The Oriental City?

Political Hierarchy and Regional Development in China, AD1000-2000

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Abstract

Because regime changes in China between AD1000 and 2000 systematically altered the relative importance of different regions in the political hierarchy, tracing the evo- lution of Chinese provincial capitals and economic activities during this period throws light on how political factors shape economic geography. Our analysis shows that eco- nomic advantages driven by political factors do not necessarily persist: while gaining provincial capital status has a large and positive on economic development as measured by population density and urbanization, the economic advantage shrinks after losing provincial capital status. This pattern is further supported by exploiting variation arising from relocation of national capitals and redivision of provincial boundaries due to regime changes as an instrument for provincial capitals. In addition, we document that (i) the relocation of public offices only explains a small part of our finding on population density, and (ii) political hierarchy affects many economic factors, even the less malleable ones like human capital and transportation networks.

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1 Introduction

In AD1000, the city of Kaifeng was the most prosperous city in China and, with an estimated urban population of 1 million, arguably the largest city in the world (Mote 2003, Morris 2013). By 2015, however, its GDP ranked 129th among Chinese cities and its former glory was long forgotten. Kaifeng's decline is closely related to its status in the political hierarchy, it having first lost political prestige as the national capital in the 13th century and then its status of provincial capital in the 20th century (Heng 1999). The city's development path thus exemplifies "the Oriental city" model proposed by Max Weber (1921) in which politics rather than the market determines the spatial distribution of economic activities.

Since Weber, scholars in the vast political economy literature have expanded our understanding of the importance of political factors in shaping economic geography (e.g., see De Long and Shleifer 1993, Ades and Glaeser 1995, and Davis and Henderson 2003 for the implications on city size)1. Because most of these studies rely on cross-sectional variation, however, they face the challenge of explaining what drives the political importance of certain regions. In this paper, we address this challenge by taking a longue duree approach that traces the evolution of provincial (and national) capitals and economic activities in China from AD1000 to 2000 to evaluate the politico-economic link. We also try to shed light on the political logic of provincial capital relocation and the factors underlying the importance of capital status.

We find that gaining provincial capital status has a large and positive effect on local economic development, which may not be surprising. A less obvious question is whether the economic advantages of capital prefectures still hold after losing capital status. On the one hand, in view of a growing literature on path dependence emphasizing economic factors (e.g., Davis and Weinstein 2002, Bleakley and Lin 2012 among others discussed later), one might expect the economic advantages to remain despite the change in political status; on the other hand, cities arising from political factors may be different from those determined by economic factors. Some scholars even conjectured that the political nature of Chinese cities partly accounts for divergent paths of China and Europe after 1500 (e.g., Weber 1921, Needham 1969).2 We find that losing capital status has a large and negative effect: the economic advantage of provincial capitals greatly shrinks with the loss of political status,

1De Long and Shleifer (1993) use historical data on European cities to document that property rights facilitate economic growth; while Ades and Glaeser (1995) draw on cross-country data to demonstrate that national capitals are larger in autocracies than democracies. In more recent work, Davis and Henderson (2003) argue that the extent to which a country's urban resources are concentrated in one or two large cities rather than more evenly distributed is directly affected by policies and politics.

2Both Weber and Needham emphasize the lack of autonomy of Chinese cities. Needham argues that the lack of an independent merchant class in the political cities inhibited the rise of modern science in China.

implying that economic advantages driven by political status do not necessarily persist. On the underlying factors, relocation of public offices matters, but we find it difficult for this factor to explain a major part of the large effect of gaining and losing capital status. Moreover, we document that political hierarchy shapes many underlying economic factors, even human capital and transportation networks.

As the largest enduring state with a distinctive political hierarchy, China provides fertile research ground on which to investigate the link between politics and economic devel- opment. From 1000-2000, the country underwent six dynastic regime changes that brought about drastic shifts in boundaries and centers of power, with national capitals relocated five times and the method for dividing provinces amended from "suiting [i.e., following] the forms of mountains and rivers" to intentionally avoiding them so that boundaries "interlocked like dog's teeth". Consequently, 63 out of the 261 prefectures defined by the 2000 boundaries were once a provincial capital whose status changed with a new regime. In addition, China has a long history of governmental censuses whose rich information on population, geography, infrastructure, and bureaucracy allow us to trace the changes in capital status, construct ex- tensive prefecture-level data over time, and identify important factors in determining capital status.

The major driver of national and provincial capital relocation is regime change, which happens infrequently and is hard to predict. For example, residents of the Song Dynasty capital (Kaifeng), would never have imagined that China could later be ruled by the Mongo- lians, who moved the national capital to northern China (Beijing) and redivided provincial boundaries for political control. This pattern also occurs after other regime changes: the new regime chooses a national capital close to its power base and redefines provincial boundaries (based on their preference over the two principles mentioned above), thereby altering the relative location of a prefecture. As a result, a prefecture's capital status often varies across regimes.

To formalize this logic of provincial capital relocation, we assume that the central government cares about governing a province, as well as about gathering resources and information from the province to the center. Two parts of cost then become important: collecting resources and information within a province and delivering some part of them to the national center. We proxy the first part by a prefecture's distance to other prefectures within the same province and the second part by a prefecture's distance to the national capital. We then define the weighted sum of the two distances as "hierarchical distance" and show a prefecture's rank in hierarchical distance within a province to be a strong predictor of its capital status. Not only does this rank vary greatly with regime change-induced national capital relocation and provincial boundary redivision, but, as we later document empirically, these latter are typically driven by political factors unlikely to be affected by any specific prefecture's characteristics. Hence, a prefecture's hierarchical distance rank can serve as a reasonable instrumental variable (IV) for provincial capital status. It will help us deal with some idiosyncratic factors that might affect provincial capital status.3

Using data from existing historical and modern censuses, we construct a panel dataset across 261 prefectures for 11 periods (980, 1078, 1102, 1393, 1580, 1776, 1820, 1851, 1910, 1964, and 2000),4 using both a difference-in-differences strategy and an IV strategy to eval- uate how political status shapes economic development. To build a panel dataset based on fixed boundaries, we use the year 2000 prefecture boundaries in our baseline analysis and also report the results of a grid-level analysis.

