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Islam and Human Capital in Historical Spain*

Francesco Cinnirella, Alireza Naghavi, Giovanni Prarolo†

December 4, 2022

Abstract

We use a unique dataset on Muslim domination between 711–1492 and literacy in 1860 for about 7500 municipalities to study the long-run impact of Islam on human-capital in historical Spain. Reduced-form estimates show a large and robust negative relationship between length of Muslim rule and literacy. We argue that, contrary to local arrangements set up by Christians, Islamic institutions discouraged the rise of the merchant class, blocking local forms of self-government and thereby persistently hindering demand for education. Indeed, results show that a longer Muslim domination in Spain is negatively related to the share of merchants, whereas neither later episodes of trade nor differences in jurisdictions and different stages of the *Reconquista* affect our main results. Consistent with our interpretation, panel estimates show that cities under Muslim rule missed-out on the critical juncture to establish self-government institutions.

Keywords: Muslim rule; Education; Literacy; Self-government; Merchant class; Spain

JEL classification codes: O43, I25, N33, Z12, H75

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1 Introduction

Religions have been associated with economic growth through the dynamics of their institutional settings and cultural norms, which could also lead to divergence in th long run (Bisin et al., 2021). The impact of religion on economic prosperity is at times characterized by reversals, but sometime by a persistent effect (Galor, 2022). For instance, a historical explanation for the relative backwardness of the Muslim world today could be found in the nature of Islamic legal institutions which, by not favoring private capital accumulation and large-scale production, hindered the process of economic development (Kuran, 2011).[1] According to Kuran, this institutional legacy had long-run consequences which can explain the persistent underdevelopment of Islamic regions today.[2] Yet, the medieval Islamic world surpassed the West and China in scientific and technological production for many centuries (Huff, 2017). Indeed, Spain enjoyed a "Golden Age" under Islamic rule was enjoyed in Spain, where the Umayyads Caliphate of Cordoba became the civilization capital of the West and the home of science, attracting a great number of scholars and scientists (Halilovic, 2017). A striking feature of this epoch was the alleged tolerant nature of the cultural environment (*convivencia*), with Cordoba, for example, hosting hundreds of public schools attended by Muslims, Christians, and Jews (Scott, 1904). Scholars have tried to address prosperity in historical perspective, through the narrative that the tolerant nature of medieval Islam with respect to other religions spurred economic growth and educational success (Glick, 1979; Menocal, 2002).[3] However, scientific production and human capital accumulation became less impressive after the twelfth century with the decline of secular bureaucracy (Chaney, 2022) casting doubts on the effective impact of religious tolerance.[4] Historical Spain offers the opportunity to study whether religious institutions, initially apt to economic growth, successively impeded the accumulation of human capital.

In this paper, we exploit variation in the length of Islamic rule in medieval Spain to study whether and to what extent Islam affected the economic development of early-modern Spain. In particular, we use unique new data on the length of Muslim rule in Spain for the period 711-1492 for about 7,500 municipalities, which have been linked to literacy rates in 1860 from the population census. Standard reduced-form estimates show that the length of Muslim rule during Islamic domination is strongly negatively related to literacy rates. The results are robust to the introduction of a rich set of geographic controls and other confounding factors related also to trade such as proximity to Roman and medieval roads. We account also for events in the post-Muslim period that could have triggered a similar pattern, such as the potential impact of Mediterranean and Atlantic trade. Most importantly, we also present several robustness checks aimed at netting out potential confounders associated with the process of the *Reconquista*.

We propose an additional channel that can explain the diverging path between regions which had different exposure to Muslim rule. In the first phases of the *Reconquista*, the Catholic

[1] Also Rubin (2017) argues that the Islamic religious leaders opposed premarket institutions and the spread of new ideas, which could have undermined their sovereignty.

[2] See Kuran (2018) for an exhaustive discussion on the relationship between Islam and economic performance.

[3] See Johnson and Koyama (2019) on the relationship between state capacity and religious tolerance and freedom. In particular see their chapter 8 on religious tolerance in Medieval Spain.

[4] In fact, according to modern historiography, the view of Islamic tolerance, in comparison to Christian fanaticism, has been exaggerated (Fernandez-Morera, 2016).

northern part of Spain was relatively weak and divided, thus, more inclined to forms of local self-government. On the contrary, centralized Muslim rule in the southern part of Spain left virtually no political independence to localities. We argue that Muslim rule in Spain, because of its political centralization, hindered the formation of local self-governments and the empowerment of the merchant class. In the critical juncture of the Commercial Revolution, the rise of the merchant class and the corresponding guilds led to the growth of autonomous towns which fostered self-government skills. Over time, towns with a strong merchant class obtained *fueros* (the Spanish analogous for England's charter cities) which granted them autonomy over tax collection and the administration of justice (Ladero-Quesada, 1994). These self-government skills fostered both trust and human capital (Greif, 2006; van den Heuvel, 2007; Ogilvie, 2011, 2014; Guiso et al., 2016). The merchant class and the self-government skills thus generated a demand for human capital, which persisted over time until the early-modern period. Specularly, the lack of an empowered merchant class and any form of self-government locked the long-Muslim dominated regions in an equilibrium characterized by a low demand for human capital which persisted over time.

This interpretation is supported by a substantial literature. By the 13th century, European principalities, including Christian-ruled parts of Spain, had representative bodies to approve taxation and self-governed democratic corporations (communes) were represented in all of them (Greif, 2006). Buonanno et al. (2022) find that Italian locations hosting communal republics for long periods developed higher tax compliance and contribution to public goods in modern times. It is difficult to find a trace of such *civic spirit* in Islamic lands. The Muslim cities of the Middle Ages lacked the forms of local participative government, which were fundamental for the development of medieval Europe (Lewis, 1937). This was the case also in Muslim Spain. As O'Callaghan (2013, p. 271) puts it: "Self-government was entirely lacking in the towns of al-Andalus, where officials were appointed by the sovereign." While Europe consisted of more than 4,000 self-governing cities by the 12th century, regions under Muslim rule were ruled from the capital. The lack of a clear separation between secular and religious authority in the Islamic context resulted in the joint administration of commercial affairs, and centralized government administrators dictated many aspects of local industries and commerce (Constable, 1994). In addition, Muslim cities lacked *corporate personhood* and could not contract as a collective entity, limiting their efficacy relative to self-governing cities (Kuran, 2018). According to Kuru (2019), the strong alliance between the state and religious authorities that emerged in the Islamic world starting in the 11th century contributed to the marginalization of the merchant class and caused a persistent general decline in scientific production.

The proposed channel is supplementary to previously adopted interpretations related to the *Reconquista*. Oto-Peralías and Romero-Ávila (2016) argues that the rate of speed of the *Reconquista* affected political inequality which, in turn, negatively affected modern income levels. The logic is that a comparatively larger frontier expansion (i.e. a faster process of *Reconquista*) created favorable conditions for an elite which excluded large segments of the population from economic opportunities.[5] This has negative consequences for long-term economic development. In a similar fashion, Beltrán-Tapia and Martínez-Galarraga (2018) use data at district level to

[5] Oto-Peralías and Romero-Ávila (2017) analyzes the border of the Emirate of Granada to show how historical frontiers can lead to persistent differences in economic inequality. Using a regression discontinuity design, they

study how landownership inequality, resulting from different phases of the *Reconquista*, negatively affected education in pre-industrial Spain. We present several model specifications which ensure that our results are robust to accounting for the process of the *Reconquista*. First, we show that our results hold within the different sub-period categorizations of the *Reconquista*; secondly, we directly control for the speed of the *Reconquista*. The results clearly indicate that both the phases and the speed of the *Reconquista* cannot explain our main results.

Acknowledging the potential issues related to persistence studies (Voth, 2020), the distribution of literacy as observed in 1860 could be the result of cultural and institutional factors that occurred *after* the Muslim domination. For example, differences in jurisdiction across municipalities are, to a large extent, the result of institutional arrangements negotiated during and after the *Reconquista*. To address this issue, we account in the analysis for the municipality jurisdiction in 1786, namely whether the location was a lordship under royal, noble, ecclesiastical, or military power (Oto-Peralías, 2019). We show that our main results are not affected by the inclusion of jurisdiction-fixed effects, thus suggesting that our relationship of interest is not mediated by these factors. The Spanish Inquisition can be another factor that intervened between Muslim domination and the nineteenth century. In fact, the Inquisition has been shown to have a contemporary and long-run impact on economic activity (Vidal-Robert, 2014; Drelichman et al., 2021). Using data on trials for all Catalan municipalities and controlling for inquisitorial intensity for the whole sample, we can show that the negative impact of Muslim rule on literacy remains unaffected.

In order to provide empirical support for our proposed channel, we undertake different strategies. First, we exploit census data on the occupational structure of the municipalities as reported in 1786. We find a significantly lower share of merchants and students in municipalities that have been a longer period under Muslim rule. These results are consistent with our interpretation that a longer Muslim rule inhibited the formation of a politically and economically strong merchant class and slowed down the demand for human capital. Secondly, we make use of the panel dimension of the city-level dataset of Bosker et al. (2013) which, among others, provides valuable information on institutional variables such as the occurrence of forms of self-government. Accounting for city- and time-fixed effects, our estimates show that cities in Spain under Muslim rule between 1200-1500 did not develop any form of self-government. Importantly, we find that this gap persisted over time: cities with a relatively longer exposure to Islamic domination in the period 711-1492 remain systematically less likely to have any form of self-government until 1900. This result is again consistent with our interpretation that, by being under the Islamic rule in the period of the Commercial Revolution, municipalities in Spain missed out a critical juncture which persistently hampered their human capital development until the nineteenth century. We show empirically that Muslims' alleged tolerance against religious minorities did not lead to the accumulation of human capital. Our analysis, instead, credits Islamic institutions as the decisive factor with persistent effects on long-run economic outcomes.

find that municipalities on the Castilian side had more economic inequality in the 18th century due to a high concentration of economic and political power in the hands of the elites.

Our paper contributes to various strands of literature. As already mentioned, it contributes to the literature on the long-run effects of the Spanish *Reconquista* (Oto-Peralías and Romero-Ávila, 2016, 2017). Oto-Peralías (2019) studies the long-term impact of towns jurisdictions in Spain. During the *Reconquista* the Christian kingdoms granted lordships, an example of delegation of public functions to private agents. Oto-Peralías shows that towns granted to nobles after the *Reconquista* are relatively poorer today. He argues that state capacity and in particular the lower provision of public goods is the main intervening factor. We provide a complementary explanation for the differential development of Spanish regions. We argue that in addition to the mechanisms related to the process of the *Reconquista*, the strongly centralized Islamic institutions hindered the long-term accumulation of human capital by preventing the development of forms of self-government.

