From Baghdad to London

The dynamics of urban development in Europe and the Arab world, 800-1800

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"The more numerous and the more abundant the population in a city, the more luxurious is the life of its inhabitants"
Ibn Khaldûn (c. 1375)

Abstract

On the basis of a large dataset of individual cities in Europe, North Africa and the Middle East, we empirically investigate why, between 800 and 1800, the urban centre of gravity moved from the Arab World to North-Western Europe. We study the characteristics of the urban system(s) involved, and assess the importance of geographical, religious and institutional factors for urban expansion. We find that the choice of main transport mode (camel vs. ship) and the development of local authority in Europe that made cities less dependent on the state, explain Europe's rise and the Arab World's gradual loss of dynamism.

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1. Introduction

Why did the Industrial Revolution begin in North-Western Europe, and not in China, Japan, India or the Middle East? At about 1000, the latter regions were clearly more advanced than Western Europe, which was still a rather backward part of the world economy with low levels of urbanization and income. Understanding why between 1000 and 1800 Western Europe developed from a backwater of the world economy into its most dynamic region is a major challenge for economists and economic historians.

This paper contributes to this debate. In particular it focuses on the divergent development of the Arab World and Western Europe (or the Latin West) in the millennium between 800 and 1800.[1] On the basis of a large new dataset of cities in Europe, North Africa and the Middle East we provide empirically founded explanations to the question why in the course of this millennium the urban center of gravity in this part of the world moved from Iraq (or more generally the Arab World) to Western Europe and the shores of the Atlantic in particular (see also Acemoglu, Johnson and Robinson, 2005 [AJR2005]). Earlier related empirical contributions by Acemoglu et al. (2005) and DeLong and Shleifer (1993) focus not so much on what made the difference between Europe and 'the rest', but much more on what made the center of economic gravity *within Europe* move from the shores of the Mediterranean to those of the Atlantic. Moreover, we aim to go beyond these earlier studies in that we have collected all our data on numbers of inhabitants, and on the various geographical, religious and institutional characteristics *at the level of the individual city*[2].

Several hypotheses have been put forward that explain the divergence between the Arab world and the Latin West. The relative decline of the Arab World has been attributed to the overseas expansion of Western Europe, which, after Portugal found the direct route to India and China, side-tracked the main trading routes that had been the engine of the economies of the Middle East and made the *'Arab middleman'* obsolete (Findlay and O'Rourke, 2008). Another prominent explanation is the alleged inability of this part of the

[1] In this paper the Arab World comprises the Maghreb and the Levant, consisting of North Africa, the Middle East, inclusive of Iraq, but excluding Iran and other countries to the east. It also includes Turkey (which is in principle not an Arab nation, but we classify it as such in this paper for ease of exposition – see also Hourani, 2002); Western Europe is Europe excluding the area of the former Soviet Union; the terms Western Europe and Latin West are used interchangeably.

[2] AJR (2005) also show results of regressions at the city-level. However, the bulk of the results provided in their paper are based on regressions at the country-level. Also, we note that both AJR (2005) and De Long and Shleifer (1993) use countries as defined by their 1990 boundaries as the unit of observation. We think that extending this country classification back to our sample period is somewhat problematic as these 1990 boundaries do hardly ever correspond to countries existing in the 9th up to the 19th century (e.g. Italy and Belgium only came into existence in 1861 and 1831 respectively). Taking individual cities as the unit of observation overcomes this problem of having to define countries.

world to develop more efficient institutions, perhaps linked to 'cultural' and 'religious' factors, to Islamic institutions perhaps, as for example Kuran (2003) and Greif (2006) argue.

A related debate is about the origins of Europe's dynamic development. Is it the Industrial Revolution of the late 18th century that made the difference between the west and 'the rest', as for example has been argued by a number of scholars working on comparative Chinese economic history (Pomeranz 2000; Bin Wong 1997)? Are the roots of Europe's advance to be sought in the gains it made after the Great Discoveries of about 1500, leading to the development of the Atlantic economy (AJR 2005: 549-50)? Or should we follow Weber (1922, 1958), or more recently Landes (1998) and Greif (2006) instead, who find the roots of European modernity in the specific institutions that emerged in the Middle Ages?

Our contribution to these debates is threefold. Firstly, we present a new dataset containing *city-specific* information that can be used to study the urban development in both Europe and the Arab world covering the period 800-1800. In effect, we are the first to contribute *empirically* to the debate on what made the difference between Europe and the Arab World. Besides having information on city sizes, our dataset contains information on cities' (relative) geographic location and on their institutional development. This allows us not only to chart the long term development of the urban systems of Europe and the Arab World, but also to analyze the spatial and institutional developments of the urban system(s).

Secondly, using this dataset we demonstrate that the Latin West and the Arab World were two largely separate urban systems, each with different features (such as different dominant modes of transport: the sea versus caravan routes) and very different dynamics (growth versus long-term stagnation). Moreover, by analyzing the interaction between cities we demonstrate that there were strong positive feedbacks within the two urban systems, but almost no interaction between them.

And finally, we assess the evidence for the importance of different institutions for long-term economic development, using the distinction made by Acemoglu and Johnson (2005) between political (or property right) and economic (or contracting) institutions. Greif (2006) has argued that the dynamic commercial (and urban) development of Western Europe compared to the Arab World was based on the superiority of its institutions regulating market exchange. His views differ from those of North (1981), who has maintained that it were mainly the *political* institutions constraining the predatory behavior of states that made Western Europe exceptionally successful. We assess the importance of the *economic* institutions that govern market exchange (Greif, 2006), by looking at the efficiency of the interactions between cities for their (economic) development and the importance of being

well-connected to the main transport routes. To get a grip on the importance of the quality of the *political* institutions on the other hand, we study the structural features of the urban systems such as its density, and urban primacy (building on e.g. Ades and Glaeser (1995) or Davis and Henderson (2003) who demonstrate that urban primacy is inversely related to the quality of the political institutions). Besides this, and arguably having an influence on both *economic* and *political* institutions, we also look at the importance of the development of forms of local authority for city development – a process that starts in Europe around 1100 but that never takes place in the Arab World.

Why compare the development of Europe to that of the Arab World and not to that of China or India? For a number of reasons the comparison between the development of the urban systems of Western Europe and the Arab World is as an ideal experiment: both regions shared the same institutional heritage of the Hellenistic and Roman world and Christendom was the dominant religion throughout the region before the Arab Conquests (see Hugh Kennedy, 2008). Following the Arab Conquests, this changed quite dramatically with the Arabs establishing a vast (Islamic) Empire stretching from Southern Spain to India in only a few decades time. After this the two urban systems developed more or less independent from each other. At the start of our sample period in 800 the Arab world was highly urbanized, inheriting the ancient centers of urbanization in Egypt, Mesopotamia and the Levant, whereas the Latin West was – with the exception of Italy – relatively backward. Finally, there were no colonial relationships between them, so that we can exclude this cause of their reversal of fortune (AJR 2001).[3]

The structure of the paper is as follows. First we introduce the concepts of 'market oriented' and 'sovereign oriented' cities on which we center our discussion of the different theoretical ideas that have been put forward in the literature about what makes successful cities, focusing on the link between (different types of) institutions, geography and economic exchange as the drivers of urban development in the medieval and early modern period. Next, we present the dataset that we have collected and give a broad outline of the process of urban growth in the two regions on the basis of the evolution of several of the characteristics of their urban system. In the following sections we relate the observed pattern in urban development to different kinds of city-specific (geographical, religious and institutional)

[3]Although they did fight many a war against each other and regularly (tried to) conquered each other's territory; the Islamic Jihad in this respect was not really different from the Christian crusades, and both had periods in which they were on the offensive alternating with periods in which they were mainly defensive (Islam was on the rise between 632 to about 1000, Christianity was on the attack between 1095 and about 1300, followed by a new expansion of Islam in the form of the Ottoman Empire between 1300 and 1683, after which the Ottoman Empire was again on the defensive).

characteristics, testing the relevance of different hypotheses that have been put forward as explaining differences in the size of cities. We begin with a baseline empirical model, and gradually introduce additional variables and study the evolution in the importance of different variables over time. These results provide a better understanding of the long run stagnation (or even decline) of urban development in the Arab World compared to the more dynamic and successful European experience. Offering an answer to the question why London, and economic backwater in 800, was able to overtake Baghdad, in 800 the thriving capital of the Abbasid caliphate, as the largest city in this part of the world.

2. Market oriented versus sovereign oriented cities.

A classification of cities that, in our view, offers a useful starting point for our investigation is the one by Max Weber (1922, 1958) who makes the distinction between 'producer' and 'consumer' cities. He contrasted the industrial or producer cities of Medieval Europe with the consumer cities of Antiquity, a distinction that has been rather fruitful, both for understanding the economic history of Antiquity and that of the Middle Ages (Finley 1985). In order to adapt Weber's classifications to our analyses we have translated his producer cities with the term 'market oriented' cities and called his consumer city 'sovereign oriented'[4]. The classical sovereign oriented city is a center of government and military protection (or occupation), which supplies services – administration, protection – in return for taxes and land rent (or more in general: non-market transactions). This kind of city is intimately linked to the sovereign. The flowering of his realm and the expansion of his territory and population will lead to urban growth, in particular of the capital city, which is the sovereign oriented city par excellence. Moreover, the most efficient location of such a city tends to be in the middle of the territory it controls; capital cities such as Baghdad, Damascus, Madrid, Delhi (the center of the Moghul Empire) or Moscow can be considered typical examples. Closeness to the main transport corridors is not a necessity, as the underlying rationale of such a city is not to exchange goods at relatively low transaction costs. Commercial activity will of course take place – for the feeding of the city and the supply of other consumption goods it has to resort to its surroundings –, but this function is secondary, derived from its political and military role.

[4] We think that the term 'market-oriented' captures the essence of a dynamic, production and trade oriented city better than the term 'producer'. Similarly the term 'sovereign-oriented' captures the essence of city that thrives only because of its role as a main administrative center than the term 'consumer'.

The economic basis of the market oriented city, on the other hand, is the production and exchange of goods and commercial/marketed services for and with its immediate hinterland and other (market oriented) cities at a greater distance. Its links with the sovereign or his state are typically much less close, and its fate can to some extent be more or less independent of the political entity it is part of because it has an economic basis of its own. There is clearly no reason to be in the spatial center of a state, in fact a strategic position on important trade routes – profiting from trade flows there – is more likely to be a good location for such a city. Given the importance of access to long-distance markets, the ideal 'market oriented' city will therefore be either located near the sea, at a navigable river, or at a hub of overland trade routes.

The difference between sovereign oriented and market oriented cities also generally expresses itself in the structure of the urban system. Capital cities are typical sovereign oriented cities: when they dominate the urban landscape the degree of 'consumerism' of the urban system is generally quite high (see e.g. the difference in urban landscape between North and South Italy documented in Bosker et al., 2008). Also, Ades and Glaeser (1995) demonstrate that high levels of urban concentration are not only linked to low levels of international trade and an inward looking economy (high tariffs), but also to political instability and lack of democracy: *"Urban giants ultimately stem from the concentration of power in the hands of a small cadre of agents living in the capital. This power allows the leaders to extract wealth out of the hinterland and distribute it in the capital"* (Ades and Glaeser 1995: 224).

A second way of linking the structure of the urban system to the underlying institutional framework is via the analysis of the interactions between cities. Whereas the spatial structure of the urban system tells us something about the political institutions in which they are embedded, the (non-)existence of feedbacks between cities can be indicative of the efficiency of their interaction. And we argue that it can serve as an indicator of the efficiency of the *economic* institutions regulating exchange. When the *economic* institutions governing exchange between cities are efficient and transaction costs are low (i.e. cities are more market oriented), the interaction effect between cities will be positive: good access to other cities' markets stimulates city growth. Instead, if the urban system is more sovereign oriented instead, cities compete for taxes and other forms of surplus extraction from other (smaller) cities and the countryside, and will tend to keep a certain distance from each other resulting in no (or even negative) interaction between cities.

Therefore, studying these feedbacks, which are comparable to the neighborhood-effects analyzed in recent work in new economic geography (see e.g. Redding and Venables, 2004; Fujita and Mori, 1996; Fujita, Krugman, Mori, 1999) contributes to the assessment of the validity of the hypothesis that the strong economic development of Western Europe was the result of its more favorable economic institutions (Greif 2006) resulting in an urban system comprised of many market oriented cities, each being much more involved in flourishing exchange compared to the cities in the Arab World.

Looking at these interaction effects can also answer the question to what extent a group of cities functions as an integrated urban system. When we find a positive (and significant) interaction effect, feedbacks between cities are strong, pointing to the existence of such a system. When instead this interaction coefficient is zero or negative, the cities apparently do not interact to such a degree that one can speak of the existence of such an integrated system. In other words, this approach allows us to verify whether e.g. European and Arab cities formed one integrated system or separate urban systems and how this evolved over time: when they came into existence as a system, and how strong their interaction was.

Summing up, by analyzing the location of cities (in particular their ease of access to important trade routes), the structure of the urban system (the share of the largest and/or the capital city in total urban population), the polity they are part of (Republics versus Monarchies), and using information on the local political organization, we empirically verify what kind of forces are driving the urbanization process, whether we are dealing with market or sovereign oriented cities, and therefore whether market forces or non-market transactions are behind urban expansion. Besides telling us something about the relative importance of political and economic institutions in the Latin West and the Arab World, the differences, and sometimes the similarities, between Europe and the Arab World that are revealed in the next sections, provide clear insights into the likely causes of the Arab World's stagnation and Europe's eventual dynamic take-off.

3. Dataset of cities in Europe and the Arab World 800-1800[5]

Much of the recent work done on long-term trends in economic performance in the pre industrial era has used estimates of the number and size of cities and/or the urbanization ratio as indicators of the economic success of regions and countries (Acemoglu, Johnson and Robinson 2005; De Long and Shleifer 1993). These figures are indeed among the few more

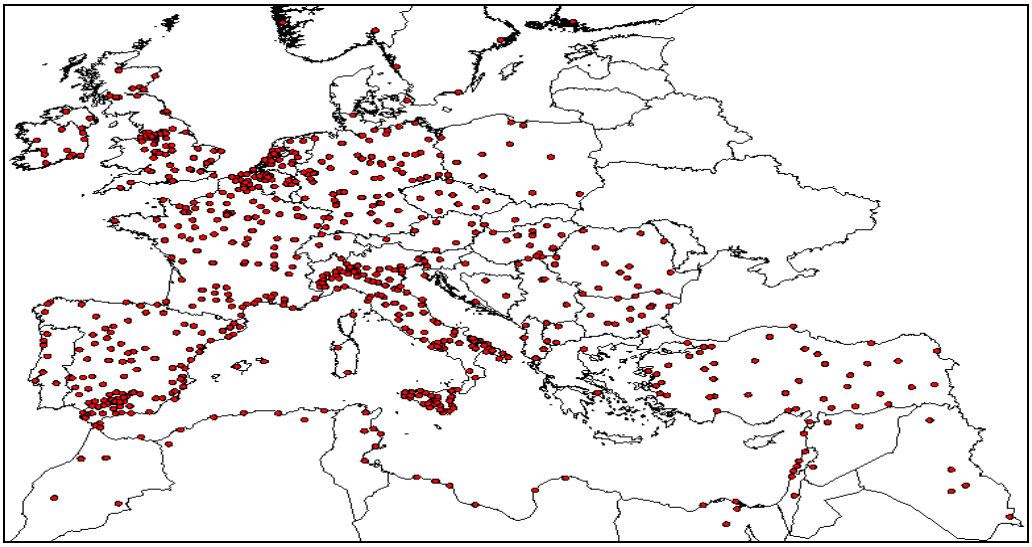
[5] In the data Appendix we explain in much more detail how we constructed this dataset, discussing each of the collected variables separately. Also we discuss the reliability of the dataset.

or less reliable data available for the pre industrial age, making it possible to chart and analyse long-term trends and spatial structures (see De Vries 1984 for a seminal example). We aim to go beyond these earlier contributions that almost exclusively focus on urban development at the country level, and focus entirely on the development of individual cities. To be able to do this, we have constructed a large dataset consisting of city-specific information about all cities in the Arab World and Europe that at some point during our sample period, 800-1800, were larger than 10,000 inhabitants.