We first employ the difference-in-differences strategy to show that gaining (losing) provincial capital status is associated with higher (lower) population density, at a magnitude of 40-50%. Using this strategy, however, we face two important empirical challenges. First, our baseline data is available infrequently and has uneven gaps. To deal with this challenge, we show that our findings are robust to employing subsamples of roughly equal gaps and dropping any specific regime. Moreover, we conduct a period-by-period analysis where the periods are defined of equal length relative to the period before capital status change and find that the effect on population occurs only after the capital status changes. Another major concern is whether whether capital status changes because of omitted variables that affect population density. To partially address this concern, we show that our findings hold for the subsample of cities that were at some time a provincial capital when no omitted variables prevented them from becoming one. In addition, the period-by-period analysis is also useful in that at least the population density trends in the capital-to be (capital-to-lose) prefectures are no different from the rest before they gain (lose) capital status.

There could still be some time-variant omitted variables that affected provincial capi- tal status. To further deal with this endogeneity challenge, we employ hierarchical distance rank as an instrument for capital status and obtain an estimate comparable to that using difference-in-differences. A general concern with this approach, however, is that hierarchi- cal distance might affect economic development via economic channels other than political status. We thus conduct several checks, whose outcomes also underscore the importance of the political capital status for our findings. First, we find that hierarchical distance is not significantly correlated with population density for the prefectures that have never been

3For instance, some large war shocks might lead to the loss of capital status of a prefecture. 4There are four additional periods with censuses available: 1880, 1953, 1982, 1990. Because including them will make the gaps between periods even more uneven, we exclude them in our baseline analysis based on the principle of dropping the periods with a gap smaller than 30 years. We will show that including them does not vary our findings.

a provincial capital, suggesting that hierarchical distance per se does not necessarily affect development. Second, we exploit national capital relocation to derive placebo hierarchical distance ranks that reveal, for instance, that once Kaifeng lost its national capital status, the rank calculated using distance to Kaifeng lost its influence on population density. Third, we also measure a prefecture's rank in terms of distances to major economic centers (instead of the national capital) and show that our findings on hierarchical distance rank is orthogonal to these alternative ranks. All these results suggest that political capital status is critical for our IV findings.

Our findings remain robust to considering lagged population and war shocks, using urbanization as an alternative outcome, and employing grid-level data. We also examine heterogeneous effects over time and across space. Over time, we find that provincial capital status is equally important before and after 1820, indicating that the political logic we document is not altered by modernization. If anything, provincial capital status appears slightly more important in modern data. Across space, we find that capital status matters less for prefectures with more natural advantages (proxied by high agricultural suitability and gently sloping land), suggesting that capital status matters via some reallocation channels that matter less if a prefecture was already productive.

What, then, explains the link between political hierarchy and regional economic development? Many factors alter along with political status including jobs, people and resources, which makes it impossible to enumerate each one. Instead of enumerating each factor, we consider a spectrum of factors based on their malleability. In particular, we start from reloca- tion of public offices, which should be rather malleable. However, given the large magnitude of our finding on population, it seems difficult for this factor to account for a large part of the effect. A back-of-the-envelope calculation using cross-sectional modern data suggests that this factor can explain around 11% of our baseline finding. Thus, this channel alone cannot account for our finding unless we assume a ten-fold multiplier effect. Then, we turn to two factors that are less malleable, namely human capital and transportation networks, for two reasons. First, we can build a panel dataset for them to examine how changes in capital status matter. Second, these factors are often argued to be persistent (e.g. Wantchekon et al. 2015, Barjamovic et al. 2018, Chen, Ma and Kung 2018). If we find that they vary system- atically with political status, it illustrates the importance of political hierarchy in shaping economics factors in our context. Empirically, while we also find a positive correlation be- tween past human capital (transportation) and present human capital (transportation), we do observe a systematic rise and fall in human capital and centrality in the transportation networks after the gaining and losing of capital status. In other words, political hierarchy is so important for a prefecture that even the less malleable economic factors change with the political status of a prefecture.

Our study contributes to the political economy literature emphasizing the impacts of political factors on cities and development (e.g., De Long and Shleifer 1993, Ades and Glaeser 1995, Davis and Henderson 2003, Galiani and Kim 2011, Campante and Do 2014). Most such studies necessarily focus on cross-sectional variation because the rarity of capital city changes in their contexts makes it difficult to study the impact of changing political status. The Chinese setting, in contrast, allows us not only to exploit multiple changes in capital status but to speak to the long-run consequences of gaining and losing political status.

Our perspective complements the literature on the long-term spatial distribution of economic activity. Most of the existing studies focus on the role of market factors and document persistent patterns in economic activity, such as the minimal impact on development of large temporary shocks to a region due to locational fundamentals (e.g., Davis and We- instein 2002, Miguel and Roland 2011, Barjamovic et al. 2018) or the persistent impacts of temporary advantages (e.g., Redding, Sturm, and Wolf 2011, Bleakley and Lin 2012, Kline and Moretti 2013, Michaels and Rauch 2016, Hanlon 2017). In contrast with the market factors, political factors are little studied in this research stream yet play a critical role in shaping economic geography in regimes like China.[5] In light of this line of research, one interpretation of our findings is that politics can affect fundamental forces in our context, for example, by altering canal routes and land routes.