Vidal-Robert (2014) looks at the long-term economic consequences of the Spanish Inquisition. Using data on inquisition trials for the universe of municipalities in Catalonia he shows that more inquisitorial activity is negatively associated to city growth. By exploring potential mechanisms, Vidal-Robert finds that inquisitorial activity is negatively associated with the adoption of new technologies. Relatedly, Drelichman et al. (2021) using data on inquisitorial trials for the whole of Spain between 1480 and 1820 show that municipalities with a longer story of religious persecution have today lower economic performance, educational attainment, and trust. Chaney and Hornbeck (2016) study the population dynamic effect of the mass expulsion of the Moriscos in Spain in 1609. They find a delayed process of Malthusian dynamics. Interestingly, Christians were able to return to pre-expulsion output levels relatively quickly, consistent with the notion that Christian migrants adapted to the economic conditions and location-specific human capital.

Beltrán-Tapia et al. (2019) analyze the evolution of literacy rates in Spain from 1860 to 1930. As in our case, they also collected data on literacy at municipal level from the population census. They explore the role of the *Ancien Régime* and the passing of the Moyano Law on education to explain regional differences in literacy. As clearly stated by the authors, they cannot explain the large differences that already existed in 1860. We propose a possible mechanism which can explain the large differences in literacy in Spain in the middle of the nineteenth century.

Our paper relates also to the literature on the cultural factors that explain the economic divergence between Christian and Islamic world. Bisin et al. (2021) develop a theoretical model which accounts for the interaction between culture and institutions to explain the evolution towards a theocratic or secular state, whereas Benabou et al. (2021) determines the long-term outcome of each path in terms of religiosity and the politics of science. According to Chaney (2011), the historical lag in human capital formation in Islamic regions is due to the resistance by the religious leaders to scientific learning and innovation as it posed a threat to their authority by undermining their teachings, societal influence, and financial support from the state. Chaney (2016), by reconstructing book production of Islamic authors, identifies a strong decline in Islamic science around the year 1100. He argues that this decline is related to the collapse of a secular bureaucracy and the political empowerment of religious leaders who altered the educational system favoring the spread of religious education (*Madrasas*).

Our paper closely relates to Bosker et al. (2013), who constructed a large dataset of cities in the Arab world and Europe which contains several religious and institutional variables for the period 800-1800. Regarding the divergence between Europe and the Arab world, they argue that the centralized institutions that governed exchange between Muslim cities was highly efficient during the "golden age" when the Islamic Caliphate reached its maximum territorial extension. Yet, the rigid nature of Islamic institutions over time made it incapable of generating long-term economic growth once the Caliphate started to disintegrate and trade overseas became more important. We argue that centralized institutions in Islamic Spain had a negative impact on the formation of self-governing cities which, in the long run, contributed to keeping literacy at low levels.

Finally, from a broader perspective, our paper also connects with the literature on the influence of colonial institutions. While a large literature spurred by Acemoglu et al. (2001) considers colonial institutions as crucial for economic growth, another strand of literature has emerged which stresses the importance of pre-colonial institutions especially in the case of Africa (Gennaioli and Rainer, 2007; Engelbert, 2009; Michalopoulos and Papaioannou, 2013; Besley and Reynal-Querol, 2014).[6] In this literature, pre-colonial political centralization has received a considerable attention. In our context, the political centralization of Muslim rule in Spain can be considered as a pre-colonial institution which mattered for the further development of the country.

2 Conceptual Framework

Our research puts forward the hypothesis that Islamic domination in Spain affected negatively the formation of human capital through its institutional features. In particular, we argue that strong political centralization blocked the formation of independent self-governments which, together with the Islamic atomistic economic organization and the lack of an empowered merchant class, led to a low demand for human capital.

The Commercial Revolution in Europe is considered a critical juncture that provided a unique chance for economic growth (Cantoni and Yuchtman, 2014). The commercial nature of the phenomenon made certain preconditions, such as easing business transactions and building foundations for the creation of a strong merchant class, essential for exploiting the opportunity given by trade. The rise of the merchant class is associated with a movement of the population from agricultural estates to urban centers during the 10th-13th century, with the aim of switching profession toward trade and shifting ownership from land to movable property. Commercial opportunities were particularly abundant at height of the Commercial Revolution in 12th–13th century (Lopez, 1976), reaching its peak in non-Muslim Spain in the *Reconquista* period during the 12th–14th century, marking the beginning of intensive trade within the Iberian Peninsula and with the rest of Europe (Ardzrooni, 1913). As trade revived, the power and social standing of the merchants grew, giving stimulus to the *incorporation* movement in medieval Europe.

The Commercial Revolution made merchant guilds thrive as autonomous self-governed institutions that contributed to securing property rights and the enforcement of contracts (de la

[6] See Stelios Michalopoulos (2020) for an exaustive review of the literature on colonial and pre-colonial institutions in Africa.

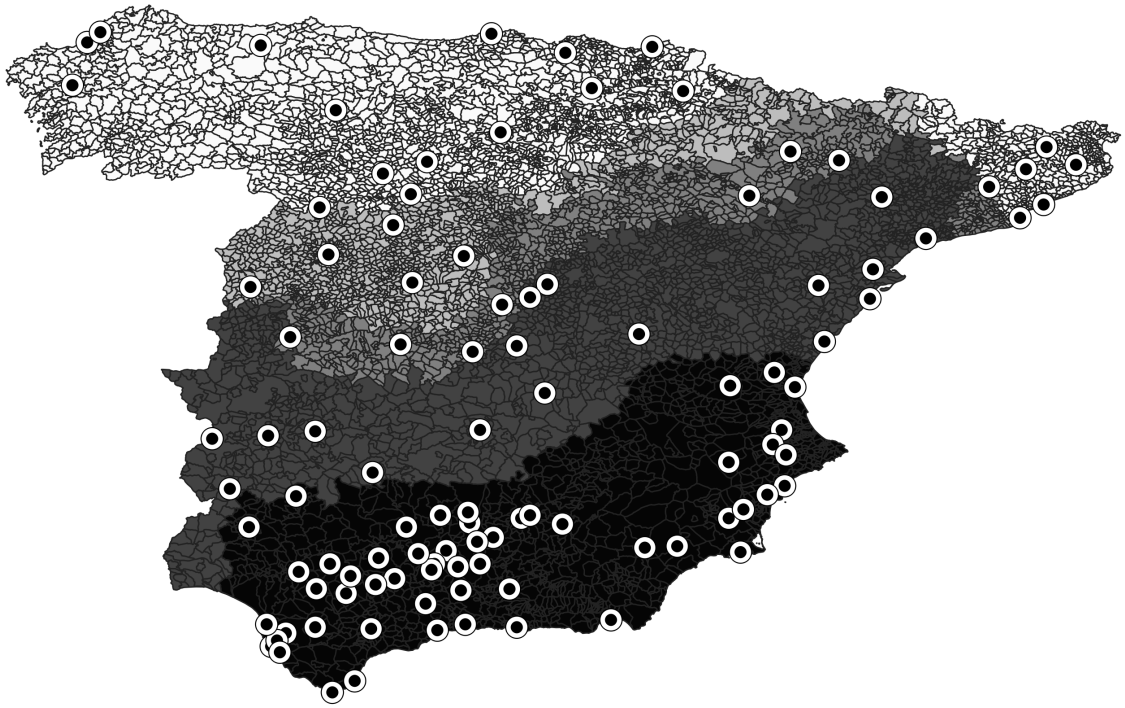
Croix et al., 2018). By securing property rights and providing contract enforcement, these self-governed associations supported markets and yielded three prosperous centuries of economic growth (Greif, 2006). Self-government capabilities and skills required by large-scale economic organization triggered a significant demand for human capital. While guilds also existed under Islamic law, they were not autonomous corporations and never had legal personhood as in Europe. They were instead used by the Muslim rulers as a form of public control by providing state monitoring and to facilitate taxation (Lewis, 1937). The non-autonomous nature of Islamic institutions resulted in the scarcity of self-governance capabilities that included strategic planning, public relations, consensus building, coalition formation, and collective negotiation (Kuran, 2016). Thus, while merchants gained power during the Commercial Revolution in Europe, the Muslim regions missed this critical juncture and experienced a structural stagnation of commercial partnerships in the region. The traditional Islamic institutional complex had instead an adverse effect of encouraging merchants to convert their wealth into real estate and, thus, potentially to charitable endowments known as the *waqf*. Founding *waqf* gained popularity among high officials not only as a religious deed, but also as a strategy to shelter wealth in a weak property rights environment (Kuran, 2016). Waqfs, thus, blocked resource reallocation over time eventually slowing growth in cities. Enterprises formed under Islamic law remained very small, which became a handicap as the volume of trade grew. As a result, an outflow of mercantile wealth from private profit oriented sectors occurred, limiting the rise of a politically strong merchant class.

We argue that Muslim domination in Spain negatively affected the possibility of municipalities to form independent local government and impeded the development of an empowered merchant class (Kuran, 2004). Whereas the Commercial Revolution accompanied the development of a new decentralized political and economic structure known as the *commune*, political power within centralized Muslim caliphates lied with officials who oversaw ordinances and monitored trade. Lack of incentives for developing a commercial organization suitable for entrepreneurship failed in imparting these competencies in the Muslim world. In the spirit of Kuran (2018), we argue that Islam's effects on human capital development through its peculiar institutions are not limited to its impact on Muslims and could persist in influenced areas in Europe even if a region is no longer under Muslim rule.

3 Data and Methods

In terms of data collection and construction, this work contributes to the literature in two dimensions. First, we systematically locate over time and space the presence of Muslim domination in Spain over eight centuries (from 711 until 1492) as our main explanatory variable. This is done annually based on the original maps from Reed (2014) elaborated in Cervellati et al. (2019) for years 1000 onward, with the data for the period 711-1000 collected from two observations, in 750 and 916, from Shepherd (1923). Duration of Muslim rule is available at the pixel level (roughly 10 x 10 km) and is then aggregated at the municipality level to construct a dataset with the length of exposure to Muslim rule (see Figure 1).