Population

In the medieval period a criterion of ten thousand inhabitants to characterize a residential area as a city is a rather hefty one. Towns often had not more than a few thousand, and sometimes only a few hundred, inhabitants, but it is impossible to trace and quantify the development of these minor towns in the period under review. Therefore, only the really large centers of population pass our criterion (Ennen 1972, 199). For European cities with 10,000 inhabitants or more we used the dataset published by Bairoch *et al* (1988). To update it, we scanned recent literature concerning the major cities covered by the dataset. For cities in the Arab World we used a wide variety of sources, and sometimes had to infer population sizes from their surface area, the number of mosques, *hammams*, and other indirect indicators. Map 1 below shows all the cities that are at some point included in our sample[6].

Map 1 All cities in our sample



[6] Because of the gradually increasing population and urbanization, the number of cities included in the analysis, which starts from 54 in the year 800, grows continually to 615 cities in 1800 (in total the sample comprises 729 cities that are ever larger than 10,000). – more on this below –.

Geography, religion and institutions

Apart from population data we also collected administrative information concerning the functions of the various cities. In particular, was it a capital city, a bishopric or an archbishopric, and did it have a university; what was the religious orientation of its inhabitants: was it predominantly Muslim or Christian, where the latter is later on divided into Catholic and Protestant? Also we collected information about each city's local political organization, i.e. the presence of a local commune or city council, capturing the extent to which a city had local authority.

Additionally we collected data concerning the precise geographical location of the different cities (its coordinates) and classified each city on the basis of whether one (or more) previous Roman road(s) led to the city, it was located on one (or more) caravan routes, it had access to a navigable waterway, or whether it was located at the sea.

Foreign Urban Potential and distances

Finally, we constructed each city's so-called foreign urban potential (FUP) that we will use in our inquiry into the importance of interaction effects between cities. We define city *i*'s FUP as the distance weighted sum of the size of all other cities, where we measure distance in terms of relative transport costs[7]. Following De Vries (1984), and Bosker et al. (2008), we calculate a city's foreign urban potential at time *t* as in (1). Note that we do not include own city population when calculating FUP, because we are interested in the effect of developments in the urban system *around* a city, i.e. in other cities, on the development of the city itself. This is different from de Vries (1984) who does include own city population in his measure of urban potential.

$$FUP_{it} = \sum_{j \neq i}^{n} \frac{pop_{jt}}{w_{ij} D_{ij}} \tag{1}$$

where pop_{jt} is the population of city *j* at time *t*, D_{ij} is the great-circle distance between city *i* and city *j*, calculated on the basis of each city's coordinates. w_{ij} is a distance weight that we use to take a city's ease of access, depending on a city's geographical conditions, into account. Hereby we distinguish between three different modes of transport – via sea, via rivers or via land (road or caravan route[8]) – and use the estimate of Masschaele (1993) for the

[7] As such our measure of urban potential is very much related to the concept of market potential that plays a central role in economic geography (see e.g. Redding and Venables, 2004 or Hanson, 2005).

[8] Comparing the speed and ton per man ration of camel transport (from Austen 1990) with similar data of medieval road transport (using horse drawn carts) (from Masschaele 1993) suggests that the costs of these two modes of transport were rather similar: camels were somewhat faster than horses (30 versus 20 miles per day),

differences in relative transport costs, i.e. 1:4:8 (i.e. road transport is 8 times as expensive, and river transport 4 times as expensive as sea transport). This results in the following definition of w_{ij}:

$$(2) \qquad w_{ij} = \begin{cases} 1/8 & \\ 1/4 & \\ 3/8 & \\ 3/4 & \\ 7/8 & \\ 1 & \end{cases} \quad if \quad \begin{array}{l} \textit{city i and city j both at sea} \\ \textit{city i and city j both on a river} \\ \textit{city i at sea and city j on a river (but not at sea) or vice versa} \\ \textit{city i at sea and city j not at navigable water} \\ \textit{city i on a river and city j not at navigable water} \\ \textit{city i and city j both not at navigable water} \end{array}$$

Regarding our choice of distance weights, we are well aware that Masschaele's estimates apply to the situation around the 14th century (more or less in the middle of our sample period). It is unlikely for transport costs to have remained exactly the same over the 800-1800 period of a millennium; also the various modes of transport will not have all developed equally in this period. We may expect for example quite some gains in efficiency in transport by sea between 800 and 1800, where technological innovations have played a considerably larger role than in the road or caravan transport. Austen (1990, p.341) indicates that travelling times of caravans through the Sahara did not change over a period of one thousand years (850-1930)[9].

4. The Arab and European urban system compared

4.1 Trends in urbanization and largest urban centers

This section offers a broad overview of the urban development in Europe and the Arab World. The different long run dynamics of urban development in these two regions become immediately clear when looking at the long run development of each region's urban population and urbanization rate shown in Figure 1.

At the beginning of our sample period the urban population in the Latin West is about half that of the Arab World. Between 800 and 1800 the urban population of Western Europe increased more than twentyfold, whereas it grew by only 50% in the Arab world.[10] Underlying trends in total population (urban and non-urban combined) show a similar

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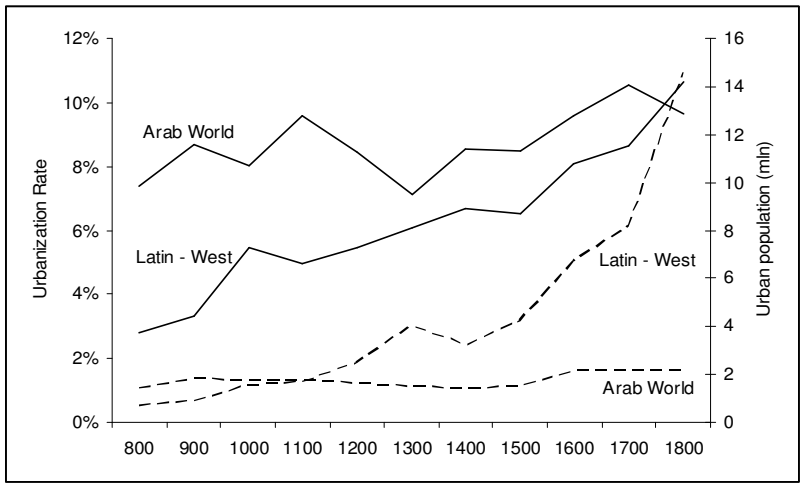
but had a lower labour productivity (tonnage per man was 0.6 versus 0.8); therefore we did not make a separate category for camel transport.

[9] We will come back to the issue of choosing these distance weights in the next sections. Our main results are qualitatively robust to using other (sensible) specifications of these weights. See the results Appendix for robustness checks regarding the choice of weights to measure the relative transport efficiency.

[10] This is consistent with the detailed discussion of demographic trends in the Middle East between 800 and 1500 in Ashtor 1976.

pattern: the total population of the Arab world increases from 19 to 22 million. In Western Europe, which in 800 has about the same population as the Arab World (22 million), it increases dramatically to 130 million in 1800.

Figure 1. Urban development in the Latin-West and the Arab World



Notes: The dashed lines denote the urban population and the straight lines the urbanization rate of each of the two regions.

From about 1200 the Latin West has a (urban) population that is more than double that of the East. The differences in terms of rates of urbanization[11] are equally striking: the Latin West shows a continuous, steady increase in its urbanization rate – in fact, it is difficult to find a 'decisive' acceleration in either urban or population growth in Europe –, whereas the Arab world shows a stagnating, hardly changing pattern over the whole period we are considering (see Maddison 2007, p.183-192 for a similar pattern). Note however, that the steady increase in the Latin West only results in the Latin West overtaking the Arab World in terms of overall urbanization rate in the final 100 years of our sample period.

At a finer geographical scale there are also regional differences within the Arab World and the Latin West[12]. Iraq is the most urbanized region during the 800-1300 period, with a for that period unrivalled rate of urbanization of around 20% - even reaching 30% in 900 - (see Ashtor 1976: 89-91 for a discussion of the high level of urbanization in 9th/10th century Iraq). But also in Syria, Palestine and Egypt a relatively large share of population

[11] The numbers of inhabitants in millions of persons in the different countries for the eleven time periods of our analysis, that are needed to calculate urbanization ratios, have been obtained from McEvedy and Jones (1979) either directly from their figures or by interpolation (when no data was provided).

[12] See Table RA4 in the results Appendix for the urbanization rates in several regions of Europe and the Arab World.

resides in cities. In Europe, by contrast, urbanization levels before 1100 are very low in comparison, with only (Islamic) Spain coming close to a comparable level of urbanization as in the Arab World. Starting in Italy (from about 1100 onwards) and the Low Countries (after 1200) areas of high urbanization also begin to develop in Europe. Culminating with Great Britain, although a relatively late urbanizer, becoming the most important center of urbanization in 1800.

The shift in the urban center of gravity from the Arab World to Europe also is apparent when looking at the changes in the largest urban centers over the 800-1800 period.

Table 1. The largest urban centers over the centuries

rank \ year	800	900	1000	1100	1200	1300
1	Baghdad 350	Baghdad 450	Baghdad 300	Baghdad 250	Baghdad 200	Paris 250
2	Byzantium 250	Byzantium 300	Byzantium 300	Byzantium 200	Cairo 200	Cairo 220
3	Basra 100	Cairo 150	Cairo 135	Cairo 150	Paris 110	Granada 150
4	Wasit 100	Alexandria 100	Cordoba 100	Tinnis 110	Byzantium 100	Venezia 110
5	Kufa 100	Cordoba 95	Sevilla 90	Damietta 100	Damietta 100	Damietta 108

rank \ year	1400	1500	1600	1700	1800
1	Cairo 250	Istanbul 280	Istanbul 700	Istanbul 700	London 948
2	Paris 200	Paris 200	Paris 300	London 575	Paris 550
3	Brugge 125	Cairo 180	Napoli 275	Paris 500	Istanbul 500
4	Tunis 100	Adrianople 127	Cairo 250	Cairo 330	Napoli 430
5	Granada 100	Napoli 125	London 200	Napoli 300	Cairo 263

Notes: population in thousands behind city name.

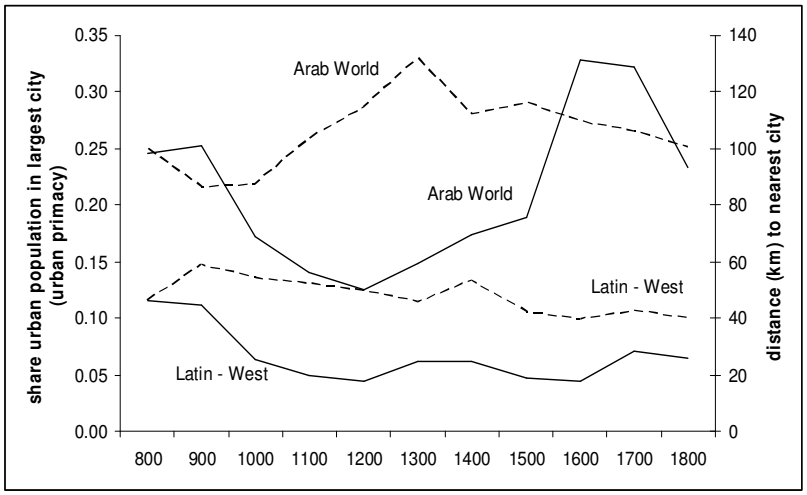
In the beginning of our sample, 800-1100, all of the largest cities, are located in the Arab World, with Baghdad, Byzantium, and Cairo the most prominent examples. The Latin West in this period did not have the giant cities characteristic of the Middle East. This changes from about 1300 onwards, when we witness the rise of first Paris (that briefly held the position of the largest city in this part of the world), Naples and eventually London as the big urban centers in the Latin West. However, the largest city remains located in the Arab world until the 18th century. Following the decline of Baghdad culminating in its (almost complete) destruction by the Mongols in 1258, Cairo takes over the position of largest city (during 1200-1500) followed after 1500 by the capital of the fast expanding Ottoman Empire, Istanbul.

4.2 Urban primacy and urban system density – a first indication of the institutional setup?

As a first indication of the institutional setup of the urban systems in Europe and the Arab World, we calculate the share of the largest city in the total urban population that we take as a measure of how sovereign oriented the urban system is (see Ades and Glaeser, 1995; Davis

and Henderson, 2003). Figure 2 shows that the trends in the two parts of Eurasia distinguished here are very different[13]: in Western Europe this share declines from 12% in 800 to 4% in 1200, after which a slight increase begins (6% in 1400, 7% in 1700 and 1800) with the rise of the nation states (see Tilly, 1990). In the Arab world the trend is downward initially as well, but from a much higher level: from 25% in 800 and 900 it declines to 13% in 1200 following the disintegration of the Abbasid Caliphate and the loss of Muslim Spain, after which it again increases to 19% in 1500 and as high as 33% in 1600 due to the rapid growth of Istanbul. These large differences in primacy point to persistent differences in the structures of the two urban systems: in the Arab World the system is dominated by a few very large cities, in Western Europe the system is much more balanced.

Figure 2. Urban primacy and average distance to the nearest city



Notes: The dashed lines denote the distance to the nearest city and the straight lines the urban primacy rate of each of the two regions.

There are similar differences in the density of the urban system (see Figure 2 but also Map 1): already in 800 the average distance in the Latin West from one city to the nearest other city was about half that in the Arab World (46 km versus 100 km), and this difference persisted (in 1800 it was 40 km versus 101 km). This implies that on a certain geographical area in Western Europe there were on average about four times as much cities as could be found in the Arab World. Already at the start of our period, the Western European urban system was

[13] A similar pattern shows up when comparing countries in the Latin-West to those in the Arab World. Results available upon request.

denser than that of the Arab World, which was dominated by a few very big cities located at relatively large distances from each other.[14]

The differences discussed so far between the European and Arab urban system are consistent with the hypothesis that cities in the Arab World came closer to the typical sovereign oriented city: the Arab urban system is dominated by a few very large cities that control the urban system seemingly restricting the development of other (nearby) cities. In the Latin West we also find some large cities, but generally we observe a much denser urban system with more large cities in relatively close range of each other, suggesting at least a much larger degree of positive interaction between cities: they are more market oriented. This section however only gives (preliminary) descriptive evidence. The aim of the next section is to go one step further and uncover the city-specific drivers of urban expansion using panel data techniques – verifying whether or not we observe differences between Europe and the Arab World in these determinants (over time).