Our study also adds to the broad literature on how nature, history, and politics shape the distribution of economic activity (e.g., Nunn 2009, Michalopoulos and Papaioannou 2013, Henderson et al. 2017). The long-lasing administrative hierarchy in China provides a useful context to investigate the role of politics. Our findings add nuances to the historical and sociological discussions on administrative cities (e.g., the so-called "the oriental city" by Weber (1921) and "the parasite city" by Bairoch (1985)), which often emphasize their roles as homes to bureaucrats or merchants and artisans serving the bureaucrats. Consistent with this discourse, we find that public employment varies greatly with political status. Meanwhile, we find that political hierarchy also shapes the allocation of many economic factors (including human capital and transportation networks). Our findings thus also provide new evidence to understanding how politics affects spatial distribution of economic activity.

The rest of the paper is organized as follows. Section 2 describes the background and provides a simple algorithm to explain changes in provincial capitals. Section 3 introduces the data and descriptive patterns. Section 4 reports the empirical results for both the difference-

5To be clear, we also find some persistent patterns in our key variables (e.g., population density, human capital, and transportation), implying that geography and other market factors also matter in China. How- ever, on top of some persistence, they also change systematically with political status, which has been less studied than the patterns of persistence.

in-differences and IV analyses. Section 5 discusses the channels. Section 6 concludes the paper.

2 Background and An Algorithm

2.1 Regime Changes & Capital Relocation

Two features of the Chinese political system are particularly important for our research design: (i) multiple distinctive dynasties/regimes existed during during A.D. 1000-2000, whose founders had no relationship to each other and could even be of different ethnicity; and (ii) despite regime shifts, China's three-tier administrative system (province-prefecture- county) remained surprisingly stable over this entire millennium.6 The regimes shifts did, however, lead to changes in national capitals, provincial boundaries, and provincial capitals, with the latter being among the prefectures that make up provinces. These features make China an ideal context in which to investigate how a region's status in the political hierarchy affects its economic development; for instance, a prefecture could be a provincial capital in one regime but lose its capital status in another and vice versa.

Regime Changes Our study focuses on the core regions of China known as "China proper" (shaded area in Figure 1) for which centuries of historical information is avail- able. During the millennium studied (AD1000-2000), six major regimes came into existence: the Song Dynasty (960-1279), which coexisted with the Liao (907-1125) and Jin (1115-1234) dynasties in the north, the Xixia Dynasty (1038-1227) in the northwest, and the Dali Dy- nasty (937-1253) in the southwest; followed by the Yuan (1271-1368), Ming (1368-1644), and Qing (1636-1912) dynasties, the Republic (1912-1949), and the People's Republic (1949-the present).

As previously emphasized, these infrequent regime changes are hard to predict, with both the Mongolians and Manchurians (who founded the Yuan and Qing dynasties, re- spectively) regarded as minorities by the Han of the preceding regimes. The administrative decisions made by the rulers at the beginning of each new regime – including national capital location, provincial boundaries, and provincial capitals – usually persisted until the regime's end, with only occasional changes in between. Our national and provincial capital variation is thus driven primarily by regime change. That said, there could still be some idiosyn- cratic factors that made certain prefecture gain or lose capital status. We will deal with this

6In the Song dynasty, the first tier is known as circuit (Lu in Chinese), which is comparable to the provincial unit in the latter regimes.

concern using both difference-in-differences design and an instrumental variation approach. Because national capital relocation and provincial boundary redivision are the precon- ditions for changes in provincial capital, we describe them in order below.

National Capital Relocation Because each regime tended to locate its national capital close to its power base, the national capitals changed five times across the six regimes, reflecting the unpredictability of where a new power base could arise. Thus, today's Kaifeng (in central China), Beijing (in northern China), and Nanjing (in central-south China) were the national capitals for the Song, Yuan, and Ming dynasties, respectively,7 after which Beijing served as capital the Qing Dynasty, Nanjing for the Republic, and Beijing again for the current People's Republic.

The different preferences for national capital locations are explained by the Mongolians (founder of the Yuan) and Manchurians (founders of the Qing) originating in the north, while the Ming and Republic power bases were in the south. Although both Beijing and Nanjing were candidates for the national capital of the People's Republic, Beijing was chosen, partly because of its nearness to China's political ally at that time (the Soviet Union). In all the cases, political considerations are usually more important than economics.

Provincial Boundary Redivision Along with national capital relocation came provin- cial boundary alteration, which during this millennium was affected by a major shift between the two previously mentioned principles for defining provincial boundaries: whether to fol- low or subsume the natural lines of mountains and rivers, which latter exemplifies a spatial "divide-and-rule" tactic to limit the power of local governments.8 Like national capitals, provincial boundaries were created not from economic imperatives but from political in- spiration, which often represented efforts to divide various communities so "each could be dealt with separately" (Skinner 1977, Guy 2010). As pointed out by Skinner, provincial boundaries arise through "administrative accidents" rather than delineation of the natural boundaries of human activity.

The Song adhered to the first principle, generally defining provincial boundaries by natural mountains and rivers, but when the Mongolians came to rule, being preoccupied with the possibility of a usurper's mobilizing resources against the central government, they adopted the interlocking principle to an extreme, intentionally including natural mountains and rivers within (larger and fewer) provinces. The regimes following the Yuan Dynasty

7Nanjing was the national capital of the Ming Dynasty until its capital was relocated to Beijing in 1421, partly because the new emperor, who took power via a coup, had his power base in Beijing. The Crown Princess, however, stayed in Nanjing, which became the norm for this regime.