FIGURE 1: Length of Muslim domination over the Iberian peninsula



Note: The figure depicts the duration of Muslim rule, which started in year 711. The five shades of grey, representing quintiles, refer to areas with 0-45, 45-373, 373-424, 424-522 and 522 or more years of Muslim domination. Lighter shades correspond to shorter domination. Dots show the cities used in the city-level analysis (Bosker et al., 2013).

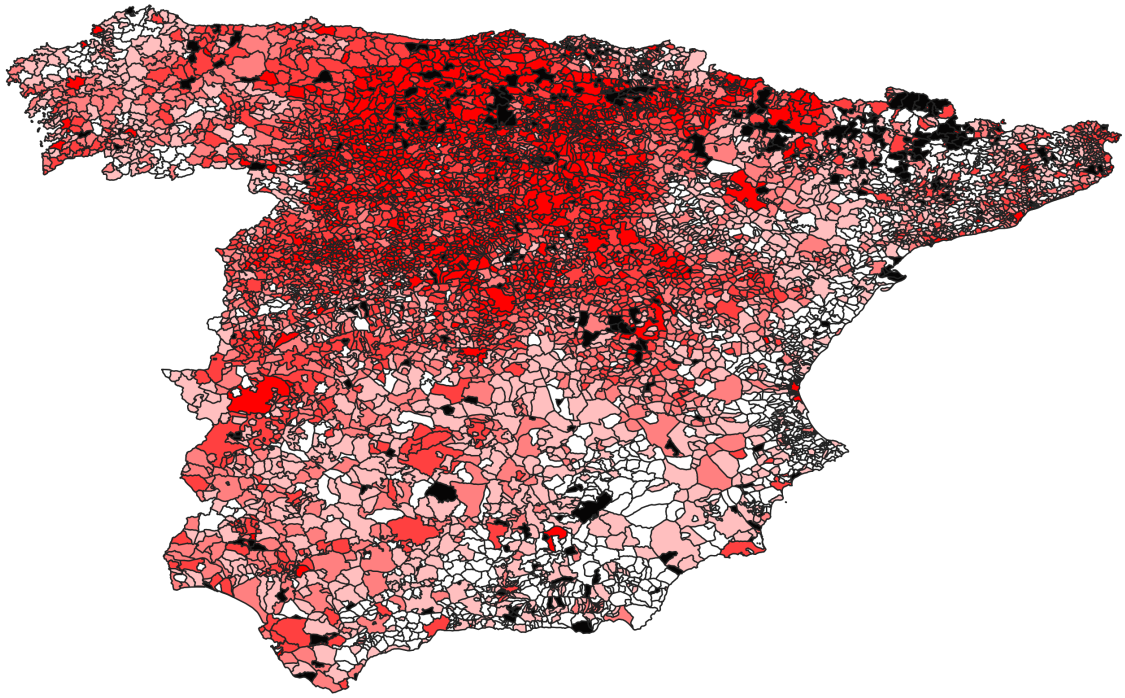
Second, from the Spanish population census of 1860 we digitize literacy rates at municipality level as our main dependent variable (see Figure 2).[7] By looking at literacy rates in 1860 we ensure a uniform educational institutional setting created by the Moyano Law of 1857 which made basic education affordable for everyone in Spain and set a minimum in terms of school infrastructure.[8] However, funding of primary education in Spain was still on the budget of the municipalities which likely led to significant differences in terms of school infrastructure and teachers' salary (Beltrán-Tapia et al., 2019).

Since a georeferenced map with historical borders of municipalities in 1860 does not exist, we use modern municipality borders from the year 2001 to compute our main variable of interest, i.e. the duration of Muslim rule. The 8,108 municipalities from the 2001 census have been then matched with the 9,364 municipalities from the 1860 population census. Due to some case of mergers and splits of historical municipalities, because of the impossibility to identify some

[7] We do not consider islands and therefore the provinces of Baleares and Canarias are not in the sample.

[8] Technically, the Moyano Law established that primary elementary education would be free in public schools only for those boys and girls whose parents or tutors could not afford it, and this had to be certified by the priest or the mayor of the town (Art. 9).

FIGURE 2: Literacy rates



Note: Literacy rates at municipal level from 1860 census. Modern municipality borders depicted. The five intensities (from white to dark red) correspond to 0-10%, 10-15%, 15-20%, 20-30% and above 30% literacy rates. Missing observations are in black.

historical names and after dropping the islands, our regression sample is constituted by 7,593 municipalities.[9]

We collect and construct several control variables at the municipality level, as failing to include them in our regression framework would give rise to omitted variable bias, given the non-experimental nature of our treatment. Human capital measures can, in fact, be shaped by many different economic variables, both from the demand and the supply side. First, we include a now standard measure of land quality, the caloric suitability of terrain available from Galor and Ozak (2016).[10] This variable could enter both positively or negatively, depending on whether the income effect (higher income should induce people to acquire more education) or the substitution effect (higher income from agricultural production could reduce relative occupation in industry, where more skills are needed) dominates. We take from the same source data on precipitations and temperature. Altitude and ruggedness of the terrain, obtained from the GMTED2010, are also included as controls for remoteness and, in general, disadvantageous

[9] In fact, our sample is very close to Beltrán-Tapia et al. (2019) who have been very kind to share their literacy data with us.

[10] We use the pre-1500 version of the measure, while using the post-1500 does not change our results.

TABLE 1: Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Literacy rate	7593	0.21	0.11	0.00	0.70
Duration Muslim rule (centuries)	7593	3.24	2.25	0.00	7.82
Share of merchants	6980	0.01	0.04	0.00	0.82
Share of students	6980	0.02	0.04	0.00	0.85
Share of daily workers	6980	0.37	0.24	0.00	0.99
Share of farmers	6980	0.45	0.26	0.00	1.00
Share of manufacturers	6980	0.01	0.05	0.00	0.87
Share of artisans	6980	0.07	0.09	0.00	1.00
Jurisd.: Military Order	6565	0.06	0.24	0.00	1.00
Jurisd.: Royal	6565	0.36	0.47	0.00	1.00
Jurisd.: Ecclesiastical	6565	0.08	0.25	0.00	1.00
Jurisd.: Nobility	6565	0.49	0.48	0.00	1.00

Notes: Literacy rates are computed from the 1860 population census. Duration of Muslim rule is based on data from Reed (2014) and elaborated by Cervellati et al. (2019). The occupational shares and the jurisdictions are from the *Censo de Floridablanca (1786-87)*.

conditions for developing human capital.[11] We construct the minimal distance from the sea and navigable rivers to control for availability of trade opportunities (from Johnson and Koyama (2017)) and we additionally control for vicinity to Roman and Medieval routes. Atlantic trade opportunities are also taken into account by controlling for distance to the ports of Sevilla, Santander, and Cadiz. Finally, we also control for the size of the municipalities, as larger areas might have been disadvantaged in the provision of schools, and population, as non linearities driven by agglomeration effects could be at work.

Descriptive statistics for our main variables are reported in Table 1. The average literacy rate in 1860 Spain was 21 percent with a wide range spanning from a minimum of zero to a maximum of 70 percent. According to our data, Spanish municipalities have been on average 324 years under the Muslim rule. Also in this case there is ample variation as there are municipalities with zero exposure to Muslim rule and municipalities which have been 782 years under Muslim rule.

In order to test our hypothesis on the lack of a merchant class, we make use of the *Censo de Floridablanca*, a population census conducted in 1786-87 which had primarily the purpose of reconstructing the demographic situation of Spain. The census reports information on the occupation of the inhabitants. Unfortunately, the occupational categories reported in the census are quite broad and not clearly defined.[12] For example, the category of day laborers (*jornaleros*) does not distinguish between workers employed in agriculture and those in (proto) industry. Similarly, the category of laborers (*labradores*) includes a wide range of occupations from land owners, share-croppers, and rentiers, although all likely related to agriculture. Other categories reported in the census which will be included in our regression analysis are: manufacturers

[11] The GMTED2010 model, developed by the US Geological Survey (`www.usgs.gov`), provides global altitude layers at different granularity. We use the 30-arc-second spatial resolution, corresponding to roughly 1 km at the equator.

[12] For more details you are referred to the online supplementary material II in Oto-Peralías (2019).

(*fabricantes*), artisans (*artesanos*), merchants (*comerciantes*), and students (*estudiantes*).[13] We therefore construct the share of people employed in the different occupations over the labor force. Following Oto-Peralías (2019), we construct the labor force as the sum of people reporting an occupation.[14] Because of missing data on occupation, the regression sample is reduced to almost 7,000 municipalities. Descriptive statistics of the occupational shares are reported in Table 1.

The *Censo de Floridablanca* reports also information on the type of jurisdiction for towns and villages included in each municipality. For our analysis we consider the four jurisdiction categories as originally reported in the census: royal (*Realengo*), military (*Orden Militar*), ecclesiastical (*Señorio Eclesiastico*), and nobility (*Señorio Secular*).[15] The different jurisdictions indicate who was delegated by the Crown to hold the power in the municipality, i.e. nobles, military orders, the church, or the Crown itself. We can thus construct for each municipality the share for the different type of jurisdictions which sum up to one.[16] Due to missing information on jurisdiction, we are able to link about 6,500 municipalities. Descriptive statistics of these variables are also reported in Table 1.[17]

The main results and robustness checks are obtained by estimating an OLS model of cross-sectional municipality-level data. We use Conley-corrected standard errors (at 50 km), in order to take into account the spatial autocorrelation of the data which could affect inference.[18] Obviously, duration of Muslim rule is not randomly assigned and the lack of a neat identification strategy does not allow to interpret the results as strictly causal. Our findings should, instead, be interpreted in the spirit of a persistence analysis, with particular attention to the analysis of the mechanism(s) that can explain our reduced-form results.

4 Baseline Results

Baseline results of the relationship between the length of Muslim rule (in centuries) and literacy rates in 1860 are shown in Table 2. In column 1 we show the unconditional bivariate correlation. We find a significant and large negative coefficient. In terms of magnitude, taken at face value, the coefficient suggests that an additional century of Muslim rule is associated with 2.3 percentage points lower literacy rates. Since average literacy rate in 1860 is 0.21, this is

[13] There are also several occupations related to the church, a category for the nobles (*hidalgos*), servants (*criados*), and professionals such as notaries (*escribanos*) and lawyers (*abogados*).