[14] An alternative explanation for these differences is that the two urban systems were embedded in very different ecological conditions and related agricultural systems.
One version of this argument is that (following Wittfogel 1957) Mesopotamia and Egypt (the most urbanized parts of the Arab world) were basically 'hydraulic' societies, which required large, centralized states to govern the water management infrastructure; the problem is that in Northern Italy and the Low Countries under similar circumstances - dependence of systems of water management - very different institutional arrangements emerged to manage this infrastructure, and very dense urban systems.
Another version is that the Arab world underwent a long term process of environmental deterioration, undermining the agricultural conditions for urban growth, whereas new agricultural technologies made possible the flowering of cities in the Latin West. It has however also been argued that the Arab world underwent an agricultural revolution during the 9^{th}-12^{th} centuries, in the same period in which Europe's 'agricultural revolution' has been located (Watson 1975; White 1962). More in general, economic historians now argue that agricultural systems are very flexible, and able to generate substantial surpluses when urban demand is sufficiently high (cf. Grantham 1999), which suggests that agriculture is not a cause of change itself, but dependent on developments outside its sphere of influence.
Finally a third version of this argument is that due to environmental conditions the Middle East offered less favorable spots for new cities to emerge than Western Europe. Again, we are not entirely convinced by this argument: the Middle East traditionally knew various regions with a high density of cities, such as the Fertile Crescent of Asia Minor/Palestine, Egypt and Mesopotamia (the region that had actually 'invented' the city), but also current day Morocco and Tunisia; moreover, some of the largest cities of the Arab world (Baghdad, Cairo, Basra) were only founded by the Arab conquerors, which also suggests the existence of niches for new urban development. Also note that we also observe differences within Europe between regions with in principle similar environmental conditions – compare e.g. the Netherlands and Britain to (southern) Scandinavia and Poland. Moreover, in Table RA5 in the results Appendix, we show that in 600 AD the number of cities with an (arch)bishop is quite similar in the countries that were to become part of the Arab World as in Southern Europe. The number of towns that could have potentially grown out to be larger urban centres did not differ substantially between the two regions. However in Southern Europe a larger percentage of these towns eventually grew to be larger than 10,000 inhabitants, e.g. in France 48% of cities with an (arch)bishopric in 600 grow above 10,000 inhabitants; while in the Arab World this percentage is much lower, e.g. in Tunisia only 3% of such towns grow so much as to pass our inclusion criterion.
To control for climatic conditions in our empirical analysis (see next section), we proxy these by including a city's latitude in the regressions (see Table RA3 in the Results Appendix), or hope to capture them by including city or country specific fixed effects (assuming that climatic conditions did not change substantially over our sample period) and country specific time trends.

5. Exploring the drivers of urban development

As our dataset contains not only information on cities' population size but also on several of their geographical, religious and institutional features; we aim to uncover the (un)importance of these city-specific features as drivers of the observed urban developments discussed in the previous section. To do this, we estimate the following simple regression equation (see also AJR2005):

$$\ln pop_{it} = \alpha_i + X_i'\beta + X_{it}'\gamma + \varepsilon_{it} \quad (3)$$

where pop_{it} is the population of city i at period t, X_i are city specific variables that do not change over time, X_{it} are city specific variables that do vary over time and ε_{it} is a disturbance term that we allow to exhibit both autocorrelation and heteroscedasticity. Also, in our baseline specifications the α_i denote a city-specific random effect that is uncorrelated with the regressors (in subsequent robustness tests we also allow α_i to be a city-specific fixed effect but this comes at the cost of being unable to say anything about the time-invariant city-specific variables in our regressions). The estimated coefficients on the included city specific variables, β and γ are our main point of interest.

To be able to distinguish between the importance of the notion of market and sovereign oriented cities, as set out in section 2, we analyze the relative importance of different factors that could leave their effect on city growth. These factors can be classified in three groups: geographic variables that do not change over time, specific institutional and religious features of cities that can change over time (being a capital city, an (arch)bishopric, religious orientation), and finally our measure of FUP that aims to capture the strength and direction of cities' interaction. More in detail the different variables are:

Geography: Location at the sea (also distinguished in being located at the Atlantic, the Mediterranean or the Baltic or North Sea coast[15]), at a navigable river, at one or more (hub) roman roads, at one or more (caravan hub) caravan routes (in a robustness check we also include a city's latitude [see footnote 15]).

Religious and institutional: a city's status as the seat of a bishop or an archbishop, or as the capital of a large territory, the presence of a university and its religious denomination where we make the distinction between Muslim and Christian that is from 1600 onwards further split in Catholic and Protestant. [In section 5.4 we focus in more detail on the

[15] Note that we use location at sea, and not the actual presence of a seaport. It can thus be viewed as capturing the potential for being a seaport which is arguably less plagued by endogeneity issues than considering only those cities with an actual seaport (see AJR 2005).

importance of institutions restricting the power of the state and also introduce our city-specific *commune-variable* indicating if a city had some form of local authority].

Cities' interaction: a city's 'foreign urban potential' measuring its access to nearby markets in other cities, see (1). We further split this variable into Muslim and Christian 'foreign urban potential[16], that allows us to distinguish between the importance of access to nearby markets of the same or different religious orientation.

5.1 *Baseline results*

Table 2. The baseline results

	all cities	muslim	christian	latin west	non latin west
Sea	0.108*	-0.047	0.138**	0.133**	0.016
	[0.080]	[0.721]	[0.035]	[0.043]	[0.911]
Navigable river	0.052	0.141	-0.01	0.019	-0.023
	[0.203]	[0.224]	[0.808]	[0.649]	[0.805]
Hub roman roads	0.051	0.023	0.096*	0.112*	-0.067
	[0.348]	[0.840]	[0.080]	[0.058]	[0.541]
Roman road	-0.013	-0.169	0.048	0.044	-0.129
	[0.759]	[0.208]	[0.242]	[0.320]	[0.290]
Caravan	-0.035	0.083	-0.026	-	0.026
	[0.757]	[0.551]	[0.881]	-	[0.830]
Caravan hub	0.526***	0.463***	0.303	-	0.506***
	[0.002]	[0.008]	[0.163]	-	[0.001]
Bishop	0.177***	0.270**	0.139***	0.139***	0.310***
	[0.000]	[0.012]	[0.000]	[0.000]	[0.001]
Archbishop	0.388***	0.217	0.438***	0.463***	0.259*
	[0.000]	[0.175]	[0.000]	[0.000]	[0.083]
Capitol	0.815***	0.766***	0.817***	0.822***	0.767***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
University	0.322***	0.107	0.301***	0.265***	0.347
	[0.000]	[0.743]	[0.000]	[0.000]	[0.170]
Muslim	0.292***	-	-	0.583***	0.084
	[0.000]	-	-	[0.000]	[0.301]
Muslim FUP	0.048	0.332***	-0.055	-0.053	0.264***
	[0.242]	[0.001]	[0.156]	[0.226]	[0.002]
Christian FUP	0.093***	-0.04	0.161***	0.176***	-0.072
	[0.000]	[0.508]	[0.000]	[0.000]	[0.237]
Protestant	0.094	-	0.076	0.07	-
	[0.102]	-	[0.187]	[0.226]	-
Observations	2376	481	1895	1831	545

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not change the results whereas the dummies themselves are insignificant. Results obtained using a panel data estimator allowing for random city-specific effects.

[16] For each city in the sample we calculate the part of its foreign urban potential that can be ascribed to other Christian and to other Muslim cities respectively.

Table 2 shows our baseline results obtained using the unbalanced panel of all cities larger than 10,000 inhabitants. Besides showing the results when considering all cities in the sample, we distinguish four different subsamples of cities that are based on two different splits of our total sample: one divides it along religious lines, i.e. in Christian cities and Muslim cities, and the other according to cities' geographical location, i.e. cities in the Latin West[17] versus cities in the non-Latin West[18]. The geographical split of our data defines the West and 'the Rest' in a way that does not change over time. This purely geographic distinction has the disadvantage that it classifies many cities (such as Cordoba or Palermo) as part of the Latin-West whereas they actually were Muslim (and thus perhaps more part of the Arab World) for sometimes many centuries. This is the reason to also consider the sample split on the basis of cities' religious orientation, which may have changed during this millennium[19]. This religious criterion provides an arguably better classification of cities belonging to the Arab and European sphere of influence.

The results of the baseline model are shown in Table 2. First, the results regarding the relevance of being well-positioned in terms of easy access to the main transport corridors (our geographical variables), that we expect to find important for market oriented cities in particular. We find interesting differences between the Muslim world and the Latin-West in this respect. Having good access to navigable water (location at sea) or being on a hub of roman roads has a positive effect on cities in the Latin West (both coefficients are positive and significant). For cities in the Muslim world we do not find this: the sea coefficient is negative, implying that location at sea does not give cities a clear advantage over their landlocked counterparts: indeed, the really big Muslim cities such as Baghdad, Damascus, Cairo and Cordoba are inland (Istanbul is a notable exception here, but it became a Muslim city only in 1453). Also Muslim cities with good access to roman roads are not larger than others. In contrast, being a hub of caravan roads has a strong positive effect pointing to the importance of transport on camel-back in the Arab World.

[17] We define the Latin West as Europe to the west of the line between Triest and Petersburg. This line is well known from the literature on the European Marriage Pattern (see Hajnal 1965) and is arguably the best approximation of the historical border of the Latin West; it coincides with the border of the Catholic Church during the Middle Ages; Latin West comprises Scandinavia (Norway, Sweden and Finland), Poland, Germany, Czech Republic, the Low Countries (Belgium, Luxembourg and the Netherlands), France, Great Britain, Ireland, Switzerland, Austria, Italy and those located on the Iberian Peninsula (Portugal and Spain). See also Findlay and O'Rourke, 2008.

[18] The Balkans (Hungary, Slovakia, former Yugoslavia, Albania, Rumania, Bulgaria and Greece), Turkey, and the Middle East (Lebanon, Israel, Jordan, Syria and Iraq) and North Africa (Egypt, Libya, Tunisia, Algeria and Morocco, all above 30 degrees latitude).

[19] Especially in the Iberian Peninsula, Italy (Sicily), in the Balkans and Turkey (former Byzantine Empire) and during the crusades the religious affiliation in a number of cities shifted between Muslim and Christian or vice versa (the main source was Jédin *et al* 1980).

These differences are related to a number of underlying factors: there appears to be more continuity between the Roman past and the urban system in Western Europe: this is clear from the effect a hub (of roman roads) has on city size, it is also clear from the positive effect of (arch)bishoprics on city size.[20] The governance structure of the Catholic Church was rather immobile, and (arch)bishops were almost always seated in towns that had been important urban centers in Roman times. These results therefore tend to confirm that there was a large degree of continuity in the structure of the urban system between the Roman Empire and the Middle Ages (Verhulst 1999).

This appears to have been less the case in the Arab world. Indeed, the Arabs largely replaced the predating Roman system with one of their own, founding many new cities from scratch[21]. As a result, the effect of Roman roads and of (arch)bishops is much smaller (and insignificant). Instead, we see a strong influence of caravan hubs indicating the importance of trade via caravan trails (linking Africa to as far as India and even China) that gained in importance after the Arab conquests. It also, combined with the insignificance of location at sea[22], shows the orientation of the Arab World towards the East and South (see e.g. Pryor, 1988, p.137 and the geographic scope of Arab travelers [more on this below]). Mediterranean trade was of marginal importance compared to the Muslim trade across the Sahara and in the Indian Ocean. This was different for the Christian traders in the West: there trade was focused on water transport, with the cities on the shores of the North Sea and Baltic coast developing a flourishing trade (Hansa League), and the Byzantines and then the Italians dominating Mediterranean trade, and, after 1500, the Atlantic ports prospering following the Great Discoveries (AJR, 2005).

Next, we turn to the results regarding the relevance of city's institutional and/or religious status. Being a capital city has a big impact on cities in both regions, and it is striking that this impact is of similar size in the Arab World and the Latin West: a coefficient of 0.80 points to a capital city 'bonus' in terms of population size of about 130%. Also, and already mentioned briefly before, we find that cities that played an important role in the

[20] Glick 1979: 23 gives examples of policies by medieval Spanish states and cities to maintain the system of Roman roads. The significant positive bishop effect found for the muslim / non latin west samples is totally due to a large number of bishoprics in Byzantine Anatolia, if country fixed effects or city fixed effects (see Table 4) are included this is immediately gone.

[21] Notable examples are Cairo, Baghdad and Marrakesh. Many Muslim cities were, in the first place founded as military encampments and spaces housing large numbers of (retired) military. Because the state paid these (retired) soldiers in cash, this led to a sudden increase in demand for goods in these areas, which stimulated the growth of a commercialized economy (Kennedy 2002).

[22] Note that Map 1 show many Muslim cities located at the sea, however the larger cities were all located inland explaining the insignificance of the 'sea-effect'.

Catholic Church tend to grow larger than other cities, and the more so the more important its status within the church (compare the bishop to the archbishop effect). Capitals and religious centres attract people and capital alike as public expenditure (often obtained by raising heavy taxes on the surrounding countryside) or royal privileges are likely to be biased towards such a city, creating jobs and business opportunities. Being close to the one(s) in power can be very beneficial (see also DeLong and Shleifer, 1993). Note however that playing an important role in the Catholic Church hierarchy is less important than being a centre of *'wordly power'*[23].

Regarding religion, we find that Muslim cities are on average larger than non-Muslim cities, which reflects the less balanced structure of the urban system that was already noticed in section 4 (big cities dominating the urban system). Interestingly, and similar to AJR 2005, we do not find evidence that cities that during the Reformation switched from Catholicism to Protestantism saw an increase in their population (hereby being unable to confirm the alleged positive effect of the Protestant working spirit on subsequent economic development suggested by e.g. Weber, 1909 and Landes, 1998). Finally we note that housing a university spurs city growth in Western Europe, but not so in the three cities in the Arab World that we classified as having a university (Baghdad, Fez and Cairo)[24].

Finally, we turn to what we view as one of our most remarkable findings: the interaction between cities. Muslim cities have a strong positive impact on other Muslim cities and the interaction between Christian cities is also positive and significant. On the contrary, interaction across religious borders is consistently insignificant or significantly negative[25]. In the neighborhood of (big) Muslim cities, Christian cities appear to be smaller than they would be under other circumstances, and the same, negative interaction effect applies to Muslim

[23] We understand that there may be endogeneity problems here, because cities may have been selected as capital cities or important religious center because they were already big for other reasons. However in many cases – Baghdad is perhaps the most striking one, but one can also think of Madrid – they were established by a powerful state outside the existing urban system, and became large because they were capital cities. In fact, not all large economic centres were to become capitals later. This depended very much on the strength of the territorial state the city belonged to and on the degree of political coordination (Epstein, 2000, p. 95). Other examples of relatively small cities that owed their rise to the capital city effect are Vienna, Naples, Berlin, Turin, and Brussels. In the Arab World many capital cities were actually founded after the Arab Conquests – notable examples are Cairo, Baghdad and Marrakesh.

[24] Again, there may be endogeneity issues here, as some universities were set up in already large cities (Paris is probably the best example); but there are many counter-examples as well, such as Bologna, Louvain, Oxford and Cambridge, to name only a few.

[25] The interpretation of the coefficient on a FUP variable is not straightforward: as explained in detail in Appendix A, it is also affected by the density of the urban system (which was much higher in the Latin West), and by the appearance of new cities (which occurred more often in Western Europe than in the Arab world). In the main text we focus exclusively on the significance and sign of the coefficient (and in section 5.2 also its trends over time).

cities close to Christian cities. Moreover, this effect is robust to using different specifications of the FUP-variables[26] or to including other proxy variables such as the distance to the nearest Muslim or Christian city (see Table RA1 in the results Appendix).