8The logic is similar to divide-and-rule documented in Michalopoulos and Papaioannou (2013).

then adjusted the number of provinces using the two principles, with a generally increasing pattern.

Historians have documented that the changes of provincial boundaries in three promi- nent regions are driven by the evolution of two principles, namely the regions where the Yellow River, the Yangtze River, the Qin Mountain are located (Zhou 1998, Li 2011). These major natural barriers were used as provincial boundaries in the Song dynasty but were gradually included within provinces over the latter regimes. In Appendix Figure A.1, we map these three regions in panel (a), and present the Yangtze River example across regimes in more detail in panels (b)-(d). As shown, the Yangtze River used as a provincial boundary by the (pre-Mongolian) Song but included within provinces by the (post-Mongolian) Ming and Qing. The boundary setting for the provinces outside the three regions has been less discussed by historians. While their boundary could also be affected by these two principles, their boundary setting is also partly restricted by the national borders due to their closeness to the borders.

Provincial Capital Relocation The relocation of national capitals and redivision of provinces naturally affected the relative importance of a prefecture, which having been central based on the old provincial boundary could become rather isolated given the new delineation and national capital. For instance, Luzhou was the capital of Hedong province during the Song Dynasty because it connected the national capital Kaifeng with other prefectures in the province (see Panel (a) of Appendix Figure A.2). During the Ming dynasty, however, it lost its capital status because redrawing of the provincial boundary placed it far away from other prefectures in the province even though it was still relatively closer to the new national capital of Nanjing (Panel (b)). When the national capital relocated to Beijing (Panel (c)), the prefecture became even further isolated and as a result, Luzhou never regained its capital status.

In contrast, Changsha, which as provincial capital of Jinghu South province during the Song Dynasty was relatively close to the national capital and the other prefectures in the province (see Panel (a) of Appendix Figure A.2), became rather isolated in the Yuan and Ming dynasties and lost its provincial status (Panel (b)). It regained its capital status in the Qing Dynasty, however, because of national capital relocation and provincial redivision (Panel (c)).

For our baseline analysis, we map the historical data onto the 261 prefectures existing in the year 2000 and construct a panel dataset. Of these 261 prefectures, 63 were at some time a provincial capital (see their locations in Figure 1): 36 lost their capital status once, 11 gained their capital status once, 8 have experienced multiple changes, and 8 have always been capitals. See Table 1 for a summary of provincial capital changes across regimes.

The relative geographical position is a systematic factor that affects provincial capi- tal relocation. In addition to this systematic factor, idiosyncratic factors could also affect provincial capital status. For instance, if a prefecture might lose its provincial capital sta- tus if it lost a large proportion of population during the regime-shifting wars. As we will show, the systematic variation provides us a useful instrument to deal with the concerns of idiosyncratic factors.

At this time, it should be noted that each province has always had only one capital except during the Song dynasty when the central government limited the power of local governments by spatially separating capitals according to fiscal affairs, judicial affairs, and welfare (Mostern 2011). As a result, the majority of provinces had two provincial capitals, one for fiscal affairs and one for judicial affairs and others.9 This feature is helpful, because we have a broad set of possible candidates for provincial capitals to start with. We include both in our baseline analysis and show that our findings are robust to dropping the Song (and any particular regime).

2.2 Changes in Provincial Capital: A Simple Algorithm

A Simple Algorithm We will provide a simple algorithm to predict where to locate provincial capitals. Our aim here is not to model all the factors that affect provincial capital choice; instead, we use the algorithm for two purposes: (1) to illustrate the political logic of provincial capital location, and (2) to provide an instrument for provincial capitals in our empirical analysis. Because of the second purpose, we would like to employ as few and exogenous variables as possible, conditional on the fact that the algorithm should be a strong predictor of provincial capital location.

Why does provincial capital status change? The background discussion suggests that this question can be answered from the perspective of the decision maker – the central government. When deciding where to locate the provincial capital, the central government would consider multiple factors, two of which are particularly important: the governance of, and gathering resources from, a province. As a result, two factors are likely to matter: (i) the costs of gathering resources from all prefectures in a province into the provincial capital, proxied here by distance to other prefectures in the same province; and (ii) the costs of delivering a portion of these resources to the national center, proxied by distance to the national capital. Because the ruler of a new regime relocates its national capital and redraws its provincial boundaries, both types of costs could vary greatly, creating wide variation for

9In a few cases, as Figure 2(a) shows, there was only one or as many as three provincial capitals.

us to explore empirically.

Expressed formally, the central government's choice of a capital for a province with prefecture i = 1,2, ..., N is a solution to minimize the following specification, which we term "hierarchical distance" (denoted by HierDist):

$$\underset{i}{\operatorname{argmin}}\ HierDist_{i,t} \equiv \sum_{j=1}^{N} A_j D_{i,j,t} + \lambda \sum_{j=1}^{N} A_j D_{i,NationalCap,t} \quad (1)$$

where $D_{i,j,t}$ indicates the distance from i to another prefecture j in the same province in period t, and $D_{i,NationalCap,t}$ indicates a prefecture's distance to the national capital. A_j is a weight variable – such as the area of prefecture j – to capture the scale of resources. Likewise, λ is a weight value that captures the relative importance of delivering resources to the center versus keeping resources within a province. Given one unit of resource, λ can be considered the share that must be delivered to the national capital. If $\lambda = 0$, only the within-province distance matters, so the provincial capital will be located in the provincial centroid. With an increase in λ, however, the provincial capital will be located increasingly closer to the national capital. Because we have no strong prior on the value of λ, we use the value with the most explanatory power ($\lambda = 0.19$) but also demonstrate that our results are robust to using alternative values.[10]

Although we motivate hierarchical distance from the perspective of gathering resources and distribution, one can also interpret it as the cost of distributing resources and information. Both interpretations imply the solution to equation (1).