[14] There are some cases in which it is reported that all individuals (*todos*) or the rest of individuals (*resto*) are agricultural workers (*labradores*) or daily workers (*jornaleros*). In the former case, we impute the labor force by applying the share of labor force over the total population of the villages and towns belonging to the same municipality. In the latter, we impute the total labor force as above and then subtract all the other occupations to recover the number of people employed in the residual category. In addition, since nobles (*Hidalgos*) and servants (*Criados*) are also problematic as they are over-reported, we exclude them from the computation of the labor force.

[15] We are very thankful to Eric Chaney for sharing his data.

[16] This is possible since information on the jurisdiction is provided at an administrative level below the municipality.

[17] In order to link the Census of Floridablanca with modern municipalities we used the INE code provided by Statistical Office and the string name of the municipality. As for the census in 1860, this information was used to bring everything to the modern borders of the year 2001.

[18] Note that 50 Km radius means that, on average, each observation is considered correlated with 120 other neighboring municipalities. Our main results remain significant when increasing the distance up to 200 km, as reported in Appendix Table **??**

TABLE 2: Muslim rule and literacy: Baseline results

Dependent variable:	Literacy rate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Duration Muslim rule	-0.023***	-0.020***	-0.026***	-0.024***	-0.025***	-0.024***	-0.023***	-0.023***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)
Caloric suitability (pre-1500)		0.007***	0.005***	0.003**	0.003**	0.002	0.002*	0.002*
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rain			-0.012***	-0.013***	-0.013***	-0.007**	-0.007**	-0.007**
			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Temperature				-0.103***	-0.080	-0.063	-0.070	-0.075
				(0.028)	(0.085)	(0.077)	(0.076)	(0.076)
Altitude					0.001	0.005	0.006	0.006
					(0.005)	(0.005)	(0.004)	(0.004)
Ruggedness						-0.075***	-0.075***	-0.075***
						(0.017)	(0.017)	(0.017)
Distance to water							-3.840	-3.755
							(2.357)	(2.347)
Population 1860								0.018***
								(0.004)
Area								-0.315
								(0.225)
Observations	7593	7593	7593	7593	7593	7593	7593	7593
R-squared	0.24	0.32	0.36	0.40	0.40	0.43	0.43	0.44

Notes: OLS estimates. Duration of Muslim rule is expressed in centuries, distance to water in 100 km and population in 1860 per 10,000 inhabitants. Conley standard errors with 50 km radius in parenthesis. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

around 11% of the mean.[19] In the next columns we progressively include geographic controls to test the extent to which the relationship between length of Muslim rule and literacy rate is affected. In fact, we find that caloric suitability is significantly positively correlated with literacy rates, pointing to an income effect playing a major role, while only marginally changing our coefficient of interest (column 2). Municipalities with higher precipitation rates and higher temperatures are negatively correlated with literacy rates (columns 3 and 4). Altitude is not significantly related with literacy (column 5) whereas there is a significant negative relationship with ruggedness (columns 6). Standard proxies of trading activity, such as distance from rivers and the sea do not seem to be correlated with literacy (column 7), while in column 8 we find that the size of the population is positively related to literacy, as one could expect. Municipality area correlates negatively with literacy and the coefficient is not different from zero.[20] Importantly, the coefficient of interest for the Muslim rule is very stable across the different specifications with a value of around 0.023.[21]

[19] A possible concern is that the relationship of interest is mainly driven by large cities. If we drop the five largest municipalities in our sample (Madrid, Barcelona, Bilbao, Sevilla, and Valencia), the results are virtually identical (not shown). OLS regressions weighted by population also deliver very similar results.

[20] We opted to have population and area of municipalities as two separate controls, instead of the usual population density measure, for two reasons. First, population dynamics could have been different for small or large administrative boundaries in Spain, for example with more or less concentrated inhabitants in one or more towns within the area of a municipality. With two controls we have more degrees of freedom to take into account such effects. Second, using population separately makes the set of controls more consistent with the subsequent panel analysis carried out in Section 7.

[21] The literacy gender gap was very large, with male literacy rate equal to 0.34 and female literacy rate to 0.07. We have tested for differences in gender and estimated a model for male literacy, female literacy, and for the literacy gender gap defined as the ratio of male literacy over female literacy. The results, reported in the Appendix Table A.2, show a significant negative impact on both male and female literacy whereas there is no significant impact on the gender gap.

In Table 3 we perform some checks on our main findings in order to account for potential issues deriving from periodization and alternation of different Muslim dynasties, confounders related to spatial spillovers and checks related to administrative fixed effects. In all upcoming specifications the set of control variables will always be that of column 8 in Table 2, except when otherwise highlighted.

In column 1 we include four dummy variables which takes value one for those municipalities that have been under Muslim domination for up to 200 years, 200-400, 400-600, and more than 600 years, respectively, the control group being municipalities never under Muslim domination. This non-parametric specification relaxes the linearity assumption used in the main specification and it broadly accommodate for the different Muslim dynasties that ruled over the Iberian peninsula throughout the second millennium.[22] Results are in line with the main findings of Table 2 and are compatible with the linear specification which will be further used in the analysis.

In order to account for unobservable characteristics related to a north-south and east-west gradient, in column 2 we include as controls the latitude and longitude of the municipalities. As one can see, the coefficient for Muslim rule remains unaffected and only the coefficient for longitude turns significant. Columns 3 and 4 take into account possible institutional differences existing until the unification of the two Crowns of Castilla and Aragon which could have had differential institutional legacies and possible heterogeneous interactions with the Muslim domination. Our results do not suggest such an interpretation as the coefficients are similar in magnitude and statistically indistinguishable from each other.

Finally, in column 5 we use the main specification and include 50 province fixed effects. However, we are very cautious in interpreting the results, as these dummies likely constitute bad controls: provinces are administrative units that developed much later than our treatment and they could be the outcome of Muslim domination, the process of *Reconquista*, and all other political and economic developments that occurred until 1833, the year in which provinces have been formally instituted. Regardless, our coefficient of interest remains highly significant both statistically and economically, suggesting that our main driver does not originate from a province-level pattern.

5 Robustness checks

5.1 The *Reconquista*

As discussed in the introduction, Oto-Peralías and Romero-Ávila (2016) finds that a faster rate of the Christian *Reconquista* has negative consequences on today's per capita income in Spain. The logic behind their results is that a larger territorial expansion reinforced the authority of military orders and landed elites, leading to large inequality in the distribution of land. In a similar vein, Beltrán-Tapia and Martínez-Galarraga (2018) uses the different phases of the *Reconquista* as instruments for inequality in the distribution of landownership to show how it reduces literacy rates for 464 districts in 1860 Spain. Beltrán-Tapia et al. (2020) also argues

[22] These are the Umayyad, Almoravid, Almohad, and the Kingdom of Granada.

TABLE 3: Muslim rule and literacy: Robustness checks

Dependent variable:	Literacy rate				
	Full sample (1)	Full sample (2)	Aragon (3)	Castilla (4)	Full sample (5)
Duration Muslim rule (0;200]	-0.081***				
	(0.031)				
Duration Muslim rule (200;400]	-0.122***				
	(0.032)				
Duration Muslim rule (400;600]	-0.178***				
	(0.031)				
Duration Muslim rule (600;712]	-0.176***				
	(0.037)				
Duration Muslim rule		-0.023***	-0.021***	-0.016**	-0.017***
		(0.005)	(0.005)	(0.006)	(0.004)
Latitude		-0.012	0.040***	-0.002	
		(0.011)	(0.015)	(0.011)	
Longitude		-0.006***	-0.023***	0.008*	
		(0.002)	(0.005)	(0.004)	
Geographic controls	×	×	×	×	×
Population and area	×	×	×	×	×
Province FE					×
Observations	7593	7593	2534	5059	7593
R-squared	0.48	0.47	0.51	0.48	0.62

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude and ruggedness. Population and area controls include population size in 1860 and municipality area. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

that in regions where the *Reconquista* advanced at a lower pace, repopulation of reconquered lands gave rise to fairly democratic institutions with a more egalitarian distribution of assets.

According to Oto-Peralías and Romero-Avila, the first phase of the *Reconquista*, i.e. the repopulation of the Duero Valley, did not involve a large territory. The distinctive feature of the recolonization process was the predominance of private initiative with a more balanced occupation of land and a minor or no role for military elites (Oto-Peralías and Romero-Ávila, 2016, p. 414). Therefore in these areas the speed of the *Reconquista* and the consequent distribution of land should not have an adverse impact on education — or should at least play a minor role. Finding a negative relationship between length of Muslim rule and literacy for the municipalities included in these areas would indicate that the speed of the *Reconquista* and the successive distribution of land have no bearing on our findings.

To address such possible confounding effects of the *Reconquista*, we take a reduced form approach and proceed in two directions by first focusing on its different temporal phases and then followed by its speed. In Table 4 we therefore split the sample and run the main specification for the three main *Reconquista* sub-periods, guided by the periodization implied in Oto-Peralías and Romero-Ávila (2016), i.e. municipalities reconquered in the periods 711-1062, 1062-1266 and 1266-1492. Results are still consistent, with a larger coefficient for the intermediate stage (1062-1266). The coefficient in column 3 for the last period (1266-1492) is not significant due to the relatively large standard error caused by the low number of observations. The point estimate is, though, similar to the periodization 711-1062 in column 1.

TABLE 4: Muslim rule and literacy: Phases of *Reconquista*

Dependent variable:	Literacy rate		
	Reconquista 711–1062	Reconquista 1062–1266	Reconquista 1266–1492
	(1)	(2)	(3)
Duration Muslim rule	-0.026***	-0.048***	-0.021
	(0.008)	(0.009)	(0.015)
Geographic controls	×	×	×
Population and area	×	×	×
Observations	2812	4331	290
R-squared	0.39	0.45	0.11

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude and ruggedness. Population and area controls include population size in 1860 and municipality area. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

We then shift focus to the speed of the *Reconquista*, with the analysis illustrated in Table 5. We start our exploration by adding as control the district-level information on the rate of *Reconquista* from Oto-Peralías and Romero-Ávila (2016), so that our main effect will be net of any confounder related to the speed at which Christians reconquered the Iberian territory. The results in column 1 show that the coefficient for Muslim rule is unaffected whereas the coefficient for the rate of *Reconquista* is negative but insignificant. We additionally construct fixed effects based on the geographical variation used to compute the variable rate of *Reconquista*. In fact, this set of fixed effects broadly coincides with the province fixed effects and, indeed, the results in column 2 are indistinguishable from the results in column 5 of Table 3.[23]

Furthermore, based on the distribution of the variable rate of *Reconquista*, we construct quartiles fixed effects and include them in the regression in column 3 (the first quartile being the baseline). Also in this case the coefficient of duration of Muslim rule is unchanged and the coefficient for the different quartiles have a negative sign. Finally, in columns 4-7 we split the sample by quartile of rate of *Reconquista*. In all these specifications, our relationship of interest remains negative and highly significant.