This low or even negative interaction between the two urban systems may be explained in a number of ways. First, scholars have pointed out that Muslim commercial interests where much more oriented towards Persia, India and Africa than towards Europe, and that the Muslim Mediterranean trade (as Pryor, 1988, p.137 puts it) "*primarily connected Egypt and the Levant with Muslim North Africa, Sicily, and Andalusia, and to some extent with Byzantium, rather than with the Christian West*". As a result trade between Muslim and Christian cities was much smaller – possibly constrained by higher transaction costs[27] – than trade between cities of similar religious orientation. Related, Bernard Lewis (1982) has drawn attention to the lack of interest of the Muslim World for what was going on in Western Europe in this period, which is exemplified by the fact that there are hardly any accounts of famous Arab travelers (such as Ibn Battuta or Al Muqaddasi who travelled from Al-Andalus to Morocco to East Africa to India) visiting the Latin West. In this the two cultures really differed from each other, because Europe did develop a keen interest in the Muslim World (adopting several Arab technologies, such as the use of paper, the Arabic numerals or the windmill).

Finally, in some areas Muslim and Christian cities seem to be crowding out each other in border regions perhaps because these regions were frequent war zones in which cities do not flourish well. The Balkan with its low urbanization ratio – in between two regions with a much higher level of urbanization – is a clear example; another is Palestine during the time of the Crusades or the Iberian Peninsula before the end of the Reconquista. The Christian drive to oust the Muslim infidel from their own lands and the Holy Land combined with the Muslim concept of *Jihad*, or Holy Struggle (e.g. exemplified by the religious zeal of the Almohads or the early Ottomans' *Gaza Ideology*[28]), fuelled these conflicts. Recent evidence shows that the Ottoman threat to 16th century Europe reduced conflict (both length and incidence) among Europeans themselves, in a way uniting them against a common enemy

[26] When, for example, transport costs per km on all routes (sea, land and river) are taken as identical, (i.e. $w_{ij} = 1$ in (2), the same patterns emerges; also when we assume that the relationship between transport costs and distance is not to linear but that transport costs vary with the root of distance, we get again very similar results.

[27] A number of authors also suggest that Arab merchants generally lacked the knowledge to trade with the West (Ashton 1976: 105; Inalcik 1994: 188); but it is also suggested that these information problems were to some extent solved by intermediaries such as Jews and Christian minorities living in the Arab world.

[28] Kafadar (1996, p. 11) notes that "what fuelled the energies of the early Ottoman conquerors was essentially their commitment to Gaza, an 'ideology of Holy War' in the name of Islam."

(Iyigun, 2008). And Glick (1979, p.21) even argues that the 'identity' of Christendom only emerged as a result of its confrontation with the Islam in the $8^{th}/10^{th}$ centuries.

Also, relatedly, both regions did have one institution in common that did not stimulate positive interaction across religious boundaries: Christians could not enslave Christians and neither were Muslims allowed to enslave their brothers in faith. As a result, the demand for slaves had to be satisfied by raiding others, which had negative consequences for people living near the borders of the two religious systems and on the shores of the Mediterranean. In Iberia and Italy whole stretches of coast where abandoned by their inhabitants; the Spanish even started to capture coastal towns on the North African shore (e.g. Algiers and Tunis) to stop further pirate raids[29]. The Ottomans also recruited a large part of their slaves from the Balkans (see Erdem 1996; Davis 2003).

The positive feedbacks between Christian cities and between Muslim cities combined with the absence of significant interaction across the borders of the two religions are evidence that Muslim and Christian cities formed two separate urban systems, which did not really interact with each other (or put differently, positive interaction via trade was undone by the negative interactions between the two), but which did indeed interact quite strongly with cities of the same religious denomination.

5.1 Robustness of the results

An important objection to our results is that we only allow for a city-specific random effect that is uncorrelated with the variables of interest in our baseline estimation. It can be argued that by doing this we are not adequately controlling for unobserved time-invariant heterogeneity (at the country or city level) that is correlated with some of the variables of interest (an example would be being located in the mountains, being surrounded by a fertile agricultural hinterland, or a city's climate). If this were the case, our estimates could be misleading. A complication with allowing for such city-specific fixed effects is however that it would leave us unable to say something about the relevance of our variables of interest that are not changing over time (basically all the geographical variables) for cities' development.

A second objection is mainly focused on our proposed measure of FUP. It could be the case that this measure is not so much capturing, as we claim, an interaction effect between cities. Instead, it could be picking up unobserved *trends* of variables related to cities development that are regional in nature (e.g. changing climatic conditions, institutional

[29] These slave raids could however extend deep into each other's territory – the south coast of England fell a few times victim to them, and the Saracens even reached as far as Iceland on one occasion.

changes at the country level, or increased hostilities). A significant FUP coefficient could simply be picking up a common regional factor affecting city growth in a region instead of an interaction effect between cities.

Table 3. Controlling for city-specific FE + country trends

	all cities	muslim	Christian	latin west	non latin west
Geography	-	-	-	-	-
Bishop	-0.113	0.046	-0.077	-0.100	0.082
	[0.207]	[0.740]	[0.529]	[0.359]	[0.549]
Archbishop	0.157	-0.078	0.269*	0.271*	-0.014
	[0.255]	[0.810]	[0.093]	[0.053]	[0.963]
Capitol	0.530***	0.497***	0.463***	0.501***	0.558***
	[0.000]	[0.003]	[0.000]	[0.000]	[0.000]
University	0.172**	0.129	0.178**	0.189**	-0.059
	[0.020]	[0.733]	[0.019]	[0.011]	[0.802]
Muslim	0.172**	-	-	0.274**	0.022
	[0.050]	-	-	[0.023]	[0.869]
Muslim FUP	0.141**	0.283*	0.019	0.025	0.368***
	[0.017]	[0.052]	[0.767]	[0.662]	[0.006]
Christian FUP	0.378***	0.212	0.432***	0.464***	0.166
	[0.000]	[0.120]	[0.000]	[0.000]	[0.184]
Protestant	0.066	-	0.123	0.118	-
	[0.450]	-	[0.163]	[0.178]	-
Observations	2376	481	1895	1831	545

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. An F-test on the included country trends indicates they are significant in any of the specifications used.

To control for both the above objections, Table 3 shows the results when allowing for both *city-specific fixed effects* ànd *country-specific time trends* in the baseline regression[30]. Except for our results regarding the bishop variable (that becomes insignificant[31]), the main results are *qualitatively robust* to the inclusion of city-specific fixed effects and country time trends. Note however that the estimated effect of being a capital city is substantially lower than in the baseline estimates. And besides that, we observe that the estimated interaction effect between

[30] Countries are defined by their 1990 boundaries (as is similarly done in AJR 2005 and De Long and Shleifer, 1993). Including city-specific time trends along with city-specific fixed effects would results in a tremendous loss of degrees of freedom, making it inherently difficult to identify the effect of the included variables of interest. The results are also robust to including either only city-specific (or country specific) fixed effects, or allowing for country specific time trends in combination with country fixed effects. Note that the use of city-specific fixed effects does by construction control for any fixed country effects. Results available upon request.

[31] We think that looking at the within-city-variation only (as when controlling for city-specific fixed effects) leaves us too little variance (a city for example never loses its (arch)bishop status) to identify the effect of these two variables on city size.

cities is now smaller between Muslim cities than between Christian respectively, hereby overturning what we found in Table 2 where this effect was much larger for Muslim cities.

A final objection to our results that we are aware of is that we are using an unbalanced panel of cities larger than 10,000 inhabitants. Using this selected sample may result in biased estimates if cities are endogenously selected into our sample (note that this would have to be due to variables other than the ones we include in the estimations). Although not being a solution to this problem it is reassuring that running the same regressions on an unbalanced panel of all cities larger than 5,000 inhabitants gives very similar results as those presented in Table 2 (see Table RA2 in the results Appendix). Another way to (partly) address this problem, see AJR (2005 and 2002b), would be to look at a balanced sample of cities, i.e. to only look at cities that are always larger than 10,000 inhabitants over the whole sample period. In our case this would amount to considering a sample of only 33 of our 729 cities (20 in the Latin West and 13 in the Arab World). This would in our view provide results that are hard to generalize (indeed the selection bias may be just as large, or even larger, than when using the unbalanced sample, given the even stricter inclusion criterion) and made us decide to focus on our unbalanced sample[32].

On the basis of the results so far, we cannot yet draw clear conclusions on the relevance of the concepts of market oriented and sovereign oriented cities put forward in section 2 for the observed developments in the Arab world and the Latin-West. Both concepts seem to be relevant in both urban systems. In both regions, cities with good access to important transport corridors (the main transport mode *does* differ between the two regions – camel vs. ship) and those having an important institutional role are larger than other cities. Also, we find evidence for positive interaction between cities in both regions. However this is confined to cities within each urban system. Any benefits of trade beyond religious boundaries, if present at all, are undone by the negative interaction between the two regions in terms of war, slave trade and piracy.

Given the size of our dataset, the next section(s) establishes[33] whether the found effects of some of the variables may have been of changing importance over the centuries. This will provide more detailed evidence regarding the above identified important factors in

[32] AJR 2005 focus on a balanced sample of cities only. As they start in 1300 this gives them a somewhat larger balanced sample than the 33 cities that we would be able to include. Also they note (in footnote 17 on p.558) that they found that the composition bias did "in practice…not seem to be important".
[33] In a similar way as AJR 2005 establishes the rise of Atlantic Europe.

urban expansion that will allow us to more clearly relate the results to the market vs. sovereign oriented debate.

5.2 Century specific impact of FUP, transport modes and capital status

We allow the effect of FUP, being a capital city, and being located on a major transport route to vary over time. The latter meaning the sea in case of the Latin West, distinguishing between location on the shores of the Atlantic (AJR 2005), the Mediterranean or the Baltic / Northsea; and location on a hub of caravan routes or a roman road in case of the Arab World.

Table 4: Transport, capital status and FUP over time – Arab World

a. MUSLIM

Year	roman road	Caravan hub	capitol	Muslim FUP	Christian FUP
800	-0.814***	0.351	1.049***	0.743***	-0.067
900	-0.564***	0.437*	1.149***	0.444***	-0.315
1000	-0.442***	0.237	1.080***	0.456***	-0.211
1100	-0.289	0.294	0.557***	0.461***	-0.351
1200	-0.337*	0.339*	0.727***	0.213	0.072
1300	-0.261	0.426**	0.825***	0.311	-0.070
1400	-0.179	0.382*	0.604***	0.082	0.031
1500	0.038	0.454**	0.807***	-0.177	0.056
1600	0.317	0.310	0.781*	-0.105	0.074
1700	0.396	0.433*	0.807**	-0.145	0.060
1800	0.074	0.418*	0.843**	0.064	-0.021
other variables			see baseline		
Observations			481		

b. NON LATIN WEST

Year	roman road	caravan hub	capitol	Muslim FUP	Christian FUP
800	-0.931***	0.458**	1.430***	0.618***	-0.054
900	-0.565***	0.514**	1.386***	0.267*	-0.100
1000	-0.295*	0.361**	0.907***	0.309**	-0.198
1100	-0.434*	0.508***	0.536**	0.164	-0.122
1200	-0.333*	0.451***	0.498***	0.179	-0.103
1300	-0.149	0.544***	0.560***	0.021	-0.085
1400	-0.077	0.439**	0.713***	-0.036	-0.123
1500	0.075	0.379*	0.989***	-0.089	-0.101
1600	0.313	0.263	1.152***	-0.074	-0.005
1700	0.438**	0.433*	1.235***	-0.036	-0.108
1800	0.133	0.430**	1.111***	0.132	-0.155
other variables			see baseline		
Observations			545		

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results also hold up to the inclusion of country dummies, city-specific fixed effects and country time trend. [see Table RA7 in the results Appendix].

Tables 4 and 5 show the results for each of the four subsamples (focusing only on the time-varying variables to save space[34]). They suggest a number of important changes in both Europe and the Arab World

Table 5: Transport, capital status and FUP over time – Europe

CHRISTIAN						
Year	atlantic	mediterrenean	baltic / northsea	capitol	Muslim FUP	Christian FUP
800	-	0.74	-	1.574***	-0.428	-0.108
900	-0.447	0.902**	-	0.617*	-0.184	-0.055
1000	-0.17	0.409	-	0.400*	0.184	-0.107
1100	0.056	0.286	-	0.482**	-0.114	0.088
1200	0.03	0.248	-	0.423***	-0.183	0.106*
1300	0.007	0.052	0.209	0.702***	-0.045	0.089*
1400	0.399	0.151	0.225*	0.564***	-0.034	0.063
1500	0.272*	0.403*	-0.035	0.635***	-0.197	0.097*
1600	0.252*	0.042	0.325	1.050***	-0.002	0.059
1700	0.414***	0.352*	0.145	1.367***	-0.128	0.094**
1800	0.436***	0.327**	-0.073	1.566***	-0.099	0.088**
other variables				see baseline		
Observations				1895		

b. LATIN WEST						
Year	atlantic	mediterrenean	baltic / northsea	capitol	Muslim FUP	Christian FUP
800	-0.283	-0.132	-	1.032***	0.263	0.255
900	-0.479*	-0.331	-	0.332	0.156	0.174
1000	-0.188	-0.068	-	0.331*	0.218	0.059
1100	-0.123	-0.162	-	0.471***	0.107	0.193**
1200	-0.068	-0.021	-	0.527***	-0.028	0.192***
1300	-0.135	-0.237	0.082	0.815***	0.119	0.170***
1400	0.299	0.042	0.158	0.590***	0.089	0.151**
1500	0.373**	0.600**	0.092	0.631***	-0.388**	0.220***
1600	0.300**	0.158	0.443	1.051***	-0.162	0.182***
1700	0.386**	0.36	0.157	1.325***	-0.164	0.177***
1800	0.372***	0.266*	-0.121	1.593***	-0.092	0.147***
other variables				see baseline		
Observations				1831		

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results also hold up to the inclusion of country dummies, city-specific fixed effects and country time trend. [see Table RA7 in the results Appendix].

The radical change in the dominant transport mode following the Arab Conquests is clearly evident from Table 4: in contrast to cities linked via the infrastructure predating the Arab

[34] Results of the other variables are very similar to those in the baseline regression in Table 4. Table RA7 in the results Appendix shows that the results hold up to the inclusion of city-specific fixed effects and country time trends.

conquest (roman roads), cities outside this network, and linked via caravan routes instead, are larger than the other cities, pointing to a clear discontinuity in the urban system following the Arab conquest: camels have taken over the role of horse-drawn carts.[35] In Europe allowing for a time-varying effect of the dominant transport mode shows that being located at the Atlantic was not an asset before 1500; in fact, during the 9th and 10th century the Atlantic effect is negative, exactly in the years that the Vikings were a constant threat to cities in North West Europe, and some bishoprics (such as Utrecht) were even relocated inland in order to cope with this (Weiler 2003). This changes from 1500 onwards, exactly in the period of the Great Discoveries when trade over the Atlantic is booming (hereby confirming the results of AJR 2005); for the 1600-1800 period we find the same strong positive correlation between being an Atlantic seaport and urban growth identified by AJR (2005). The pattern is different for cities located on the Baltic / Northsea: here trade boomed during the period of the Hansa (1300-1500), but after 1500 this trade was increasingly dominated by Dutch merchants and ships (and its size became less significant in terms of the overall expansion of international trade), leading to a decline of the coefficient. Being on the shores of the Mediterranean is however only significant in 900 and during the Early Modern Period (1500-1800).[36]

This is very much in contrast to the Arab World where the 'sea' variable is almost always non-significant (and negative) when allowing it to vary over the centuries [not shown here]: in Western Europe from about 1500 onwards being close to the sea is a big bonus (when the three sea-variables are lumped together, the sea variable for the cities in the Latin West is positive, and significant, from 1500 onwards). This different relationship with the sea is a fundamental difference between the two urban systems; moreover the Atlantic effect that we find confirms the importance of the differential impact of the Great Discoveries in explaining their different development paths after 1500.