We can extend the algorithm in several ways such as allowing λ to vary across regimes and using a more flexible weight variable A_j. However, we prefer not to do so because we will use $HierDist_{i,t}$ later as a possible instrument – for this purpose, it is useful to keep the algorithm as exogenous as possible.

Our Assumption on Provincial Boundaries When considering the change in provincial capitals, we take provincial redivision as given. One may wonder, however, whether the central government redefine the provincial boundary in order to benefit a potential capital prefecture. We have three remarks on this concern.

First, as discussed in the background, boundary changes stem from the evolution of two principles, which are not likely to be affected by a specific prefecture. Moreover, based on historians' work mentioned earlier, we know that boundary changes in the three regions with

10The choice is based on the magnitudes of R-squared in the following regression: $ProvCap_{i,t} = \theta HierDist_{i,t} + Prefecture_i + year_t$, where $Prefecture_i$ and $year_t$ indicate prefecture and year fixed effects. Varying the value of λ in $HierDist_{i,t}$, we find that the R-squared is the highest when $\lambda = 0.19$.

the Yellow River, the Yangtze River and the Qin Mountain (mapped in Appendix Figure A.1) were particularly driven by the two principles. We can separate provinces within these regions from the rest when using $HierDist_{i,t}$ as an instrument. Second, because changing one province's boundary naturally affects all the neighboring provinces, it is not easy to redefine provincial boundary for the sake of one single prefecture. Existing administrative histories have documented the dates of provincial capital designation (e.g., Zhang (1739) for the Ming Dynasty). In all the cases, a prefecture was designed as a provincial capital conditional on the existence of a province. We are not aware of any case that the central government created a province for the sake of a prefecture.

Third, if one assumes that the central government redefine the provincial boundary in order to benefit a potential capital prefecture, one can take losing capital status as an exogenous event. In our empirical analysis, we will also separate losing capital status from gaining capital status.

Depiction of Hierarchical Distance In Figure 2, we graph the location of provincial capitals across major regimes (Song, Yuan, Ming, Qing, and 2000) using the case of $\lambda = 0.19$ and marking provincial centroids with crosses and regions with hierarchical distance below the provincial mean with shading. These maps reveal a clear pattern: consistent with our logic of hierarchical distance, the provincial capitals in each regime are likely to be located away from the provincial centroid and toward the national capital.

We also plot the probability of being a provincial capital by a prefecture's rank in the province in terms of hierarchical distance (see Figure 3). As panel (a) shows, for the prefectures that rank first (which vary across periods), the probability of being a provincial capital is around 0.38, whereas for those that rank second, it is around 0.27. This probability decreases as rank increases: once the rank is over 5, the probability becomes lower than 0.1; once it is above 10, the probability is close to 0. The nonlinear pattern also suggests a linear relation between logged rank and probability of being a capital when the rank is lower than 10, one that is confirmed by the pattern in panel (b).

In sum, regime changes led to the relocation of provincial capitals based not on random decision but the logic of political control. Hence, by understanding this logic and exploiting the wide variation produced by regime change, we can identify the consequences of capital status (see Section 4).

3 Data and Descriptive Patterns

Prior to explaining the descriptive patterns that motivate our analysis (Section 3.2), we first describe our main analytic variables whose summary statistics and data sources are given in Appendix Table A.1.

3.1 Prefecture-Level Data

Population Density in 980-2000 Because population density information is the most comprehensive data with which to measure long-term economic development, our baseline estimations employ population data for 11 years based on all the existing censuses – 980, 1078, 1102, 1393, 1580, 1776, 1820, 1851, 1910, 1964, and 2000 – and calculate population density based on prefecture boundaries in 2000 (see Appendix Figure A.3 for population trends and density over time).

In our analysis, we drop these years one by one to ensure that our results are robust to different periods. We also employ subperiods of roughly equal length (e.g., one period for each regime) to ensure that our findings are not driven by the length of periods.

We are also able to access population data in years of 1880, 1953, 1982 and 1990. But as mentioned above, one challenge we face is the uneven gap between periods and including these years would make the gap even more uneven. So we intentionally exclude them in our baseline and include them as a robustness check.

Urbanization in 1580-2000 Compared with population data, urbanization data are less systematically available, being accessible for only four of our 11 periods: 1580, 1820, 1964, and 2000. The 1580 data are estimated based on local gazetteers,[11] the 1820 data are from CHGIS (2007), and the 1964-2000 information is taken from population censuses. By plotting the correlations between urbanization and population density in 1580 and 2000 (see Appendix Figure A.4), we reveal a strong link between these two measures, with correlational coefficients of 0.44 in 1580 and 0.47 in 2000. This comparison can thus be considered a validity check of our data.

Provincial Capitals and Boundaries We use CHGIS (2007) information on the bound- aries and provincial capitals from the Ming Dynasty to 2000 and digitize the information for the Song Dynasty based on the Treatise of the Nine Regions from the Yuanfeng Reign

11We thank Cao Shuji, a leading scholar in Chinese population history at Shanghai Jiaotong University, for providing this information. The historical urbanization data in 1580 and 1820 are estimated based on the population living inside and outside walled cities.

(1078-1085), a Song imperial geography. As expected, the variation in the provincial boundaries and capitals comes from cross-regime variation (i.e., they were set up at the beginning of each political regime). To construct our panel dataset, we use the boundaries for the 261 prefectures in 2000 as the baseline unit of analysis. To make sure that our results are not driven by how we define the prefecture boundary, we also conduct a 1-degree × 1-degree grid-level analysis in which the 261 prefectures are divided into 361 grids.