The analysis of the *Reconquista* as a possible confounding factor carried out in Tables 3-5 strongly suggest that Muslim rule has an independent impact on human capital in nineteenth century Spain. It is therefore reasonable to argue that Muslim rule was a significant factor in Spain's uneven growth trajectory. The following sections will further substantiate this interpretation.

5.2 Jurisdictions

A possible confounder of our relationship of interest is the type of jurisdiction that have been implemented in the municipalities between the reconquest and the time of measurement of literacy. The type of jurisdiction was, to some extent, the result of the different stages of the *Reconquista*, while other drivers were plausibly orthogonal to the *Reconquista* and the Muslim

[23] While we were expecting an overall negative impact of the rate of *Reconquista* on literacy, through a mechanism where (i) higher speed drove higher land inequality (Oto-Peralías and Romero-Ávila, 2016), and (ii) higher inequality reduces the demand for education (Galor et al., 2008), we suspect that some issues of ecological fallacy arise in our setting, as the rate of *Reconquista* is measured at the district level.

TABLE 5: Muslim rule and literacy: Speed of *Reconquista*

Dependent variable:	Literacy rate						
	Full Sample (1)	Full Sample (2)	Full Sample (3)	Sample Q1 (4)	Sample Q2 (5)	Sample Q3 (6)	Sample Q4 (7)
Duration Muslim rule	-0.023***	-0.018***	-0.023***	-0.031***	-0.031***	-0.030***	-0.016***
	(0.005)	(0.004)	(0.004)	(0.006)	(0.008)	(0.004)	(0.005)
Rate of Reconquest	-0.000						
	(0.001)						
Rate Reconquest Q2			-0.014				
			(0.015)				
Rate Reconquest Q3			-0.005				
			(0.013)				
Rate Reconquest Q4			-0.010				
			(0.016)				
Geographic controls	×	×	×	×	×	×	×
Population and area	×	×	×	×	×	×	×
Rate of Reconquista FE		×					
Observations	7249	7249	7249	1984	1677	1928	1660
R-squared	0.42	0.61	0.42	0.40	0.45	0.63	0.54

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

domination, such as the strength and level of state capacity of the Catholic Kingdoms in the different periods and localities. Also, changes of jurisdictions over time occurred as result of negotiations between the single municipalities and the Crown.

As described in section 3, we use the *Censo de Floridablanca* and consider the four jurisdiction categories as originally reported in the census: royal (*Realengo*), military (*Orden Militar*), ecclesiastical (*Señorio Eclesiastico*), and nobility (*Señorio Secular*). In particular, we construct for each municipality the share of the different type of jurisdictions which sum up to one. Due to missing information, the regression sample is constituted by about 6,200 observations. The results are reported in Table 6. It is important to note that, beyond the usual geographic, population, and area controls, the set of fixed effects for the quartiles of the speed of *Reconquista* will be included in the analysis from now on.

Consistent with the notion that the main cities, i.e. those with a stronger economic conditions, remained under royal jurisdiction, we find a large and positively significant coefficient for *Realengo* (column 1). On the contrary, municipalities under ecclesiastical (column 2), noble (column 3), or military order (column 4) jurisdiction have significantly lower literacy rates in 1860. The same results are obtained when simultaneously including the different jurisdictions as in column 5 (nobility is the reference group). These results are consistent with evidence reported in Oto-Peralías (2019), which uses the same data from the *Censo de Floridablanca* to show that towns granted to nobles after the *Reconquista* are relatively poor today. The finding that municipalities under military order have a lower level of development is also consistent with the results in Oto-Peralías and Romero-Ávila (2017). The results in Table 6 clearly show

TABLE 6: Muslim rule and literacy: Accounting for jurisdictions

Dependent variable:	Literacy rate				
	(1)	(2)	(3)	(4)	(5)
Duration Muslim rule	-0.023***	-0.022***	-0.023***	-0.022***	-0.022***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Royal	0.028***				0.022***
	(0.007)				(0.007)
Ecclesiastical		-0.037***			-0.028***
		(0.009)			(0.008)
Nobility			-0.010*		
			(0.006)		
Military				-0.025***	-0.018**
				(0.008)	(0.008)
Geographic controls	×	×	×	×	×
Reconquest FE	×	×	×	×	×
Population and area	×	×	×	×	×
Observations	6233	6233	6233	6233	6233
R-squared	0.44	0.44	0.43	0.43	0.45

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

that accounting for municipality jurisdiction and population size does not affect our coefficient of interest which remains negative, significant, and similar in size to the baseline estimates.[24]

5.3 The Inquisition

The Spanish Inquisition is another potential channel which could explain why municipalities with a longer Muslim rule have lower level of human capital accumulation. The Spanish Inquisition started in 1478 to persecute *crypto-Jews* and *Moriscos*, i.e. Jews and Muslims converted to Catholicism. Later, the Spanish kings used the Inquisition as an instrument of persecution to fight any religious and political ideology which could jeopardize the *status quo* and the authority of the king. The Inquisition conducted more than 100,000 trials in the three centuries after its establishment. Vidal-Robert (2014) finds that inquisitorial activity significantly decreased annual population growth for Catalan municipalities until the first half of the nineteenth century. Inquisitorial activity might have suppressed the birth or spread of new ideas and cultural attitudes toward innovation. Indeed, Vidal-Robert (2014) finds a negative correlation between inquisitorial activity and modern attitudes towards new technologies. Drelichman et al. (2021) shows that the Spanish Inquisition left a trace even in today's economic activity, trust and education.

Based on these results, if inquisitorial activity was more pronounced in areas which experienced longer Muslim domination, our main finding could be explained by the negative impact of the Inquisition on the accumulation of human capital. In fact, descriptive statistics based on the Catalan sample on the type of trials show that only about half of the trials had a religious motive. Trials against crypto Jews (27%) were relatively more prevalent than those against

[24]It is important to note that duration of Muslim rule does not seem to be predictive of the different jurisdictions. We only find a negative relationship, significant at 10% level, between duration of Muslim rule and noble jurisdiction (*Señorio Eclesiastico*). Results are not shown but available upon request.

TABLE 7: Muslim rule and literacy: Accounting for the Inquisition

Dependent variable:	Literacy rate							
	Full sample		Catalonia					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Duration Muslim rule	-0.023***	-0.024***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.004)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Inquisitorial intensity	0.210***	0.191**						
	(0.043)	(0.081)						
Total trials density				0.008				
				(0.009)				
Religious trials density					-0.074***			-0.136***
					(0.023)			(0.026)
Moriscos trials density						-0.011		0.130***
						(0.010)		(0.029)
Non-religious trials density							0.033**	0.035**
							(0.016)	(0.016)
Geographic controls	×	×	×	×	×	×	×	×
Reconquest FE	×	×	×	×	×	×	×	×
Population and area	×	×	×	×	×	×	×	×
Observations	7232	6992	879	879	879	879	879	879
R-squared	0.43	0.43	0.17	0.17	0.19	0.17	0.19	0.22

Notes: OLS estimates. Conley standard errors with a 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Inquisitorial intensity for the full sample (columns 1–2) is from Drelichman et al. (2021). Inquisitorial intensity for the Catalonia sample (columns 3–8) is from Vidal-Robert (2014). Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). Sample in column 1 comprises the entire available dataset, while the sample in column 2 is restricted to municipalities with less than 5,000 inhabitants. The sample in columns 3–8 comprises only Catalan municipalities. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

Moriscos (16%) and Protestants (3.5%). About half of the trials had social motives such as bigamy, blasphemy, and superstition (Vidal-Robert, 2014, Table 2).

We assess the robustness of our results accounting for the country-wide impact of inquisition using the data from Drelichman et al. (2021). In addition, using data on trials for all the Catalan municipalities from Vidal-Robert (2014) allows us to test the extent to which different types of inquisitorial activity can explain our relationship of interest.[25] In particular, we estimate our baseline full specification adding as controls, one by one, the total number of trials, the number of religious trials, the number of trials against Moriscos, and the number of non-religious trials, to check whether our results on Muslim treatment remain robust.[26]

The results are presented in Table 7. Column 1 shows the result for the whole of Spain using a general measure of inquisitorial intensity defined as the number of years when the Inquisition persecuted at least one member of a particular community as a proportion of the number of years with surviving data (Drelichman et al., 2021), while column 2 replicates this analysis focusing on cities below 5,000 inhabitants in 1860. While the coefficients for inquisitorial intensity are positive, the coefficient of interest remains unaffected. Successively we focus on the subsample of municipalities in Catalonia ($n = 879$). The first thing to note is that, compared to the baseline results in Table 2, the coefficient for the length of Muslim rule is smaller for

[25] We are very thankful to Jordi Vidal-Robert for sharing his data on Catalonia.

[26] The number of trials are standardized by the area of the municipality. If we include in the regression the absolute number of trials, results are virtually the same.

TABLE 8: Muslim rule and literacy: Accounting for Jewish communities

Dependent variable:	Literacy rate			
	(1)	(2)	(3)	(4)
Duration Muslim rule	-0.023***	-0.023***	-0.023***	-0.023***
	(0.004)	(0.004)	(0.005)	(0.005)
Jewish community (dummy)	0.059***			0.065**
	(0.010)			(0.033)
Length Jewish community		0.016***		-0.002
		(0.003)		(0.010)
Distance from Jewish community			-0.012	-0.007
			(0.021)	(0.022)
Geographic controls	×	×	×	×
Reconquest FE	×	×	×	×
Population and area	×	×	×	×
Observations	7249	7249	7249	7249
R-squared	0.43	0.43	0.42	0.43

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude, and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

Catalonia municipalities (column 3). Nevertheless, the relationship is economically substantial as one standard deviation increase in the length of Muslim rule (190 years of Muslim rule) is associated with 19% of a standard deviation in literacy rate. In column 4 we include as control the measure for the density of all types of trials, in column 5 only religious trials density, in column 6 trials density against Moriscos, and in column 7 non-religious trials density.[27] We find that municipalities in Catalonia with more intensive religious inquisitorial activity tend to have lower levels of literacy rates (column 5). A higher number of non-religious trials density is instead positively related to literacy rates (column 7). In column 8, we include all the controls at the same time and the coefficient of interest for the duration of Muslim rule remains unaffected.