Another important result is the development in the estimated capital city *'bonus'*, which is different between the two regions. In the Arab World the capital bonus is quite large during the flowering of the Umayyad and Abbasid Caliphates (661-1258), declines with the

[35] Hourani 2002: 44: 'In the greater part of the Near East wheeled transport disappeared after the rise of the Muslim Empire, not to come back until the nineteenth century, and various reasons have been suggested for this: Roman roads decayed, the new Arab ruling groups had an interest in the rearing of camels, and transport on camel-back was more economical than by cart'; according to Glick 1979: 24 the disappearance of wheeled transport antedated the Arabic expansion by several centuries, but he also stresses the link with the military use of the camel.

[36] Remarkably, it was not significant in 1300 and 1400, at the height of the flowering of the Italian economy, perhaps as a result of the impact of large 'industrial' cities such as Florence and Milan.

gradual fragmentation of the latter state(s) in the 12th/13th century, and returns to the previous high level with the rise of Istanbul – the capital of the Ottoman Empire – as the most important urban center of the Arab World after 1453. In the Latin West, ignoring the big capital city bonus in 800 (due to Byzantium in the Christian and Cordoba in the Latin-West sample respectively), we find a gradual increase in the capital city bonus over our sample period, starting from a relatively low level between 900 and 1200 (when Europe underwent a process of political fragmentation)[37], and afterwards increasing to a level similar to that observed in the Arab World during the heydays of the Ummayad and Abbasid Caliphates and later the Ottoman Empire. This slow rise in the capital city bonus clearly reflects the process of state formation that began in Europe around 1000 and resulted in the formation of new and strong territorial states (France, Germany, Spain and Britain) with large centralized governments (located in Paris, Berlin, Madrid and London respectively) afterwards (Tilly 1990).

Finally, we turn to the century specific FUP coefficients. They show some remarkable changes over the centuries. During the Middle Ages the interaction effects between Muslim cities are very strong, pointing to high levels of positive feedback between cities in the Arab World. By contrast, Western European cities do not form an integrated urban system before 1100. The high level of the FUP-coefficient for the Muslim world in the Middle Ages is perhaps one of the most striking results: it demonstrates that the institutions regulating exchange there were probably more efficient than those of the Latin West during this early period. However, in the Arab World, we find the gradual disintegration and loss of dynamism of the urban system. There is an almost constant decline in the FUP-coefficient, pointing to a gradual loss of positive feedbacks between these cities, resulting in the effect becoming insignificant after 1300 (a trend that clearly precedes the 16th century discoveries). What was before 1300 a well functioning integrated urban system seems to be disintegrating rapidly. The immediate cause may have been the conquests by the Mongols in the 13th century, who conquered large parts of the Muslim world in a short period (1206-1258), destroyed Baghdad, but also created a free zone for trade between Europe and Asia (China, India) which side tracked the Arab world (Abu Lughod 1989; Findlay and O' Rourke, 2008). Also of interest is that the rise of the Ottoman Empire does not result in the return of the strong positive feedbacks within the urban system as experienced during the Golden Age of Islam.

[37] When controlling for city-specific fixed effects and country-specific trends, the capital city effect even becomes insignificant in this period. In the Arab world the trend in this effect is rather similar as the one discussed here (see Table RA7 in the results Appendix).

In Europe we observe the contrary; there, a well integrated urban system evolves from about the 11th century onwards, and shows in terms of the efficiency of its interaction, remarkable stability in the 1100-1800 period (the FUP-coefficient remains basically unchanged). This all suggests that the typical European institutions that governed exchange, and made possible the rapid urban expansion of Europe in the centuries after 1000, came into being during the period before 1200 [consistent with Greif (2006) and Van Zanden (2008)]. [38]

How plausible are these results? That the Arab World had an efficient system of exchange is well known, although it has so far not been possible to quantify this in one way or another. Until 750 the whole region – from Cordoba in Spain to Baghdad in Iraq (and beyond) – was united in one state, which guaranteed peace and order and imposed similar institutions for exchange. The ruling class spoke one language, and there existed hardly any barriers to trade in this vast empire[39]. By contrast, Europe after the disintegration of the Carolingian Empire went through a process of political fragmentation, resulting in a complex patchwork of (small) political entities, which were developing their own institutions (independent cities, counties, regions). Moreover, it knew many different languages and systems of common law. But out of this rather chaotic situation new institutions emerged that were increasingly able to regulate exchange in an efficient way (Greif 2006; Van Zanden 2008). At the same time, in the Arab World, the Umayyad Dynasty was succeeded by the Abbasid Caliphate (750-1258), which did not include Spain and West-Africa, and gradually began to lose its control over other parts of the Arab World as well, leading to a process of political fragmentation that resulted in the loss of the positive interaction between cities (as is evident from the decline of the FUP-coefficient).

It is significant that the cities and the urban system of Western Europe emerged in a situation of weak states and political fragmentation, and found ways to overcome these problems. No such 'bottom up' process of institution building followed the disintegration of the Abbasid Caliphate in the 13th and 14th centuries – instead a new empire, the Ottoman, emerged which to some extent took over the role of its predecessor, without, however, recreating a similar well-integrated urban system.

The above time-varying results provide a more detailed link to the market vs. sovereign oriented debate we introduced in section 2. The time-varying results regarding the

[38] The above discussed effects and differences in developments over time become even stronger when controlling for city-specific fixed effects and country-specific trends [see Table A3 in the Appendix].

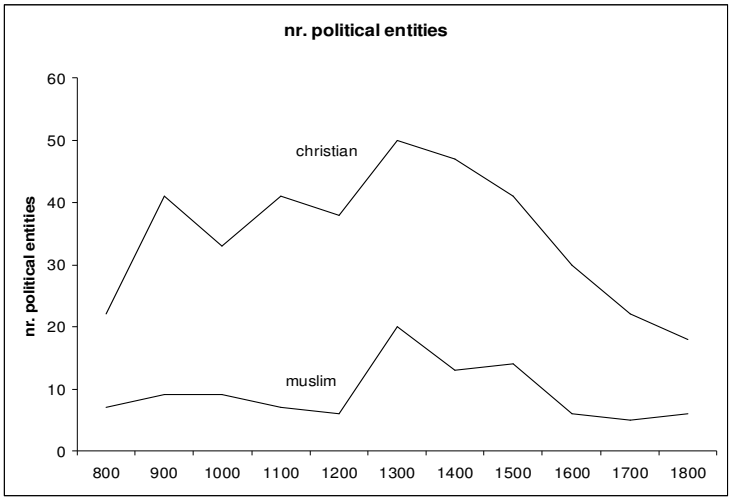
[39] See also Findlay and O'Rourke, 2008. Language, cultural and institutional similarity still play an important role in determining trade costs in the modern empirical international trade literature (see e.g. Anderson and van Wincoop, 2004).

benefits of having good access to important transport corridors and regarding the size and strength of cities' interaction (FUP), modify the notion that cities in the Latin West and the Arab World were to a similar degree both market and sovereign oriented. Both concepts are still relevant in both urban systems but its evolution over time is quite different. The cities in the Arab World start out as being dynamic urban centers, connected through an efficient network of caravan roads, but they loose this property following the demise of the Abbasid Caliphate. In the Latin West we observe the opposite; there cities, in the aftermath of Charlemagne, did initially not bear out any signs of being market oriented, but starting from the 12^{th}-13^{th} century we see a dynamic, well connected, urban system evolve with a strong focus on maritime trade, that gets a significant boost in the period following the Great Discoveries.

In terms of being sovereign oriented; in the Arab World, we observe a large effect of being the seat of government during the heyday of Islam in the period up to the 11^{th} century, followed by a short-lived decline in the effect, and thereafter returning to a similar high level with the rise Ottoman Empire. In the Latin West, we instead observe a gradual increase in the capital city bonus reflecting the rise of the European nation states (Tilly, 1990). What is interesting to note is that both during the Golden Age of Islam and the later rise of Europe, a strong state (or states) attracting investment to its capital does not seem to conflict with a dynamic, market-oriented urban system – the strong state(s) may even help in providing similarity of laws, protection, etc.

A further difference between Europe and the Arab World is that whereas the Golden Age of Islam occurred when the Arab World was ruled by a single unified Caliphate, in Europe we observe the emergence of a dynamic urban system despite being divided into a much larger number of states. Figure 3 clearly shows this difference in terms of the number of political entities. In the Arab World we observe an increase in the number of states following the disintegration of the Abbasid and Ummayad dynasties, but following the rise of the Ottomans we observe a gradual return to a low number of states.

Figure 3. Number of political entities and the Arab and European urban system



Notes: see the data Appendix for an exposition of how we calculated the number of political entities.

In Europe on the contrary the number of political entities is much larger and is on the rise until about the 14th century, after which we clearly observe the rise of the (large) nation states that significantly reduces the number of political entities (but the number is still almost four times as large as in the Arab World). The interesting puzzle remains why in Europe a dynamic market oriented urban system starts to evolve in a period of fragmentation which survives despite the rise of the nation states. We think that the answer to this has its roots to a large extent in Europe's institutional developments. In particular, it may lie in the emergence of cities with a substantial degree of local authority, a process that starts in Europe from the 11th century onwards but that never takes hold in the cities of the Arab World.

5.3 Local authority – a defining difference between Europe and the Arab World?

Previous work by Acemoglu et al. (2005b), De Long and Shleifer (1993) and also more recently Bosker et al. (2008) have already focused in more detail at the importance of the political institutions for the development of cities. All three papers point to an important positive effect of the quality of political institutions on urban development, indicating that the more *"free"* a city is, i.e. the greater the degree of local authority and the fewer the constraints on economic activity imposed by the national ruler, the better the incentives and opportunities for economic and urban expansion.

City specific institutions

The above-three papers rely largely on country- or region-specific variables measuring the quality if political institutions. Here, we try to go beyond these nationwide measures[40] and have constructed a variable we call *commune* that gives information on the local, city-specific political organization[41]. We have classified each of the cities in our sample on the basis of whether or not it had a local commune, a number of consuls or a city council exercising local authority *(Rat, raad, vroedschap, conseil, consejo, conselho, commune),* a privilege that was usually granted by the emperor or king of the realm involved (Jones, 1997). The result of local autonomy was that citizens could protect their property against predating local lords, could regulate their own systems of justice, and introduce laws that would enhance industry and trade. The first occurrences of such local city authority show up in 1100 in cities in Italy and France, spreading from there to more cities in the rest of Western Europe in the following centuries: in 1500 about 50% of the cities in the Latin West have some form of local authority after which this rises only marginally to 55% in 1800. In the Arab World such a process of cities acquiring some form of local authority independent from the state did not take hold. Although there is some discussion on the emergence of feudal institutions in the Arab world as well, they lack the important dimension of fragmented sovereignty that is characteristic for the Latin West in the Middle Ages (see the discussions in Ashtor 1976 and Inalcik 1994)[42].

Next, to establish empirically whether, as shown in the above-mentioned previous papers, having local authority is beneficial to a city's development, we added our commune-variable to our baseline regression. Table 6 shows the results; we only show the Christian and Latin West subsamples as none of the Muslim or non Latin west cities have a form of local authority during our sample period.

[40] A clear disadvantage of these measures is that they define countries according to their 1990 boundaries (see also footnote 3).

[41] 14.93% of cities under an unfree regime in De Long and Shleifer (1993) terms do have a form of local authority, compared to 53.92% of cities under a free regime.

[42] This corresponds to AJR 2005, who do consider some countries outside the Latin West when constructing their measures of *protection for capital* and *constraint on the executive*. All these countries (Albania, Greece, Rumania, Turkey, Yugoslavia and Bulgaria) get the lowest possible score on each of the two variables throughout the period considered in that paper.

Table 6. Focus on city-specific institutions, the effect of local authority

	all cities	christian	latin west		continued	all cities	christian	latin west
Sea	0.077	0.101	0.086		Capitol	0.803***	0.800***	0.801***
	[0.205]	[0.122]	[0.181]			[0.000]	[0.000]	[0.000]
Navigable river	0.014	-0.05	-0.029		University	0.300***	0.281***	0.242***
	[0.755]	[0.252]	[0.530]			[0.000]	[0.000]	[0.000]
Hub roman roads	0.06	0.108*	0.125**		Muslim	0.296***	-	0.586***
	[0.276]	[0.051]	[0.036]			[0.000]	-	[0.000]
Roman road	-0.012	0.048	0.043		Muslim FUP	0.081**	-0.016	-0.008
	[0.775]	[0.231]	[0.312]			[0.048]	[0.668]	[0.855]
Caravan	-0.023	-0.014	-		Christian FUP	0.074***	0.138***	0.153***
	[0.844]	[0.938]	-			[0.002]	[0.000]	[0.000]
Caravan hub	0.533***	0.308	-		Protestant	0.079	0.066	0.058
	[0.001]	[0.164]	-			[0.164]	[0.243]	[0.308]
Bishop	0.170***	0.131***	0.132***		**COMMUNE**	**0.145*** **	**0.127*** **	**0.147*** **
	[0.000]	[0.000]	[0.001]			**[0.000]**	**[0.000]**	**[0.000]**
Archbishop	0.390***	0.441***	0.465***					
	[0.000]	[0.000]	[0.000]		Observations	2376	1895	1831

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results obtained using panel data estimator allowing for random city-specific effects. Results are also robust to the inclusion of city-specific or country-specific fixed effects, and country-specific time trends [see Table RA8 in the results Appendix]

The results clearly show that having local political authority positively affects a city's urban expansion[43]. Hereby confirming the earlier evidence provided by Acemoglu et al. 2005b, De Long and Shleifer, 1993 and Bosker et al., 2008 on the basis of the (sometimes artificial) country-specific measures of the quality of political institutions[44]. Note also that including this measure of a city's political institutional quality does not affect our earlier conclusions about the other variables in the regression (most notably the FUP variables, and the capital city dummy). The only exception here is the sea-variable, which becomes insignificant. Apparently there is a strong correlation between having a form of local authority and being located at sea as determining factors of urban growth. However, when subdividing the sea-variable into location on the Atlantic, Mediterranean or Baltic-North Sea coast, being located on the Atlantic still has a significant positive impact on population size (results are available upon request).

[43] One may be worried about reverse causality here, however it does not seem to be the case that the larger cities are those that get local authority. Conditional on not having a form of local authority, cities in our sample that do get local authority have on average 21068 inhabitants versus 29752 inhabitants of cities that do not get local authority. When restricting the sample to Latin West or Christian cities only, this becomes 21110 vs. 22207 and 21110 vs. 22370 respectively. Table A4 in the Appendix furthermore shows that the results hold up to the inclusion of both city specific fixed effects and country specific time trends.

[44] We have also run the regressions including a 'free/prince variable' based on De Long and Shleifer (1993) – with Arab nations continuously classified as 'prince'. These show, see Table RA6 in the results Appendix, similar results as our 'commune-results', however in contrast to the commune-variable, significance of the free / prince variable is lost once we control for city-fixed effects and/or country time trends (available upon request).