Additional Prefecture Characteristics We capture a prefecture's characteristics by including three sets of additional variables: factors related to geography, agriculture, and regional location. The geographic variables include whether a prefecture contains a plain or major river or is on the coast, as well as its slope, elevation, longitude, and latitude. The agricultural variables include the crop suitability of wheat, rice, fox millet, maize, and sweet potato (FAO GAEZ 2012), the first three being major old-world crops; the latter two introduced through the Columbian exchange. By allowing these crops' impacts to vary by year, we control for changes in land productivity.12

For our comparison of prefectures within a given macroregion, because the dramatic historical shift in provincial boundaries precludes a straightforward within province comparison, we use the nine physiographic macroregions defined by Skinner (1977): the north China plain, northwest, lower/mid/upper Yangtze, southeast coast, Lingnan, Yun-Gui, and Manchuria (see the map in Appendix Figure A.5). According to Skinner, these macrore- gions, which he defines based on major river drainage basins and other travel-constraining geomorphological features, are a better measure of markets because provincial boundaries emerged for political reasons rather than economic consideration.

By listing the correlations between these characteristics and ever-capital status in Appendix Table A.2, we demonstrate that having a plain and a major river matters for status because of their importance for building a city. Because the characteristics are time invariant and will be adsorbed by prefecture fixed effects in our analysis, we will also allow their impacts to vary by period.

3.2 Provincial Capitals and Regional Development: 980 & 2000

Before analyzing our 11-period panel data, we present descriptive patterns based on the 980 and 2000 data, a two-period structure that allows us to depict the main pattern by catego- rizing the prefectures into four groups:

to 12See using Nunn Galor and and

Qian Ozaka ¨

(2010) for a review of the exchange's influence. Although our results are all robust (2016) caloric suitability as an alternative measure, we focus on crop-specific suitability for simplicity.

(1) capitals in both periods, denoted by “yes-yes” (2) capitals in 980 but not in 2000, denoted by “yes-no” (3) capitals in 2000 but not in 980, denoted by “no-yes” (4) not capitals in either period, denoted by “no-no”

In Panel (a) of Figure 4, the x-axis indicates the standardized logged population density in 980, while the y-axis indicates the standardized logged light density in 2000. These patterns remain similar if we use logged population density instead of logged light density in year 2000 (see Appendix Figure A.7).

Our analysis of the prefecture groups (see Figure 4) reveals systematic changes, as indicated by the four crosses. In particular, an average “no-no” prefecture group was close to mean in both periods and an average “yes-yes” prefecture was above the mean in both periods. In contrast, an average “no-yes” prefecture was 0.3 standard deviation below the mean in 980 yet became one standard deviation above the mean in 2000, indicating that gaining capital status is correlated with better economic development. An average “yes-no” prefecture was 0.5 standard deviation above mean and comparable to a “yes-yes” prefecture in 980 (when both were provincial capitals), but it became close to the mean and similar to a “no-no” prefecture in 2000 after losing capital status. Next, we will quantify these changes with different methods based on multiple-period data.

4 Provincial Hierarchy and Regional Development: Empirical Results

We study how much capital status matters for economic development using both a difference-in-differences method (Section 4.1) and an IV approach (Section 4.2), and summarize several additional checks in Section 4.3.

4.1 Difference-in-Differences Analysis

Baseline Results Our baseline estimation examines the correlation between provincial capital status and population density in 980, 1078, 1102, 1393, 1580, 1776, 1820, 1851, 1910, 1964 and 2000. We also show that the results are robust to dropping any specific year or using subperiods of roughly equal length. Our difference-in-differences estimator is as follows:

$$lnPopDensity_{i,t} = \beta Capital_{i,t} + \alpha_i + \gamma$$

$_t + \theta X_i \times \gamma_t + \theta \pi_m \times \gamma_t + \varepsilon_{i,t}$, (2) indicates where $Capital_{i,t}$ whether a prefecture i is a provincial capital in year t. Here, we control for prefecture characteristics that do not vary or vary slowly over time (e.g., geography) and the factors affecting all prefecture similarly (e.g., dynasty cycles) by including prefecture fixed effects (α_i) and year fixed effects (γ_t). X_i is two sets of prefecture characteristics: (i) geographical variables including whether a prefecture contains a plain or major river or is on the coast, as well as its slope, elevation, longitude, and latitude, and (ii) agricultural variables including the five types of crop suitability. We allow X_i's effects to vary across time by controlling for X_i) to compare prefectures within the same macroregions, again allowing their effects to vary by year (indicated by $\pi_m \times \gamma_t$. We also use the Skinner measures ($\pi_m \times \gamma_t$). All standard errors are clustered at the prefecture level. The resulting estimates indicate that provincial capital status is associated with a 40- 50% higher population density. Column (1) of Table 2 presents the result with all the fixed effects, as well as logged area and its interaction with γ_t ; columns (2) and (3) add other geographical features and five-type crop suitability and their interactions with γ_t. When applying a first-difference strategy to our data, we obtain estimates in the same range (columns (4)-(6)). We further separate capital status loss from capital status gain and find that both have a sizable impact (columns (7)-(9)): gaining capital status is associated with a 44-52% increase in population density, whereas losing capital status is associated with a 40% decrease in population density.

The finding on losing capital status suggests that the omitted variable concern may not be essential; otherwise, we would observe that losing capital status matters little. Moreover, it indicates that the advantages brought by capital status did not necessarily last in the long run. We will turn to understanding the factors underlying this finding in Section 5.