5.4 Jewish Communities

The Iberian peninsula had also relatively large communities of Jews before their expulsion in 1492. Jewish people tended to have a relatively high level of human capital because Jews were taught to read to access the Torah and they also specialized in trade and money-lending activities (Botticini and Eckstein, 2012). This might have had a positive impact on the long-run accumulation of human capital (Pascali, 2016). Yet, if the presence (or persecution) of Jewish communities is related to the length of Muslim rule, this could affect our results and the interpretation thereof. In Table 8 we present specifications that address this issue. In particular, we use data on the presence and length of Jewish communities in the period 1100-1500 from Anderson et al. (2017).

[27] Regarding the expulsion of the Moriscos studied by Chaney and Hornbeck (2016), by dropping the province of Valencia or dropping the municipalities corresponding to the districts used in their analysis, our results are unchanged (available upon request).

In column 1 we include a binary variable for the presence of a Jewish community in the municipality. Interestingly, we find a strong positive relationship between the presence of a Jewish community in the period 1100-1500 and literacy rates in 1860. However, the negative relationship between Muslim rule and literacy remains unaffected. In column 2 we control for the length of Jewish presence in the municipality. Consistently with the results in column 1, we find that a longer presence of a Jewish community is positively related to literacy rates and the negative coefficient for Muslim rule remains unaffected. In column 3, we control for the distance to the nearest Jewish community. In this case the results point to a very localized effect of the impact of a Jewish community on literacy, i.e. there is no evidence of geographical spillover outside the municipalities where the Jewish communities resided. Finally, in column 4, we include all the controls simultaneously. The robustness of the negative relationship between length of Muslim rule and literacy rates is confirmed.

5.5 Trade

It is important to stress that we do not claim that trade was an unimportant constituent of Muslim Spain. In fact, there is little doubt about the influential role of trade in the principles and the spread of Islam (Michalopoulos et al., 2018). Islam spread to many places through traveling merchants rather than armies, whose religious training helped convert local populations (Kuran, 2011).

In this section, we address the role of (pre-)existing trade opportunities during the Iberian Muslim period and post-1492 events that could have differentially shaped literacy through other channels rather than the one proposed. Specifically, we compute for each municipality the distance to pre-existing Roman and Medieval roads. The results when including these variables are reported in column 1 and 2 of Table 9, respectively.[28] In both cases we do not find any direct impact of trade routes on literacy. Our coefficient of interest is virtually unaffected indicating that proximity to internal trade routes have no bearing on our results.

The Atlantic trade changed dramatically the economy of Spain and shifted the previous maritime commercial routes in a different direction. To account for this potential confounding factor, we assign to each municipality the minimum distance to one of the three ports which, at different points in time, operated as port of entry for the wealth coming from the Americas, namely Santander, Sevilla, and Cadiz. The results in column 3 show that a larger distance from these ports is negatively related to literacy in 1860. This result is consistent with our hypothesis that the presence of a strong merchant class, in this case proxied by distance to an Atlantic port, favored the accumulation of human capital in the long run. Yet, the fact that the coefficient for the duration of Muslim rule remains practically unaffected strongly suggests that the "Atlantic trade effect", despite being highly significant, does not explain our relationship of interest.

According to Braudel (1996), exposure to the vibrant sixteenth-century Mediterranean trade just after the demise of Islam in the Iberian peninsula could have created a similar effect as the Commercial Revolution and even spawned a much larger and richer merchant class. We test also this mechanism by controlling for the minimum distance of each municipality to the two largest

[28] Data on Roman and Medieval roads are from Johnson and Koyama (2017).

TABLE 9: Muslim rule and human capital: Accounting for potential trade

Dependent variable:	Literacy rate				
	(1)	(2)	(3)	(4)	(5)
Duration Muslim rule	-0.023***	-0.022***	-0.020***	-0.012***	-0.017***
	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)
Distance to Roman roads	0.006				0.020
	(0.036)				(0.021)
Distance to Medieval roads		-0.014			0.003
		(0.012)			(0.009)
Distance to nearest Atlantic port			-0.045***		-0.041***
			(0.005)		(0.005)
Distance to nearest Mediterranean port				0.028***	0.008*
				(0.005)	(0.005)
Geographic controls	×	×	×	×	×
Reconquest FE	×	×	×	×	×
Population and area	×	×	×	×	×
Observations	7249	7249	7249	7249	7249
R-squared	0.42	0.42	0.53	0.48	0.54

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude, and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

Mediterranean ports of the time, Valencia and Barcelona. We include also the port of Algeciras which was contested between Muslim and Catholics in the period under consideration. The results reported in column 4 show that a larger distance to a Mediterranean port is *positively* related to literacy. The coefficient for duration of Muslim rule becomes smaller but remains highly significant. The results in column 3 and 4 suggest that it was the vibrant activity around the Atlantic ports and not around the Mediterranean ones that created the conditions for high levels of human capital observed in the middle of the nineteenth century.[29] In column 5, we include simultaneously all the control variables for trade. The results are unchanged and confirm the interpretation about the importance of the Atlantic trade.

5.6 Fertility

The mechanism we propose to explain the robust relationship between the duration of Muslim rule and literacy entails the lack of forms of self-government which obstructed the accumulation of human capital. However, one could also put forward a cultural explanation according to which the legacy of Islam is linked to a stronger preference for fertility, thus reducing human capital in a standard quantity-quality trade-off framework. If confirmed empirically, lower human capital in the Muslim world could be explained by the persistence of culture rather than institutions.

For example, in the context of industrialization and fertility transition, Spolaore and Wacziarg (2022) stress that economic and cultural drivers jointly determine the patterns observed in European provinces for the period 1830-1970. While they find that new fertility behaviours diffused slower to European provinces culturally distant from the French, the delay only lasted several decades. In our historical setting, economic forces are represented by the Islamic institutional

[29] One should however treat this association with caution as it could merely be due to a high negative correlation (-0.67) between the duration of Muslim rule and distance from Mediterranean ports.

TABLE 10: Muslim rule and human capital: Accounting for fertility

Dependent variable:	Literacy rate		
	(1)	(2)	(3)
Duration Muslim rule	-0.022***	-0.022***	-0.022***
	(0.005)	(0.005)	(0.005)
Fertility rate (0-5)	-0.216*	-0.223*	-0.210*
	(0.117)	(0.114)	(0.112)
Geographic controls	×	×	×
Reconquest FE		×	×
Population and area			×
Observations	7096	7096	7096
R-squared	0.42	0.42	0.43

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude, and ruggedness. Population and area controls include population size in 1860 and municipality area. *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

complex which accounts for low demand for (and supply of) human capital, whereas the cultural component consists of preferences for a higher number of children. While it is possible that the cultural component could have brought some lag in differential preferences regarding fertility between short and long-Muslim dominated regions in Spain, the institutional component should have a more persistent effect as a self-enforcing equilibrium (Greif and Kingston, 2011). Moreover, the cultural component directly linking Islam to higher fertility should have diminished after 1492, when Muslims were expelled from Spain.

To test whether the potential cultural component linking Islam to fertility affects our relationship of interest, we include a measure for fertility contemporaneous to literacy. In particular, we use the information from the 1860 census on the number of children below age 5. We construct a fertility measure as the ratio of the number of children aged 0-5 over the total population. In Table 10 we present the regression results when including such a measure for fertility in our baseline model. In column 1 we include only the geographic controls, in column 2 we add the *Reconquista* fixed effects, whereas in column 3 we finally include population in 1860 and the municipality area as additional controls.

The coefficient for fertility is weakly significant and enters with the expected sign if interpreted through the lens of the quantity-quality trade-off of children. That is, higher levels of fertility are negatively related to literacy rate (Becker et al., 2010). Most importantly, our relationship of interest remains virtually unaffected by the inclusion of fertility as a control. This implies that a potential cultural channel linking Islam to a stronger preference for fertility (and thus a lower preference for human capital) cannot explain our relationship of interest.

6 Muslim Rule and Occupational Structure

So far we have shown that the *Reconquista*, the Inquisition, Jewish presence and trade possibilities do not downplay the relationship found between duration of Muslim rule and accumulation of human capital in the early-modern period. Starting with this section, we present empirical evidence consistent with our proposed mechanism based on the lack of forms of self-government

TABLE 11: Muslim rule and occupations

Dependent variable:	Merchants	Students	Daily workers	Farmers	Manuf.	Artisans
	(1)	(2)	(3)	(4)	(5)	(6)
Duration Muslim rule	-0.001**	-0.001**	-0.027***	0.026**	-0.000	0.004*
	(0.000)	(0.001)	(0.009)	(0.010)	(0.001)	(0.002)
Geographic controls	×	×	×	×	×	×
Reconquest FE	×	×	×	×	×	×
Population and area	×	×	×	×	×	×
Distance to nearest Atlantic port	×	×	×	×	×	×
Observations	6642	6642	6642	6642	6642	6642
R-squared	0.01	0.03	0.25	0.20	0.01	0.06
Mean dep. var.	0.01	0.02	0.37	0.45	0.01	0.07

Notes: OLS estimates. Conley standard errors with 50 km radius in parenthesis. The dependent variables are shares of the relative occupation in the labor force. The original categories as reported in the census are *comerciantes* (column 1), *estudiantes* (column 2), *jornaleros* (column 3), *labradores* (column 4), *fabricantes* (column 5), *artesanos* (column 6). Duration of Muslim rule is expressed in centuries. Geographic controls are: crop suitability, precipitation, average temperature, shortest distance to coast or large river, altitude, and ruggedness. Population and area controls include population size in 1860 and municipality area. Rate of Reconquista fixed effects include four indicators for quartiles of the speed of the Reconquista based on Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

and the relative paucity of a strong merchant class in municipalities which were comparatively longer under Muslim rule.