The results clearly point to substantial benefits to a city's development of acquiring a form of local authority, making it less dependent on the state it is part of. Both institutions regulating exchange as well as cities' local political organization are important determinants of a city's (economic) development. It may be no coincidence that we see the emergence of a dynamic urban system in Europe from about the 11th century onwards during a period of substantial political fragmentation (see Figure 3) that persists even when the nation states start to dominate the European landscape, in exactly the same period when cities start developing forms of local authority. This stands in sharp contrast to the absence of such a process of bottom-up institution building at the individual city level in the Arab World during the period of increased political fragmentation following the demise of the early Muslim Caliphates.

6. Conclusions

This paper sheds empirical light on the divergent development of the Arab World and Western Europe (or the Latin West) in the millennium between 800 and 1800. On the basis of a large new dataset of cities in Europe, North Africa and the Middle East we provide empirically founded explanations to the question why in the course of this millennium the urban center of gravity in this part of the world moved from Iraq (or more generally the Arab World) to Western Europe and the shores of the Atlantic in particular.

A first descriptive analysis of our data demonstrates that in terms of urbanization the Arab World was much ahead of Western Europe over most of 800-1800 period, but also that in the long run this level of urbanization did not increase very much. Western Europe, on the other hand, from the 9th/10th century onwards embarked on a process of urbanization resulting in the overtaking of the Arab World in the Early Modern Period, and in the emergence of an industrial society in the late 18th and 19th century.

In looking for the possible reasons for this reversal of fortune, we distinguish a number of hypotheses explaining the divergent developments of the two urban systems, closely linked to the Weberian concept of producer, or market oriented, and consumer, or sovereign oriented, cities . Two hypotheses were related to the links between institutions and economic performance. The first one focuses on economic institutions that determine the efficiency of exchange, which we tried to measure by quantifying the degree of interaction between cities in the two urban systems, We establish that we indeed find two separate urban systems in the area under study: the interaction between Muslim and Christian cities was generally not significant and if so mostly negative. Within each of the two systems, we find

positive feedbacks between cities. It indicates that culture/religion does matter, that these two cultures had and/or developed different institutions that facilitated exchange amongst cities within each urban system, but hindered exchange over the borders of the two urban systems (or differently, if any positive interaction resulted from trade, its effect was overshadowed by the negative interaction, e.g. wars, piracy and slave trade, between Europe and the Arab World). Moreover, it also explains why the Arab world could continue to stagnate, in spite of the enormous growth of the European economy and urban system – it simply did not get the positive stimuli from Europe.

Second, the hypothesis that the divergent development of the two urban systems was caused by the higher efficiency of exchange within the European urban system compared to that in the Arab World, had to be slightly modified. Initially, coinciding with the 'Golden Age of Islam', the cities in the Arab World show strong positive interaction, pointing to efficient institutions regulating exchange. During this period the Arab world was unified by one state, which guaranteed law and order and imposed similar institutions on economy and society and with the same official language spoken throughout. From 800 onwards, the strength of cities' interaction declined however, parallel to the gradual disintegration of the Abbasid Caliphate, and it became insignificant after 1300. In short, efficient exchange was *dependent* on the existence of a large territorial empire, a situation which is quite normal in world history – Qing China, Tokugawa Japan, the Roman Empire and the Moghul Empire were 'similar' empires that brought law and order and abolished previously existing trade barriers, resulting in a boom in long-distance trade (Shuie and Keller 2007 and Findlay and O'Rourke, 2008). In Europe no integrated urban system existed in the $9^{th}/10^{th}$ century, but it emerged in the 11^{th} century in a period of political fragmentation (after the collapse of the Carolingian Empire); it was largely based on 'bottom up' institution building (such as independent cities and merchant guilds), and created a set of institutions that was able to cope with the existence of many borders, institutional regimes and languages (Van Zanden 2008). Overall, these institutions were not necessarily more efficient than the set of institutions governing trade in the 9^{th} century Arab world but they were more robust and much less dependent on the states they were part of. Most notably because these states delegated authority to individual cities to regulate their own affairs, and these liberties were strongly defended by the cities.

This demonstrates that the institutions regulating exchange of the Arab world and Europe were in a different way embedded in the states they were part of, pointing to the importance of the differences between the political institutions of the two urban systems.

When we look at the structure of the urban system, the differences are indeed quite big: the share of the primate city was much higher in the Arab World than in the Latin West and the urban density of the system was much lower in the east than in the west. Moreover, the growth cycles of the Islamic urban system was closely linked to the rise and decline of big territorial entities – first flourishing under the Umayyad and Abbasid Caliphates (661-1258), then declining during the disintegration of the Islamic state system in the 13th-14th centuries, and again followed by a reconsolidation linked to the rise of the Ottoman Empire. Big cities such as Damascus, Baghdad, Cairo and Istanbul were the centers of big states, and when the big states collapsed, the level of urbanization went down.

As argued already, in Western Europe this was much less the case; in particular in the period between 900 and 1300 the rise of cities ran parallel to a collapse of the Carolingian Empire and the disintegration of its successor states, suggesting that the cities of the Latin West were not dependent on large territorial states (which is reflected in the decline of the capital coefficient). In fact, during that period cities started to develop forms of local authority with clear positive effects on their subsequent economic success. From about the 14th century onwards state formation and urban growth went hand in hand again, and in particular after 1500 Western Europe saw the re-appearance of typical sovereign oriented cities such as Brussels, Madrid, Naples or Vienna (De Vries 1984), which is reflected in the rise of the capital-city effect to levels that are also usual in the Arab World. However, despite this process many cities managed to keep local control through which they could mitigate any 'predatory actions' undertaken by the state.

Another factor that we argue has played a substantial role was the importance of different in modes of transport. In a way, the Arab world was more innovative in that it replaced the system of Roman roads by caravan routes, and the cart drawn by oxen or horses by the camel packed with goods (a rational move as camel transport was a more efficient means of transportation – there was no need for road maintenance and the camel outperforms the horse when it comes to stamina in desert type conditions). By focusing on caravan routes, Muslim cities to some extent turned their back to the seas, which initially may have been related to the fact that during the Arab Conquests of the Middle East and North Africa, Christian powers – in particular Byzantium – still dominated the Mediterranean, which made sea transport more risky than overland trade.[45] This choice for camels and caravans as the key mode of transport had long-term consequences. Given its technology, prospects for

[45] Ashtor 1976.

productivity growth were meager; in fact, the productivity of camel transport may not have changed at all during the ten centuries under study (see Austen 1990).

The West, on the other hand, was increasingly oriented towards the sea. The potential for productivity growth in sea transport proved to be very large, and one of the explanations for the increased strength of the 'sea' variable through time is the fact that transport costs overseas declined much more than via other modes of transport.[46] One of the factors explaining dynamic growth of the urban system in the West and stagnation in the East is therefore this – perhaps to some extent fortuitous – choice of the key mode of transport and its long term growth possibilities. The Muslim world became locked in into the camel-overland trade, whereas the Latin West could profit from the productivity growth of seaborne trade.

These changes all began much before 1500. In fact, the dynamic Western European urban system emerged during the High Middle Ages. The disintegration of the Arab urban system occurred during the same period (between 1100 and 1300), and was possibly related to the rise of the Mongol Empire in the 13th century that gave the Europeans a direct overland trade route to China and India (avoiding the extra costs incurred by using the Arab middlemen). After the disintegration of the Mongol Empire in the 14th century which effectively ended the use of the direct overland to China by the European (see Findlay and O'Rourke 2008), the search for a direct trade route to the Eastern spice markets via the seas began, which eventually resulted in the Great Discoveries of about 1500 that greatly speeded up the divergent trends of the two systems (but these developments occurred when the real changes in institutions and urban systems had already happened): we find a strong 'Atlantic economy' effect in the 1500-1800 period: it is clear that cities bordering the Atlantic profited a lot of the economic consequences of Columbus, Da Gama and others.

Summing up, the Arab world was in a way quite innovative (it adopted a 'new' mode of transport replacing the Roman infrastructure), exchange between Muslim cities initially was highly efficient, but at the same time cities remained dependent on the basic institutions of the state which were, because of their predatory nature, unable to generate long-term economic growth. The urban system that arose in Western Europe between 900 and 1300 was by contrast geared towards generating its own resources via market exchange; it was highly competitive, independent of large territorial states (which were quite weak between 900 and 1300) and became oriented towards long-distance trade via the sea. It was this new dynamic,

[46] This may have been scale-dependent: whereas sea transport was subject to strong economies of scale, land transport (by cart and by camel) probably was much less so.

more state-independent urban system that generated the long term economic development that was characteristic of Western Europe in the millennium after 900 and which finally, spurred on by the impact of the Great Discoveries, made Europe overtake the Arab World in terms of economic prosperity.

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Appendix A. The interpretation of the FUP coefficient in more detail[47]

From (1) we derive the elasticity of an increase of population in city *j* on city *i*:

$$(4) \qquad \frac{\partial \ln y_{it}}{\partial y_{jt} / y_{jt}} = \alpha \frac{\partial \ln FUP_{it}}{\partial y_{jt} / y_{jt}} = \alpha \left[\frac{\partial FUP_{it}}{\partial y_{jt}} \right] \frac{y_{jt}}{FUP_{it}} = \alpha (w_{ij} D_{ij})^{-1} \frac{y_{jt}}{FUP_{it}}$$

The estimated coefficient on FUP, α, does not give all information on the interaction between cities *i* and *j*. It also depends (negatively) on the weighted distance between the cities, $w_{ij}D_{ij}$, and (positively) on the relative importance of city *j* in city *i*'s FUP. The larger city *j* compared to city *i*'s total FUP, the larger the effect of a 1% population increase in city *j* on city *i*.

The birth of a new city *k* with *K* inhabitants also affects city *i* through FUP[48]:

$$(5) \qquad \frac{\partial \ln y_{it}}{\partial y_{kt}} = \alpha FUP_{it}^{-1} (w_{ik} D_{ik})^{-1} \quad \Leftrightarrow \quad \partial \ln y_{it} = \alpha FUP_{it}^{-1} (w_{ik} D_{ik})^{-1} K$$

Besides α, this depends (positively) on the size, *K*, of the new city *k* (relative to city *i*'s total FUP) and (negatively) on the weighted distance between the new city *k* and city *i*.

Using (4) and (5) we can also offer a more intuitive interpretation of α. It measures [see (6)] the effect of a 1% population increase in *all* other existing cities on city *i*, irrespective of city *i*'s location, its FUP or the other cities' population size. Also it is closely related to the *average* effect of a 1% increase in *only one* other city [see (7)].

$$(6) \qquad \sum_{j \neq i} \frac{\partial \ln y_{it}}{\partial y_{jt} / y_{jt}} = \alpha FUP_{it}^{-1} \sum_{j \neq i} \left[(w_{ij} D_{ij})^{-1} y_{jt} \right] = \alpha$$

$$(7) \qquad \frac{1}{n} \sum_{i} \left[\frac{1}{n-1} \sum_{j \neq i} \frac{\partial \ln y_{it}}{\partial y_{jt} / y_{jt}} \right] = \alpha \frac{1}{n} \frac{1}{n-1} \sum_{i} \left[FUP_{it}^{-1} \sum_{j \neq i} \left[(w_{ij} D_{ij})^{-1} y_{jt} \right] \right] = \frac{\alpha}{n-1}$$

where, in both (6) and (7), we use $\sum_{j \neq i} \left[(w_{ij} D_{ij})^{-1} y_{jt} \right] = FUP_{it}$. *n* denotes the number of cities.

[47] Note that this Appendix is concerned with first order effects only, the derivation omits second and higher order spatial effects (e.g. the fact that a city has an effect on itself via its effect on another city and the effect of that city on the city itself, etc, etc).

[48] Calculating an elasticity in this case is impossible since the emergence of a new city cannot be translated into a % increase in that city's population.

(7) shows that the higher the total number of cities, the lower the average impact of a 1% population increase in only one other city: in an urban system comprising many cities each city is less vulnerable to a negative population shock in another city than in an urban system containing only few cities.

Data Appendix

Dataset of cities in Europe, North Africa and the Middle East, 800-1800

This appendix documents how we collected the data used in our paper. The threshold for a city to be included in our study is 10,000 inhabitants, so we needed data on the numbers of inhabitants in cities housing 10,000 people and more and the total numbers of inhabitants in an area to calculate its percentage of urbanization. We have to realize that in the medieval period a criterion of ten thousand inhabitants to characterize a residential compound as a city is a rather hefty one. Many a medieval person living in a town housing a couple of thousand inhabitants then would have considered himself as definitely living in a city because his community either possessed franchises of a city or had mighty city walls. Nevertheless by far most medieval towns then were still well below this criterion of 10,000 inhabitants and therefore at that time only the really large centers of population qualify our criterion (Ennen, 1972, 199). Because of the gradually increasing population and urbanization over time such a size criterion for inclusion becomes less discriminating, and it eventually leads to an increasing number of cities in the analysis. This starts with 54 cities in the year 800 and ends with 615 cities in 1800 in Europe and the Middle East (including North Africa) containing 10,000 or more inhabitants. The total number of cities included in the analysis is still larger of course (729 cities) because a number of cities only qualified for some of the time periods as their population first rose and then later dropped below the size limit again.

The population data has been collected for European countries and the Mediterranean area including the Middle East for the years around whole centuries starting in the year 800 and ending in 1800. We excluded the area of the former Soviet Union from our analysis, furthermore using the geographical borders of the countries as they where around 1990. Apart from population data we also collected administrative information concerning the functions of the various cities. For instance was it a capital city, as well as collecting information on local church organization (e.g. bishopric or archbishopric) and local political organization (city council), its universities, the religious orientation of its inhabitants, its possible membership of the Hanseatic league at some time during history and additional data concerning the precise geographical location of the different cities, the location of previous Roman roads leading to the city and the availability of navigable waterways or of a local seaport.

Regional and religious clusters

We discerned a number of larger clusters of cities to facilitate our analysis: Christian cities versus Muslim cities (the religious component) and cities in the Latin West versus cities in the non-Latin West (the spatial component). These partly overlapping categories were necessary to allow a comparison between on the one hand the geographical locations of cities, which of course do not change over time, and on the other hand the main religious orientation of the inhabitants of a city, which may have changed during this millennium. Especially in the Iberian Peninsula, Italy (Palermo) and in the Balkans and Turkey (former Byzantine Empire) and during the crusades the religious orientation in a number of cities shifted between Muslim and Christian or vice versa during the period of analysis. We used the *Atlas of Church History* by Jedin *et al* (1980) to categorize the religious orientation of the majority of the inhabitants of a city. For Turkish cities we used Vryonis (1971) or the Encyclopaedia of Islam to establish the conversion dates of the rulers of a city, and assumed that a local (Byzantine) bishopric still was functioning during the first century after conversion and after that ceased to function in practice, as has been described for quite some Anatolian cities by Vryonis.

The cities categorized as belonging to the Latin West were generally, but not necessarily always, in the sphere of influence of the medieval Roman Catholic Church. In this article the Latin West comprises the larger cities in Scandinavia (Norway, Sweden and Finland), Poland, Germany, Czech Republic, the Low Countries (Belgium, Luxembourg and the Netherlands), France, Great Britain, Ireland, Switzerland, Austria, Italy and those located on the Iberian Peninsula (Portugal and Spain). The non-Latin West comprises the larger cities of the Balkans (Hungary, Slovakia, former Yugoslavia, Albania, Rumania, Bulgaria and Greece), Turkey, the Middle East (Lebanon, Jordan, Israel, Syria and Iraq) and North Africa (Egypt, Libya, Tunisia, Algeria and Morocco, all above 30 degrees latitude).