Ever-Capital Prefectures The 63 prefectures that were a provincial capital at least once serve as a useful subsample for examining the importance of capital status because the variation within them comes only from gaining or losing such status, with no omitted variables preventing any one prefecture from becoming a capital. We use this information in two ways. The first is to focus on this subsample; the second is to further control for $EverCapital_i \times \gamma_t$ in our analysis, which allows this subgroup to exhibit trends different from the other prefectures.

When focusing on the subsample of ever-capital prefectures, we find a similar pattern (Appendix Table A.3, columns (1)-(2)). The estimates are slightly lower (31-46%) than those in Table 2, because we exclude the never-capital prefectures in the comparison group.

When including $EverCapital_i \times \gamma_t$ for the full sample, our estimates are close to those in Table 2, whether we use the level specification (Appendix Table A.3, columns (3)-(4)) or the first-difference specification (Appendix Table A.3, columns (5)-(8)).

Although using ever-capital prefectures does not fully address the endogeneity concern, these results suggest that our baseline finding cannot simply be explained by the omitted variables affecting whether a prefecture could ever serve as a provincial capital.

Dealing with Uneven Gaps Our data come from the censuses conducted by the central government, which are of low-frequency with uneven gaps over the millennium. We employ two methods to deal with this challenge.

First, in our analysis, we did not include four additional years (1880, 1953, 1982, 1990) that would make the gaps more uneven. Including them (column (2) of Appendix Table 3) delivers an estimate (0.50) close to our baseline (0.51, replicated in column (1)). Now we further restrict our sample to be of roughly equal length. We use the data in 980, 1393 and 1820 to construct a subsample (of a gap around 400 years) and those in 980, 1102, 1393, 1580, 1820 an 2000 to construct another subsample (of a gap around 120-180 years). The estimates from these two subsamples are 0.51 and 0.58 (columns (3)-(4) of Table 3), close to our baseline estimates, suggesting that our results are not driven by the gaps.

Moreover, our findings hold if we exclude any specific regime (Appendix Table 3, columns (5)-(9)). In particular, when excluding modern China (column (8)), we obtain an estimate of 0.47. Thus, our finding holds without modern periods.

Second, we conduct a period-by-period analysis where we define periods relative to the period before the change in capital status (denoted by period0). Due to the frequency of data availability, we have more periods after capital status change than those before change. Thus, we divide the pre-periods before period0 into 1-75 years before 0, and 75+ years before 0; the post-periods into 1-75 years after 0, and 76-150 years after 0, 151-300 years after 0 and 300+ years after 0.

Replacing $Capital_{i,t}$ with $\sum_{\tau=-75+}^{300+} \beta_{\tau} Capital_{i,\tau}$ and using period0 as the reference group, we find no significantly different trends in population density between the capital group and other prefectures until the status changes. These results are presented in Appendix Table A.4. Figure 5 further visualizes the findings, where the lines connect the estimates and the dotted lines indicate the 95% confidence intervals. As shown, both the increase and the decrease in population density occur only after gaining and losing capital status.

Besides addressing the concern of uneven gaps, these patterns also imply that it is difficult to use population trends per se to explain our baseline findings.

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4.2 Rank in Hierarchical Distance as an Instrument

Our analyses above have shown that time-invariant omitted variables are unlikely to account for our baseline finding. Nevertheless, there could still be a concern of time-variant omitted variables. To deal with this concern, we will conduct an instrumental variable (IV) analysis by exploiting hierarchical distance.

As explained in the background, the changes in a prefecture's hierarchical distance stem from relocation of national capitals and redivision of provincial boundaries, which are unlikely to be driven by a prefecture's own characteristics. Moreover, as illustrate in Figure 3, a prefecture's rank in hierarchical distance within a province is indeed strongly correlated with the probability of being a provincial capital. Thus, hierarchical distance rank seems a viable instrument for provincial capital status.

For hierarchical distance to be a valid instrument, however, we must ascertain that (i) it is not driven by a prefecture's pre-change characteristics and (ii) it satisfies the exclusion restriction that it should not affect economic development via channels other than capital status. Next, we will provide tests for condition (i), present the IV estimates, and then discuss condition (ii).

Validity Checks To determine whether the change of a prefecture's hierarchical distance is not driven by its own characteristics, we conduct three sets of tests. In the first, we show that ($\Delta lnRankHierDist_{i,t}$) is not significantly correlated with past levels of logged population density ($lnPopDensity_{i,t-1}$ and $lnPopDensity_{i,t-2}$) or past changes in logged population density ($\Delta lnPopDensity_{i,t-1}$ and $\Delta lnPopDensity_{i,t-2}$) (see Table 4A, columns (1)-(6)). Across all specifications, the correlation between $\Delta lnRankHierDist_{i,t}$ and past population density (or its change) is close to zero. These results indicate that the change in hierarchical distance rank is not driven by any change in population density.

In the second test, because it seems unlikely that the central government would intentionally increase a prefecture's hierarchical distance to make it lose its capital status, we separate the impacts of changed hierarchical distance on losing versus gaining status. Our seemingly unrelated regressions show that the impact of hierarchical distance rank has a similar magnitude for both cases (Table 4B): a one log point increase (and decrease) in hier- archical distance reduces (and enhances) the probability of being a provincial capital status by 2.6 percentage points (and 3.1 percentage points).

Finally, we separate prefectures within the three regions with the Yellow River, the Yangtze River, and the Qin Mountain from the other prefectures. As discussed in the background, historians have explicitly documented that provincial boundary changes in these regions were driven by the two principles. We find that hierarchical distance rank matters both within and outside these regions (Table 4C). This findings further suggest that our assumption on provincial boundaries is not unwarranted.