In particular, by using the occupations reported in the *Censo de Floridablanca*, we show that differences in the occupational structure of the municipalities are broadly consistent with the proposed mechanism. We use the following categories as dependent variables: merchants (*comerciantes*), students (*estudiantes*), daily workers (*jornaleros*), farmers (*labradores*), manufacturers (*fabricantes*), and artisans (*artesanos*).[30] We thus construct the share of people employed in the different occupations over the labor force. Following Oto-Peralías (2019), we construct the labor force as the sum of people reporting an occupation.[31] We include as controls the standard set of geographic variables, reconquest fixed effects, population and area. In order to address concerns regarding the potential confounding factor of the post-1492 expansion and the resulting oversea trade, we also include distance to the nearest Atlantic port as a control. Because of missing data on occupation, the regression sample is reduced to about 6,642 municipalities. The results are reported in Table 11.

In the first column we report the results for merchants. Consistent with our hypothesis that longer Muslim domination is negatively related with the presence of a merchant class, we find that duration of Muslim rule is indeed negatively related with the share of merchants in the

[30]There are also several occupations related to the church, a category for the nobles (*hidalgos*), servants (*criados*), and professionals such as notaries (*escribanos*) and lawyers (*abogados*). The content and limits of the occupational categories as reported in the census have been discussed in section 3.

[31]There are some cases in which it is reported that all individuals (*todos*) or the rest of individuals (*resto*) are agricultural workers (*labradores*) or daily workers (*jornaleros*). In the former case, we impute the labor force by applying the share of labor force over the total population of the villages and towns belonging to the same municipality. In the latter, we impute the total labor force as above and then subtract all the other occupations to recover the number of people employed in the residual category. In addition, since nobles (*Hidalgos*) and servants (*Criados*) are also problematic as they are over-reported, we exclude them from the computation of the labor force.

municipalities as in 1787. Taken at face value, the point estimate implies that an additional century of Muslim rule is associated with 0.1 percentage points lower share of merchants which is equal to 10% of the sample mean (reported at the bottom of the table). We believe this to be a result of the aforementioned elements in Islamic institutions that hindered the formation of a large and strong merchant class. In the second column, we find that the duration of Muslim rule is also negatively related to the share of students in the municipality, which is again consistent with the notion that a longer Muslim domination had a persistent negative impact on human capital in Spain.

Regarding other occupations, we find that length of Muslim rule is negatively related to the share of people employed as daily worker (column 3) and positively related to the share of farmers (column 4). As far as the category for daily workers includes people working in the proto-industrial sector, the results in columns 3 and 4 would be consistent with the argument that a longer Muslim domination led to fewer urban occupations. However, given the broad categorization of this occupation, any strong interpretation would be highly speculative. The coefficient in the specification for manufacturers is statistically insignificant (column 5), while we find a positive relationship between the duration of Muslim rule and the share of artisans in the working population (column 6).

Even though the results using the occupation data from the *Censo de Floridablanca* have to be taken with caution, the estimates indicate that municipalities which experienced a longer Muslim domination tend to have, respectively, a smaller share of merchants and of students three centuries after Muslims left the Iberian peninsula. This result is consistent with our proposed mechanism which links the length of Muslim rule with the lack of a strong merchants class which, in turn, hindered the accumulation of human capital in the long-run. Relatedly, in the next section we will show that Muslim rule hindered also the formation of self-government institutions.

7 Muslim Rule and Self-Government Institutions

In order to provide additional evidence on the proposed mechanism, we turn our attention to a city-level panel dataset based on Bosker et al. (2013), which contains data from Bairoch (1988) on population of European cities having more than 10,000 inhabitants in at least one century during the sample period. Bosker, Buringh, and van Zanden augmented the Bairoch dataset collecting new city-specific information such as geographical, institutional, and religious characteristics. The Spanish part of the dataset contains a panel of 103 cities observed every 100 years in the period 800-1800.[32] Although this is not a representative sample, these cities make roughly 25 percent of the Spanish population in 1900 and, likely, a higher share in the previous periods. The advantage of using this dataset is that it contains a number of variables which can help to identify the proposed channel, i.e. the non-adoption of self-government institutions that can explain why municipalities subject to Muslim domination for a longer period have lower levels of literacy rates in 1860.

[32] We could only match 102 cities with the 1860 census.

Our conjecture is that Islam, because of its institutional framework, impeded the rise of a politically powerful merchant class and thus the development of forms of self-government. While Muslim cities were functional by standards of the time, they missed the window of opportunity consisting in the spread of the communal experience occurring in central and southern Europe during the first centuries of the second millennium AD. In the successive centuries, having local participative institutions became important for long-term economic success and cities without such institutions were locked in a "bad" institutional equilibrium. As a consequence, cities without a strong merchants class and participative institutions had a depressed demand for human capital.

In this context, our main variable of interest is whether a city had any form of self-governance, thus constraining the dominant role of the church, state or feudal lords. This is captured by the dummy variable *Commune* coded by Bosker et al. (2013). This variables measures the extent of local participatory government (a local administration in which at least part of the citizens participate) at the beginning of each century. Typically *Communes* had autonomy in the regulation of taxation, commerce, and other administrative activities.[33] The authors rely on several criteria for their classification. First, they check if historical sources mention the presence of communal institutions such as consuls or town councils (*consejo*). As a secondary option, they use the building date of a town hall, or if missing, information on the first time city rights were granted (as mentioned in historical encyclopedias) and a *ciudad* status was obtained.

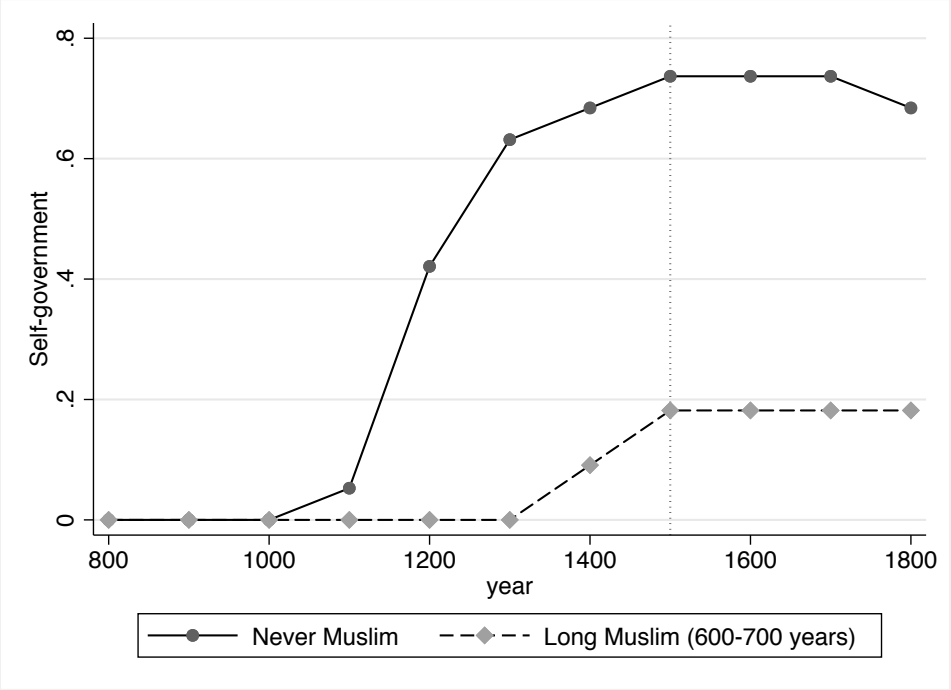
Figure 1 shows also the location of the cities in the Bosker et al. dataset used in our analysis. It is important to stress that we do not claim that the sample of Spanish cities is representative of the whole of Spain. Indeed, average literacy in the city panel is 36% against 21% for the whole of Spain, and average length of Muslim rule in the city panel is 454 years while in the full municipality sample is 324 years. These differences are due to the fact that (i) larger cities have higher level of literacy, and (ii) cities in the south of Spain, especially in the Emirate of Granada, are over represented in the Bosker et al. sample.[34] Yet, it is to some extent reassuring that the cross-sectional analysis based on the cities in Bosker et al. produces results on the effect of Muslim duration on literacy rates which are very similar to the baseline results for the whole of Spain (Appendix Table **??**).

Before moving to the econometric analysis of the city-level data, we show in Figure 3 the evolution over time of our variable of interest. In particular, we show how the presence of self-government institutions evolve century by century for two polar groups of cities: those 19 that never experienced Muslim rule compared to those 11 that were practically Muslim throughout the entire period (600-700 years). The graph suggests that cities never dominated by Muslims have a systematically higher probability of having self-government institutions while cities that have been the longest under Islamic rule persistently lagged behind. Never-Muslim cities experienced a rapid increase in self-government institutions when the commercial revolution hit in

[33] Bosker et al. (2013) define it as a variable to "capture the institutional developments in Europe that have been claimed to be the important drivers of Europe's long-term success, [...] whether a city had a degree of local participative government, that is, the presence of a local urban participative organization that decides on local urban affairs."

[34] On the extensive margin, there are 19 cities (about 18% of the sample) which have never been under Muslim rule.

FIGURE 3: Trend of self-government institutions by duration of Muslim rule in selected cities



Notes: The figures depict the evolution of the share of self-governed cities, distinguishing between those 19 cities that never fell under the Muslim rule and those 11 that experienced Muslim domination for the longest period (600-700 years). Source: Data from Bosker et al. (2013).

the 12th-14th century. This critical juncture was missed by Muslim cities, which continued to have centralized non-participative institutions without embracing any form of self-government. It is important to notice that, after the *Reconquista* of the last remaining Muslim territories in 1492 (dotted line), cities that have been long under Muslim domination did not adopt any self-government institution. Therefore, despite being formally under the same set of institutions starting from the end of 15th century, cities that have been longer under Muslim never managed to catch up in terms of local participative institutions.