Population

For European cities with 10,000 inhabitants or more we used the dataset published by Bairoch *et al* (1988). To update it, we scanned recent literature concerning the major cities covered by the dataset, in particular all cities which during some point in time were larger than 60.000 inhabitants. This led to a number of important revisions concerning Cordoba and the other Muslim cities in medieval Spain (estimates were corrected downwards on the basis of Glick (1979)), and Palermo, Paris and London in the same period.[49] For the year 1100 Bairoch's population data have been linearly interpolated between those of the years 1000 and 1200.

The numbers of inhabitants in millions of persons in the different countries for the eleven time periods of our analysis have been derived from McEvedy and Jones (1979) either directly from their figures or interpolated from the lines characterizing the population developments. For Slovakia we assumed its numbers of inhabitants to have been the same as those of Hungary, except for 1800 where we distributed the inhabitants of Czechoslovakia between the Czech Republic and Slovakia in 1:2 (in accordance with their contemporary population sizes). McEvedy and Jones did not make a distinction between Slovakia and the Czech Republic because in the 1970s Czechoslovakia still was one country.

For all cities we also established their different Roman, Arabic, Persian, Byzantine, Christian and later local names or synonyms. For the non-European cities in North Africa and the Middle East we first established a list of some fifty of the most important ones from Roolvink's historical atlas (1957) and afterwards used Chandler and Fox (1974) to fill in the population data of these non-European cities as far as was possible. For Turkey we used the list of cities in Behar (1996), which was supplemented by a number of older cities named in Vryonis (1971) that met the size criterion. Next we used the old (first) and the new edition of the Encylcopaedia of Islam (EoI) (Houtsma *et al*., 1993 and Gibb *et al*. 1975-2005) to find population estimates for the missing dates in the non-European cities in North Africa, the Middle East and Turkey. For the then still missing periods or cities we additionally used the two editions of the EoI , Kennedy (1992), Woodford (1990), Raymond (2002), Escher and Wirth (1992) and various Baedeker travel guides of the areas to establish more or less hard physical data as the surface area of the specific city in medieval times in hectares from

[49] Bairoch et.al. (1988) estimates were corrected for a number of extreme outliers, Cordoba (on the basis of Glick 1979) and Palermo (email exchanges with Jeremy Johns and S.R. Epstein); according to Bairoch et.al. Cordoba was supposed to have 450.000 inhabitants at about 1000 (but only 110.000 according to Glick), Granada was supposed to have 150.000 inhabitants in 1300 (but only 50.000 according to the Lex d Mittlalt. iv-1648), Palermo's size was 350.000 according to Bairoch et.al., whereas our estimate (following Epstein and Johns) is 60.000; for Paris we used the numbers of hearths (61,098) from a census of 1328 presented by Pounds (1969) to estimate its population in 1300, for the next two centuries we assumed a regression of the Parisian population because of the Black Death and Hundred Years War; London was the only city for which estimates were revised upwards following Campbell 2000.

excavations or maps, the numbers of local mosques or the numbers of public hammams in the various cities and time periods, in order to use such physical data as an indicator of the otherwise not-available numbers of inhabitants.

Generally we used a number of 150 inhabitants per hectare of surface area of a medieval city, except for "garden" cities as Baghdad for which we used a lower number of 75 inhabitants per hectare. For Baghdad we therefore have come to a lower population estimate (half) than the one presented by Chandler and Fox. We additionally used a number of roughly one thousand inhabitants per mosque or public hammam when these entities had to be taken as a basis for the population estimates.[50] Furthermore we used two accounts made by Arabic travellers in North Africa and the Middle East, that of Al Muqaddasi around the year 1000 (Collins, 1994) and that of Ibn Battuta in the first half of the fourteenth century (Dominique, 1995) to fine tune the various population estimates made above in order to prevent conflicts with contemporary observations on city sizes made by these two local travellers.
With the procedure that we followed we will have undoubtedly missed a number of the cities in North Africa, Turkey and the Middle East, which at some moment during the millennium of our analysis would have qualified for the size criterion. Had that information been available we would have included these cities too. However, we may assume that the missed towns probably would not have been one of the more important cities in that area, because then they would have been reported somewhere in the Encyclopedia of Islam or in the references or maps that we used and thereby included in our database. However, we feel confident that missing a couple of cities that barely exceed 10,000 inhabitants at some time in the millennium between 800 and 1800 will not really affect the numerical outcomes that have been presented in the various analysis.

Reliability of estimates of urban population
What can we say about the reliability of our dataset? One way to check the results is to compare the (corrected and expanded) Bairoch dataset with other similar datasets. For Western Europe between 1500 and 1800 we can compare with Jan de Vries' compilation of similar estimates; the differences are small: the correlation coefficient ranges from 0.986 (for both 1500 and 1800) to 0.992, showing how close the two datasets are. A similar comparison with the Malanima (1998) dataset of Italian cities in the period 1300-1800 shows somewhat larger differences, but still the correlation is as high as 0.903 (1300), 0.900 (1400), 0.983 (1500), 0.990 (1600), 0.979 (1700) and 0.981 (1800) (note that the fit is somewhat lower for the pre 1500 period, for which in general the data are less good). The very high correlation between our data and the other datasets by De Vries and Malanima in our view provide additional confidence in our data. For the non-European data we can compare with the estimates of the share or urbanization in the Ottoman Empire by Sevket Pamuk, which are generally slightly higher than our estimates.[51] Similarly, the estimates of the urbanization ratio published by Malanima (1998) for Italy are higher than those arrived at here, probably because we miss some of the smaller cities just above the 10,000 threshold. The objective of our paper is, however, not to explain trends in urbanization ratios (which are also dependent

[50] For Ottoman Cairo Raymond presents 243 mosques, while indicating a population of 263.000 inhabitants in 1800, this comes quite close to the rule of thumb derived from other data, which we applied for some of the population estimates where other data were missing.
[51] According to Pamuk's estimates it increased – mainly due to the strong expansion of Istanbul – from 9,2% in 1500 to 12,2 % in 1820, in the Arab World (which was almost completely under control of the Ottoman Empire) we find an urbanization rate of 8.5% and 10% respectively for the same years. The data on the Ottoman Empire were kindly shared with us by Sevket Pamuk.

on estimates of size of the 'national' populations, adding, especially for the pre 1500 period, another source of error) but on explaining why some cities are big and others are not.

Medieval map as a check
As another touchstone of our database we used a medieval Catalan world map (Paris, BnF, Esp 30) that describes the world known around 1375. Grosjean (1977) gives a detailed description of this *mapa mundi*. His description shows that in 1375 on this map the most important residencies or capital cities have been indicated in red with a flag, the somewhat less important cities were indicated in red too but without a flag while even smaller cities were indicated in black. The average numbers of inhabitants in 1400 in our database are 59,100 for the cities indicated in red with a flag on the Catalan world map, 19,400 inhabitants for the cities only indicated in red and on average a mere 8,700 for the cities with a name in black. Indicative for the situation with a capital city in Germany is that none of the German cities has got a flag with it on the Catalan world map of 1375, while for instance the not too distant capital cities of Prague (Bohemia) and Krakow (Poland) were both indicated in red with a flag on this map.

Administrative Data - institutions
The administrative information (capital city, university, local bishopric, historic membership of the Hanseatic league, local political organization) has been mainly collected from the *Lexikon des Mittelalters* (LdM) (Auty, 1980-1999) and for the non-European cities also from the two editions of Encyclopaedia of Islam.

Capital cities
Capital cities have been mainly characterized from the maps of the different political entities that were indicated in the historical atlases by McEvedy (1977a,b). Because of the large scale of these maps relatively small entities (as city-states) will not always have been indicated and cities might be missed as capitals. Also, for some medieval empires as the German where there were no natural administrative centers during a large part of their history this leads to the situation that capital cities there only start to develop at the end of the Middle Ages. During the period of our analysis the nation state and with it a capital city comes into being (especially in Europe). In the early medieval period for instance Charlemagne did not have a specific capital city and due to the size of his realm his court used to travel from place to place. In some smaller medieval kingdoms as France en England the local royals later settled down at one specific place, which afterwards developed into an administrative centre and a capital city.

Universities
The numbers of universities in the various cities and their dates of foundation have been mainly characterized from the ninth edition of the Encyclopaedia Britannica (1898) and Jedin *et al* (1980). For the Islamic countries the there prevailing and sometimes high numbers of madrasas (e.g. 150 in Damascus in 1500), which by some authors have been classified as universities (Eche, 1967, 150), have not been classified by us as such because the higher education they offered was more comparable to that at a western college than that at a real university. (Huff, 2003, 77). Huff (2003, 179) sees the European uniqueness of universities at three distinct levels: legal and organizational, curricula, and philosophical and metaphysical.

Church organization
Additionally Jedin *et al* (1980) has also been used to find the data on the Episcopal organization (bishopric, archbishopric) and their foundation dates for the various cities in this

analysis. Additional information on the demise or relocation of bishoprics has been found in Wikipedia under 'Roman Catholic (arch)diocese of…', or under the city specific lemma in the English, French or German editions of Wikipedia. The nature of the Islamic faith, which lacks a structured religious organization contrary to that of the Western Roman Catholic or Eastern Orthodox Churches, unfortunately does not allow us to characterize and arrange Muslim cities in a similar administrative way as we could do for the Christian cities. Bishoprics and archbishoprics in Islamic cities therefore always concern the various Christian minorities in these cities.
We finally also used Jedin *et al* (1980) to establish whether a city in the Netherlands, France, Germany, Poland or Switzerland was in majority Roman Catholic or protestant after the Reformation and when this switch occurred. Similar switches of cities between Muslim and Christian (Roman Catholic or Orthodox) have also been indicated in the database and will be used in the analysis.

Local urban political organization in Latin West – the commune variable
For the dates of the first appearance or the loss of a local urban participative organization in the different cities in the Latin West we tried as much as possible to use specialized studies, such as e.g. that of Charles Petit-Dutaillis for France. However, as such studies unfortunately are sparse we mainly had to rely on other secondary sources for our information on the local urban political organization. For a general overview in the medieval Latin West we used the city specific descriptions in the *Lexikon des Mittelalters (LdM),* in which a mentioning of the occurrence of a commune, consuls or a town council (*Rat, raad, vroedschap, conseil, consejo, conselho*) in the city specific lemmas was used to classify the various towns in our sample and attach a date (in the form of the subsequent whole century) to the first signs of a local administration in which (at least part of) the citizens participated. This source (*LdM*), which covers the period of the Middle Ages, had to be supplemented with various others to expand the period to 1800 and also to fill gaps in its coverage. The various sources we used to come to city specific dates for the local participative administration have been indicated in the database, also to allow a subsequent analysis of their influence on the outcomes of our study.

As a general fall back option when the *Lexikon des Mittelalters* failed to present the sought after information on a local town council, we used the mentioning of the building date of a town hall in that specific city as a proxy for the first appearance of such a local participative administration. The building dates of town halls were generally collected from the various area specific Baedeker travel guides, complemented with the city specific lemmas for Italy from the *Enciclopedia Italiana, di szienze, lettre ed arti*, (published by: Instituto Giovanni Trecani, 1929) for Spain from the *Enciclopedia Universal Ilustrada* (published by: J. Espase-Calpe, 1905) and for Portugal from the *Grande Enciclopédia portuguesa e brasileira* (published by: Editorial Encyclopedia, 1936). Of course we also checked whether these encyclopedias gave more specific information on the occurrence of a local participative administration in the various towns, if so, such information was preferentially used. For the building dates of Dutch town halls we used the *Kunstreisboek voor Nederland* (published by: P.N. van Kampen, 1960) as a complementary source and for Germany Wikipedia readily presented us with this building information on the halls of the various towns in our sample.

To translate a building date of a town hall into the first sign of a local political administration we used a simple rule of thumb: we assumed that a town council would have been functioning at the turn of the century preceding the presented building date of a town hall. When a building date of a town hall was indicated to have been that of the second one in

succession, we assumed the local participative administration to have begun even two centuries earlier, to compensate for the demise of the previous town hall (by assuming a rather conservative useful life of only two centuries for the first town hall). Naturally, the procedure used above with building dates of town halls as a proxy for missing information on the appearance of a local participative administration will lead to some misclassifications, as building dates of town halls are only indicators of the occurrence of town councils. However, generally such misclassifications may expect to lead to just an amount of extra noise in the data without necessarily biasing the outcomes of the later regressions, though we are aware that the statistical significance of the regressions is likely to decrease with more noise in our data.

When information on building dates of town halls was missing too, we used information on the first time a town was described as a *ciudad* (Spain), or when city rights were granted (Spain, Portugal, Hungary, Poland and Yugoslavia) as a different proxy for the appearance of a local administration. The sources of this information on city rights were the *Lexikon des Mittelalters,* and the various encyclopedias we used. As a basic rule of thumb we decided that a local council would probably have evolved in the first turn of the century after the granting of city rights to a town. Quite often city rights granted were belonging to a specific category (e.g. those of Magdeburg, Lübeck, etc.), under auspices of such city rights it was more often then not customary for a local council to operate, therefore we think such an assumption based on the proxy of city rights may be justified. Generally however, we preferred more direct data, if available, on the occurrence of a commune, council or consuls, above those on building dates of town halls or city rights.

Wikipedia presented some supplementary information on the occurrence of local councils in the UK for the 178 reformed boroughs from the Municipal Corporations Act from 1835 and the boroughs incorporated in England and Wales 1835-1882.

Whenever there were no clear indications of either a specific stop of a council or an inclusion of a city (and its council) into a hereditary seigneurie we assumed the local participative institutions to have functioned until 1800. Charles Petit-Dutaillis (1970, p. 193) indicates for France the following: « Notons d' abord que généralement les communes françaises qui existaient à la fin du Moyen Age ont subsisté jusque à la Révolution. » However, sometimes the various sources listed above reported dates at which a local participative administration in a town stopped functioning, these dates of course have been used for the classification scheme we applied. For instance, at times a ruler punished a disobedient or insurgent city by dissolving its city council and quite often he then designated a specific administrator to the city. In other instances, which happened regularly in Italy, an initially participative town council was eventually taken over by an important and powerful local family. The occurrence of such hereditary seigneuries of course indicates that the participative aspect in the local administration disappears and for these towns we have ended the indication of a commune. The rule of thumb we applied to decide that such a change should be applied to the town in question was the occurrence of the second generation of a certain family indicated as local town rulers. For the different towns in the Balkans we assumed that the local participative organizations disappeared after the usurpation by the Ottomans there and we have classified these cities accordingly.

When there was not enough information, for instance when there were no clear indications in the various references concerning a commune or the building date of a town hall, we have not classified the city in question. This too might have resulted in a misclassification for the

specific city, when this lack of information was been based on inadequate sources instead of on an actual absence of participative organizations in a town.

