	0.03	0.033
				(0.032)	(0.033)	(0.032)

Notes: Standard errors are clustered at the destination level.

Table A.4: **Urban institutions and notables**

	$1\,(Commune_{d,t})$					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln N_{d,t}$	0.10***	0.07***	0.01	0.03	0.02	0.03
	(0.01)	(0.02)	(0.01)	(0.03)	(0.04)	(0.03)
$\ln L_{d,t}$		0.05*	0.07**	0.00	0.01	0.00
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Constant	0.58***	0.44***				
(0.05)	(0.09)					
Destination FE			✓	✓	✓	✓
Time FE			✓	✓	✓	✓
Observations	719	719	719	518	517	517
R^2	0.14	0.16	0.90	0.93	0.93	0.93
Within R^2			0.04	0.00	0.01	0.00
Wald (1st stage), $\ln N_{d,t}$				49.98	15.69	24.80
Sargan						0.15
Sargan, p-value						0.70
First stage: Distance x Push IV	-	-	-	0.75***	-	0.8***
				(0.086)		(0.098)
First stage: Push x Pull IV	-	-	-	-	0.13***	0.047**
					(0.02)	(0.022)

Notes: Standard errors are clustered at the destination level.