From an econometric standpoint, the city panel dataset allows us to exploit variation *within* city, thus accounting for time-invariant city specific characteristics and time-fixed effects. In the analysis we proceed in two steps. First, we establish whether Muslim domination in Spanish cities in the first half of the second millennium had an effect on variables we consider relevant. Second, we formally test for persistence, i.e. whether the past experience of Spanish cities in terms of length of Muslim domination had long-lasting impact on the likelihood of being a self-governed city—according to our interpretation, one of the key drivers of the lag in literacy rates in 1860. Formally, we start by setting up model 1 below:

$$y_{it} = \alpha_i + \gamma_t + \beta_{800} \cdot M_{it} + \sum_{\tau=900}^{1400} \Big(\beta_\tau \cdot M_{it} \cdot \mathbb{1}(t = \tau) \Big) + \delta_t \cdot X_{it} + \varepsilon_{it} \tag{1}$$

where y_{it} is our main outcome variable, namely a dummy variable for having a form of self-government. We also run regressions using as dependent variable city population, a dummy for being seat of a bishop/archbishop and one for hosting a university; M_{it} is a dummy for being

TABLE 12: Muslim rule and city characteristics: Panel estimates

Dependent variable:	Self-government	City size	University	Bishop
	(1)	(2)	(3)	(4)
Muslim	-0.009	-0.713	-0.059	-0.160
	(0.126)	(2.831)	(0.038)	(0.133)
Muslim × 900	0.011	1.861**	-0.000	-0.044
	(0.010)	(0.831)	(0.002)	(0.073)
Muslim × 1000	0.029	3.030**	0.030	-0.029
	(0.025)	(1.473)	(0.020)	(0.098)
Muslim × 1100	-0.030	1.881	0.037**	-0.183*
	(0.061)	(1.643)	(0.018)	(0.105)
Muslim × 1200	-0.497***	0.314	0.051**	-0.188*
	(0.120)	(2.226)	(0.025)	(0.106)
Muslim × 1300	-0.791***	11.314	-0.048	-0.179*
	(0.110)	(11.022)	(0.036)	(0.103)
Muslim × 1400	-0.857***	9.520	-0.108**	-0.143
	(0.107)	(7.763)	(0.052)	(0.110)
Year FE	×	×	×	×
City FE	×	×	×	×
City pop × year FE	×		×	×
Rate of Reconquista × year FE	×	×	×	×
Observations	721	721	721	721
R-squared	0.58	0.10	0.12	0.19

Notes: OLS estimates with robust standard errors clustered at city level. In column 1 the dependent variable is a binary variable which takes on value one if a city has a form of self-government; in column 2 the dependent variable is city population; in column 3 the dependent variable is a binary variable which takes on value one if a city has a university; in column 4 it takes on value one if a city has a seat of a Bishop. Rate of Reconquista is from Oto-Peralías and Romero-Ávila (2016). *** denotes statistical significance at the 1% level, ** at 5% level, and * at 10% level.

under Muslim rule which varies across cities and over time, $\mathbb{1}(t)$ are indicators for centuries; X_{it} are controls which might also have time-varying effects, such as population-by-year fixed effects and rate of Reconquista-by-year fixed effects. α_i and γ_t are city and time fixed effects, respectively. Note that such specification allows for a heterogeneous effect of Muslim rule across centuries, captured by the coefficients β_t, where the interpretation of β_{900} to β_{1400} is the standard additive one. It is also important to note that the binary variable for being under Muslim rule used in these models is already contained in the Bosker et al. (2013) dataset and is, therefore, independent from our measure. The last point to note is that the panel stops at the fifteenth century as there are no Muslim cities after the fall of the Emirate of Granada in 1492.[35]

The estimates of model 1 are reported in Table 12. The results show a clear pattern only for what concerns having a form of self-government (column 1). In particular, being under Muslim domination in the 13th, 14th, and 15th century drastically decreases the probability of having a form of self-government. With respect to the other dependent variables, Muslim domination positively impacted on population size from 900 until 1099, coinciding with the golden age of Islam (column 2).[36] No clear patterns are associated concerning the presence of a university (column 3) or the seat of a bishop/archbishop (column 4).

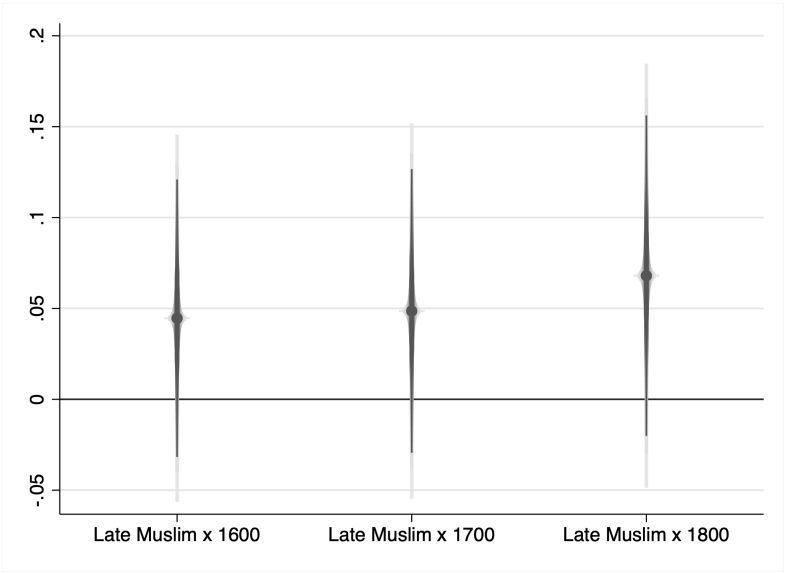
[35] Regarding the notation, the year 1000 refers to the century 1000-1099, the year 1100 to the century 1100-1199 and so on.

[36] This can be interpreted as indirect evidence that Islamic centralized institutions at that time were conducive to economic prosperity.

In fact, the results on self-government reported in column 1 of Table 12 are not surprising since it is well established that the process of communal self-government and forms of local participative government never took hold in the Islamic world (Bosker et al., 2013). Indeed, in the dataset there is no single city under Muslim domination in Spain that ever adopted any form of self-government. A more interesting question which contributes to address our main hypothesis is whether those cities that have been under Islamic domination until 1492 managed to catch-up, namely gaining some form of self-government after the Islamic period. In order to address this question we perform a panel analysis running from 1500 until 1800 and estimate how different lengths of Islamic domination affect the probability of having some form of self-government. In particular we estimate model 2 below:

$$y_{it} = \alpha_i + \gamma_t + \sum_{\tau=1600}^{1800} \Big(\beta_\tau \cdot M_i^H \cdot \mathbb{1}(t=\tau)\Big) + \varepsilon_{it} \tag{2}$$

FIGURE 4: Persistence of gap in self-government institution



Note: The figure plots the results of equation (2) and estimates of β_{1600}, β_{1700} and β_{1800} with 90% (lighter) and 95% (darker) confidence intervals. Late Muslim is a dummy variable for being under Muslim rule for at least five centuries.

where y_{it} is a dummy for the status of self-governed city and M_i^H is a dummy for those cities that experienced a long Muslim treatment, i.e. above 5 centuries.[37] The estimated coefficients for the dummies β_{1600}, β_{1700} and β_{1800} are reported in Figure 4. As one can see, despite a weak upward trend the coefficients are not different from zero, indicating that cities which remained under Muslim rule until late did not catch up in terms of self-government institutions. Thus, even after the last Islamic stronghold, the Kingdom of Granada, was defeated in 1492, these cities remained persistently less likely to develop any participative form of local government. This result is consistent with the interpretation of our reduced-form cross-sectional estimates showing that the length of Muslim rule is strongly and robustly negatively correlated with literacy in 1860.

[37]Note that, also in this case, we use the variable Muslim included in the Bosker et al. dataset to construct the variable for long Muslim treatment.

8 Conclusion

Islamic religion today is accused of being backward in terms of attitudes toward education and openness to innovation. In support of this, it is generally shown that countries with a predominant Muslim population tend to have lower levels of human capital. Some studies recently have shown that this is not intrinsic to the Islamic religion, but due to the interpretation of religious precepts and attitudes of the religious ruling elites. Considering Spain, however, Muslims are known to have initially enjoyed a comparative advantage in human capital with respect to the conquered Visigoths, turning Muslim Spain into a bridge through which knowledge diffused over to the rest of Europe.

In this paper we exploit variation in the length of Muslim domination across municipalities in medieval Spain to assess how the peculiarities of Muslim rule hampered the adoption of forms of local self-government which later became conducive to the accumulation of human capital. We have digitized unique new data on the length of Muslim rule and literacy rates in 1860 for about 7,500 municipalities in Spain. Reduced-form estimates show an astoundingly robust negative correlation between the length of Muslim rule and literacy rates. We present several robustness checks which exclude that the different phases of the *Reconquista* and the resulting distribution of jurisdictions and landownership drive our results.

We provide an explanation for the persistent lag in human capital in areas that have been longer under Muslim rule, namely, the impediment to the rise of the merchant class placed by the Islamic institutional complex. We argue that the commercial towns in the relatively less centralized Catholic north could exploit the window of opportunity that spanned Europe in the 11th-13th century gaining degrees of autonomy and setting up the human capital-oriented institutions functional to a strong merchant class. Conversely, the more centralized Muslim south missed such opportunity putting itself on a different path characterized by a low demand for human capital. Cross-sectional estimates of the relationship between duration of Muslim rule and the occupational structure in 1786 support indeed the notion of a relatively small share of merchants in municipalities dominated for a long time by Muslims.

Panel estimates for a sub-sample of relatively large cities suggest that, because of the Islamic domination and their institutions, cities missed out critical junctures such as the development of local forms of self-government. We show that this gap persisted until the nineteenth century, long after the last Islamic stronghold in Granada was defeated in 1492. We argue that the absence of inclusive and participative forms of local institutions hindered the economic development of the cities reducing, in the long run, the demand for human capital.

Scholars of different fields have tried to address prosperity and divergence through doctrinal comparisons of Islam and Christianity on relative tolerance, with the premise that the latter automatically translates into better economic performance. The Golden Age of Islam in Spain temptingly created associations between such tolerance and the initial economic growth and educational success of the region. Even if Islamic law did contain features that made medieval Islam more hospitable to the adherents of other Abrahamic religions than medieval Christianity did, Muslim Spain did not witness superior human capital accumulation in the long-run.

We are well-aware that the length of Muslim rule on the Spanish territory is to a large extent inversely related to the process of *Reconquista* and that the effect we discuss could not

be tightly identified. Nevertheless, we stress that the centralization of the Muslim institutions was an important determinant behind the missing critical juncture experienced by territories in southern Spain. We are confident that these findings could open further avenues of research to collect more systematic historical data on the time and geography of the transition from Muslim to Christian domination, to better pin down the specific mechanisms at play.

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