Geographical information
Further geographical information concerning location of a city at a sea coast (split into location at the Atlantic, Mediterranean, or Baltic / North sea) and navigable waterways has been found from Dumont and Mieremans (1959). When a town was indicated to be lying along a waterway that is presented on one of the maps in an Atlas with a scale of at least 1:2,000,000 it was classified as having a navigable waterway. It was classified at sea when there was a possibility to beach or harbor boats along the coast where the city was located. The presence of a Roman road or a hub of Roman roads (three or more coming into one city) or a hub of a navigable waterway crossing a Roman road at a city was collected from Hammond (1981) and Talbert (2000). To determine if a (medieval) city was lying on a Roman road (or within a mile of it) or was having a seaport the original location of the city and coastline was used as a criterion and not the current sometimes much more extensive surface that a city occupies nor the current position of the coastlines.
The information on caravan routes in North Africa and the Middle East was derived from maps by Barraclough (1981, 134-136), Roolvink (1957, 16-17) and Rostovtzeff (1971, 2). For Anatolia the information on caravan routes was collected form the new edition of the Encyclopaedia of Islam: in the lemma: "Anadolu". We used the map of roads in seventeenth-century Turkey and only counted the double tracks as important caravan roads and used this information to classify whether or not cities were lying on a caravan route or a hub of caravan routes (three or more routes meeting in one city).
Finally we also collected each city's geographical coordinates from *www.heavens-above.com* a website that provides the coordinates of over 2 million places in the world. We subsequently use these coordinates to calculate the great circle distance between each specific pair of cities in our sample. These distance are the input into our *Foreign Urban Potential (FUP)* measure introduced in section 3, see (1). Also, we include the latitude of each city as a proxy for its climate in the robustness checks in the Results Appendix.

Potential centers of urban growth
To find the potential areas of urban growth existing before our period of analysis we estimated the geographical distribution of all Christian bishoprics and archbishoprics around the Mediterranean in circa 600 AD. The then predominant religion in this vast area (more than half a century before the arrival of Islam) was that of Christianity: either Catholic (Roman/Arian) or Monophysitist (Syrian, Coptic or Persian). Our preliminary assumption is that those Christian Churches will have concentrated their resources in such a way that they optimized their spans of control over their various flocks and will have developed an intricate system of local branch offices (bishoprics) that covered the most important concentrations of their believers. In other words we think that the fact that a town was an (arch)bishopric in 600 indicates that it then had the status of a centre in the local economy, which at the time the Church thought to be important enough to control. Therefore the obtained set of bishoprics may be considered to be potential centers for later urban growth. In total we found more than 1400 bishoprics which were operating around 600 AD in the countries mentioned above surrounding the Mediterranean Sea on the maps 10A, 10B, 20, 21, 22, 23 and 24 of the *Atlas zur Kirchengeschichte*. All towns indicated on the maps with different locations but sometimes with similar names have been classified as a separate bishopric.

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Results Appendix

Table RA1. Summary of FUP robustness checks

	all cities	muslim	christian	latin west	non latin west
geography			similar to baseline		
institutions / religion			similar to baseline		
Check 1: avg distance to other muslim / christian city					
To Muslim city	0.239***	0.033	0.264***	0.323***	-0.029
	[0.005]	[0.861]	[0.001]	[0.000]	[0.865]
To Christian city	-0.057	-0.02	-0.236**	-0.236*	0.137
	[0.522]	[0.912]	[0.024]	[0.081]	[0.400]
Check 2: nearest distance to other muslim / christian city					
To Muslim city	0.045*	0.0	0.045	0.048	0.039
	[0.089]	[0.996]	[0.108]	[0.163]	[0.360]
To Christian city	-0.039*	0.048	-0.070***	-0.098***	0.086**
	[0.066]	[0.365]	[0.005]	[0.000]	[0.039]
Check 3: unweighted FUP					
Muslim	0.035	0.358***	-0.071*	-0.073	0.267***
	[0.412]	[0.002]	[0.085]	[0.117]	[0.004]
Christian	0.100***	-0.035	0.170***	0.186***	-0.065
	[0.000]	[0.562]	[0.000]	[0.000]	[0.281]
Check 4: sqrt(distance) instead of distance					
Muslim	0.002	0.368**	-0.118*	-0.145**	0.379***
	[0.980]	[0.028]	[0.052]	[0.026]	[0.005]
Christian	0.095***	-0.055	0.177***	0.203***	-0.097
	[0.002]	[0.474]	[0.000]	[0.000]	[0.151]
Check 5: total FUP (not split between muslim and christian)					
FUP	0.158***	0.199***	0.165***	0.183***	0.128*
	[0.000]	[0.003]	[0.000]	[0.000]	[0.051]
Observations	2376	481	1895	1831	545

Notes: Results per robustness check are from **separate** regressions including all variablesas in the baseline specification, but with the two FUP variables replaced one of the variable(s) above. p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results obtained using panel data estimator allowing for random city-specific effects.

Table RA2. Results when including cities as soon as more than 5000 inhabitants

	all cities	muslim	christian	latin west	non latin west
Sea	-0.064	0.02	-0.112*	-0.08	0.034
	[0.292]	[0.882]	[0.090]	[0.228]	[0.809]
Navigable river	-0.016	0.1	-0.090**	-0.048	-0.087
	[0.702]	[0.385]	[0.035]	[0.274]	[0.338]
Hub roman roads	0.109*	0.059	0.151**	0.158**	-0.031
	[0.058]	[0.596]	[0.015]	[0.015]	[0.767]
Roman road	0.011	-0.206	0.063	0.069	-0.181
	[0.810]	[0.121]	[0.148]	[0.131]	[0.129]
Caravan	0.074	0.098	0.184	-	0.066
	[0.532]	[0.476]	[0.286]	-	[0.584]
Caravan hub	0.592***	0.521***	0.263	-	0.551***
	[0.001]	[0.003]	[0.253]	-	[0.000]
Bishop	0.200***	0.210*	0.193***	0.186***	0.327***
	[0.000]	[0.054]	[0.000]	[0.000]	[0.001]
Archbishop	0.445***	0.24	0.532***	0.542***	0.305**
	[0.000]	[0.126]	[0.000]	[0.000]	[0.032]
Capitol	0.840***	0.790***	0.866***	0.874***	0.785***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
University	0.287***	0.171	0.251***	0.232***	0.409
	[0.000]	[0.595]	[0.000]	[0.000]	[0.104]
Muslim	0.348***	-	-	0.774***	0.085
	[0.000]	-	-	[0.000]	[0.291]
Muslim FUP	0.108***	0.341***	0.031	0.018	0.275***
	[0.005]	[0.001]	[0.422]	[0.673]	[0.001]
Christian FUP	0.146***	-0.056	0.232***	0.243***	-0.075
	[0.000]	[0.334]	[0.000]	[0.000]	[0.200]
Protestant	0.081	-	0.059	0.053	-
	[0.137]	-	[0.278]	[0.329]	-
Observations	2915	499	2416	2343	572

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results obtained using panel data estimator allowing for random city-specific effects. Splitting the sea-variable in Atlantic, Mediterrenean and Baltic/North sea gives again a significant effect of being on the shores of the Atlantic.

Table RA3. The baseline results including latitude as a proxy for a city's climate

	all cities	muslim	christian	latin west	non latin west
Sea	0.124*	-0.172	0.137**	0.138**	-0.071
	[0.056]	[0.231]	[0.045]	[0.046]	[0.664]
Navigable river	0.072	0.171	-0.010	0.024	-0.005
	[0.142]	[0.140]	[0.832]	[0.650]	[0.958]
Hub roman roads	0.055	0.022	0.096*	0.112*	-0.061
	[0.306]	[0.843]	[0.080]	[0.057]	[0.572]
Roman road	-0.024	-0.134	0.048	0.041	-0.117
	[0.582]	[0.279]	[0.230]	[0.344]	[0.319]
Caravan	-0.056	-0.044	-0.026	-	-0.043
	[0.632]	[0.786]	[0.884]	-	[0.760]
Caravan hub	0.516***	0.388	0.303	-	0.468***
	[0.002]	[0.018]	[0.164]	-	[0.001]
Bishop	0.175***	0.258**	0.139***	0.139***	0.288***
	[0.000]	[0.011]	[0.000]	[0.000]	[0.002]
Archbishop	0.386***	0.250	0.439***	0.463***	0.257*
	[0.000]	[0.116]	[0.000]	[0.000]	[0.089]
Capitol	0.817***	0.783***	0.817***	0.823***	0.776***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
University	0.320***	0.096	0.301***	0.266***	0.316
	[0.000]	[0.753]	[0.000]	[0.000]	[0.184]
Muslim	0.290***	-	-	0.583***	0.037
	[0.000]	-	-	[0.000]	[0.689]
Muslim FUP	0.033	0.341***	-0.055	-0.057	0.267***
	[0.448]	[0.000]	[0.189]	[0.219]	[0.002]
Christian FUP	0.099***	-0.005	0.161***	0.177***	-0.041
	[0.000]	[0.935]	[0.000]	[0.000]	[0.521]
Protestant	0.122*	-	0.075	0.075	-
	[0.072]	-	[0.259]	[0.274]	-
LATITUDE	**-0.005**	**-0.048*** **	**0.000**	**-0.001**	**-0.025**
	[0.319]	**[0.010]**	**[0.991]**	**[0.864]**	**[0.187]**
Observations	2376	481	1895	1831	545

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not change the results whereas the dummies themselves are insignificant. Results obtained using a panel data estimator allowing for random city-specific effects.

Table RA4 Urbanisation rate (total pop. in cities >=10000 inhabitants / total pop.)

Country	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
Scandinavia	-	-	-	-	-	-	-	1	2	4	5
Great Britain	-	1	4	3	3	3	3	2	6	11	23
Ireland	-	-	5	-	-	3	3	-	0	4	9
Low Countries	-	-	3	3	10	12	23	20	21	27	20
France	3	3	4	4	6	6	6	6	7	9	9
Germany	3	4	6	5	5	5	6	5	5	5	8
Austria / Switzerland	-	-	-	-	1	1	2	2	2	5	8
Italy	4	5	8	9	11	14	13	13	17	16	17
Iberia	6	8	13	10	9	9	10	10	12	11	14
Poland	-	-	-	-	0	1	2	3	5	3	3
Czech Republic	-	-	1	1	1	2	4	3	2	2	2
Hungary / Slovakia	-	-	-	-	-	-	-	1	1	1	3
Yugoslavia / Albania	-	2	3	1	1	3	4	4	8	6	5
Bulgaria / Rumenia	2	4	4	4	5	6	5	6	5	6	6
Greece	3	7	6	5	4	6	9	3	6	4	4
Turkey	5	7	8	10	6	5	7	10	16	14	12
Lebanon / Israel	4	9	12	13	10	11	6	5	3	3	8
Syria	8	8	9	9	10	9	9	12	12	15	14
Iraq	26	31	22	19	19	19	15	11	7	10	18
Egypt	5	7	7	10	10	8	10	6	5	8	8
North Africa	2	2	3	5	6	6	8	8	6	8	5
Latin – West	3	3	5	5	5	6	7	7	8	9	11
Balkan	1	4	4	3	3	5	5	5	6	5	5
ME – NA	7	9	8	10	8	7	9	9	10	11	10

Table RA5 (Arch)bishoprics in 600 [see footnote 15]

Country	# (arch)bishoprics in 600	% of (arch)bishoprics in 600 ever >10k during 800-1800
Algeria	115	3 %
Tunesia	135	4 %
Lybia	11	9 %
Egypt	76	3 %
Palestine	69	3 %
Syria & Lebanon	50	8 %
Iraq	21	0 %
Turkey	391	7 %
Cyprus	13	0 %
Greece	87	2 %
Italy	252	27 %
France	118	48 %
Iberia	69	46 %
total	1407	15 %

Table RA6. Focus on country-specific institutional variables [see footnote 45]

	all cities	latin west	christian
Geography		see baseline + text	
Religion / institutions		see baseline	
FUP		see baseline	
Free / Prince DLS	0.114***	0.098***	0.097***
	[0.001]	[0.004]	[0.006]
Observations	2376	1831	1895

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results obtained using panel data estimator allowing for random city-specific effects and country dummies (included as the free-prince variable is defined on a country level). Results without country dummies are very similar. In contrast to the commune-variable, significance of the free / prince variable is lost once we control for city-fixed effects and country time trends.

Table RA8. Focus on city-specific institutions controlling for city-specific fixed effects and country trends

	all cities	christian	latin west		continued	all cities	christian	latin west
Bishop	-0.113	-0.094	-0.096		Muslim FUP	0.177***	0.067	0.068
	[0.205]	[0.441]	[0.372]			[0.004]	[0.261]	[0.232]
Archbishop	0.153	0.253	0.269		Christian FUP	0.361***	0.417***	0.445***
	[0.265]	[0.113]	[0.053]			[0.000]	[0.000]	[0.000]
Capitol	0.526***	0.462***	0.496***		Protestant	0.082	0.125	0.122
	[0.000]	[0.000]	[0.000]			[0.352]	[0.160]	[0.161]
University	0.168**	0.179**	0.186***		**COMMUNE**	**0.138*** **	**0.105*** **	**0.109*** **
	[0.020]	[0.016]	[0.010]			**[0.005]**	**[0.027]**	**[0.023]**
Muslim	0.179**	-	0.301**					
	[0.042]	-	[0.013]		Observations	2376	1895	1831

Notes: p-values, based on autocorrelation and heteroskedastically robust standard errors, in brackets. *, **, *** denotes significance at the 10%, 5%, 1% respectively. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. Results are also robust to the inclusion of country-specific fixed effects instead.

Table RA7. Time-varying results controlling for city-specific fixed effects and country trends

	non latin west			muslim		
year	capitol	Muslim FUP	Christian FUP	capitol	Muslim FUP	Christian FUP
800	0.578*	0.698**	-0.186	0.691*	0.822***	-0.063
900	0.833***	0.530**	-0.145	0.872***	0.615**	-0.238
1000	0.702***	0.567**	-0.153	0.612**	0.629***	-0.227
1100	0.418**	0.514**	-0.157	0.392**	0.564**	-0.175
1200	0.427***	0.416**	-0.007	0.607***	0.333	0.064
1300	0.488***	0.377	0.062	0.565***	0.306	0.163
1400	0.559***	0.237	0.082	0.446**	0.178	0.221
1500	0.811***	0.029	0.210	0.547**	-0.235	0.426*
1600	0.788**	0.060	0.291	0.477	-0.192	0.502*
1700	0.777**	0.087	0.279	0.456	-0.322	0.567*
1800	0.658**	0.247	0.147	0.343	-0.186	0.371
other variables		see Table 4			See Table 4	
observations		545			481	

	latin west			christian		
year	capitol	Muslim FUP	Christian FUP	capitol	Muslim FUP	Christian FUP
800	0.754***	-0.131	0.397**	0.897***	0.346	0.151
900	-0.007	-0.036	0.424***	0.041	0.183	0.265
1000	-0.001	0.223	0.313**	0.038	0.568**	0.084
1100	0.209**	0.096	0.491***	0.155	0.279	0.343**
1200	0.274**	-0.019	0.530***	0.132	0.076	0.447***
1300	0.553***	-0.004	0.527***	0.482***	-0.001	0.467***
1400	0.515***	0.047	0.567***	0.557***	-0.070	0.513***
1500	0.532***	0.077	0.588***	0.550***	0.113	0.512***
1600	0.760***	0.107	0.565***	0.747***	0.152	0.486***
1700	1.083***	0.135	0.565***	1.094***	0.172	0.490***
1800	1.299***	0.174	0.567***	1.292***	0.213	0.500***
other variables		see Table 5			See Table 5	
observations		1831			1895	

Notes: *, **, *** denotes significance at the 10%, 5%, 1% respectively. They are based on p-values, calculated using autocorrelation and heteroskedastically robust standard errors. Without exception, the inclusion of century dummies does not significantly change the results whereas the dummies themselves are insignificant. We leave out all non-time varying variables in the above regressions.