IV Estimates In our IV estimates, we focus on logged hierarchical distance rank because of its linear relation with the probability of being a provincial capital (Figure 3(b)). Our first-stage and second-stage specifications are as follows:

$$Capital_{i,t} = \delta \ln RankHierDist_{i,t} + \alpha_i + \gamma_t + \theta X_i \times \gamma_t + \theta \pi_m \times \gamma_t + \varepsilon_{i,t}, \quad (3)$$

and

$$\ln PopDen_{i,t} = \beta \widehat{Capital}_{i,t} + \alpha_i + \gamma$$

t

$+ \theta X_i \times \gamma_t + \theta \pi_m \times \gamma_t + \varepsilon_{i,t}$, (4)

where X_i includes all the controls in our difference-in-differences analysis. These IV estimates, whose reduced form is reported in column (1) of Table 5, provide further support for our main findings. The F-stat from the first stage is 125.8 (reported in the lower panel of column (4)), implying that instrument weakness is unlikely to be a concern. The IV estimate using $\lambda = 0.19$ is around 0.70 (the upper panel of column (4)), and ranges from 0.57 to 0.81 when we vary λ (see columns (2)-(6) Appendix Table A.5). In addition, our results are also robust to extending the linear functional form of the distances in equation

(1) to a nonlinear form (i.e.,

$\sum_{j=1}^{N} A_j D^{\alpha}_{i,j,t}$

and

$\sum_{j=1}^{N} A_j D^{\alpha}$

i,NationalCap,t

). The IV estimates remain

in a comparable range when we take α = 0.5 or α = 2 (columns(7)-(8) of Appendix Table A.5). Thus, these IV estimates are not far from those from our DID analysis.13

Nevertheless, because an instrumental approach raises the concern of whether the instrument may affect channels other than capital status, we conduct three sets of tests for whether our findings are specific to political capital status. First, we examine whether hierarchical distance affects population density for the never-capital prefectures. Second, we use placebo hierarchical distances by exploiting the relocation of national capitals. Finally, we examine whether our findings are confounded by distances to major market centers.

(i) Hierarchical Distance for Never-Capital Prefectures We find that our IV results are driven by the variation within the ever-capital prefectures (Table 5, column (2)). In contract, hierarchical distance is not significantly correlated with population density for the

13Two reasons could be consistent with the pattern that the IV estimates are slightly larger. If the selection of capitals favors the prefectures with a large population and population growth exhibits convergence pattern, our DID estimates would be an underestimate. As we will document in Section 4.3, population density growth is indeed negatively correlated with lagged population density. In addition, the pattern can also be explained as a local treatment effect.

never-capital prefectures (column (3)). This finding is reassuring: if hierarchical distance affects population density regardless of capital status, we expect to see that it also matters within the never-capital prefectures. This is not the case.

(ii) Placebo Hierarchical Distances For this test, we exploit the change in national capital status to construct a set of placebo hierarchical distance ranks. For instance, we calculate one such placebo to Kaifeng when Kaifeng was not a capital and similar ones for Nanjing and Beijing before they became national capitals. Because these placebo measures are correlated with our instrument, some of them are also correlated with the probability of being a capital. However, including these placebo hierarchical distance ranks does not alter our IV estimate. Nor does it affect population density, implying that our findings are specific to these cities' political status (Table 5, columns (5)-(7)).

(iii) Distance to Major Market Centers To check whether our findings are confounded by distances to major market centers, we calculate a prefecture's (hierarchical) distance to three types of market centers: the north China plain during the Song Dynasty and the lower Yangtze after the Song (cf. Skinner 1977), Shanghai in the east, and Guangzhou in the south. To calculate the ranks of these distances, we replace $D_{i,NationalCap}$ in equation (1) with $D_{i,Market}$. Like the placebo distances, these ranks are also correlated with our instrument and thus may be correlated with the probability of being a capital. However, once again, none explains the role of our hierarchical distance (Appendix Table A.6). Thus, this finding shows that the hierarchical distance to the political center (instead of national economic centers) is the driver of our finding on capital status.

Taken together, these results indicate that capital status is a critical channel through which hierarchical distance rank can affect economic development.

4.3 Additional Results

Although our primary analyses focus on changes in population density across (year 2000 defined) prefectures in 980-2000, our findings considering lagged population density and important war shocks, using urbanization (instead of population density), or employing grid-level data (instead of year 2000 prefectures). In addition, we present heterogeneous effects over time and across space. We summarize these findings below and detail the results in the appendix.

Considering Lagged Population Our baseline finding is robust to controlling for lagged population density, $\ln PopDensity_{i,t-1}$

and $\ln PopDensity_{i,t-2}$ (reported in Appendix Table A.7). The negative coefficient on $\ln PopDensity_{i,t-1}$ indicates a convergence pattern, i.e., less dense prefectures grow faster. Once $\ln PopDensity_{i,t-1}$ is included, $\ln PopDensity_{i,t-2}$ matters

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little. The coefficients on provincial capital status are stable across specifications and slightly lower than our baseline estimates.

War Shocks Political regime changes often involved deadly wars. It is possible for a prefecture to lose its capital status if it experienced a large decline in population during the regime-shifting wars. Our instrument above is not correlated with the war shocks and hence mitigates this concern. Here, we also examine these shocks directly. Specifically, for each prefecture, we calculate population shock for three major regime changes, i.e., population change from 1102 (Song) to 1393 (Ming),14 from 1580 (Ming) to 1776 (Qing), and from 1910 (Qing) to 1953 (P.R.China). We find that the first shock is negatively correlated with provincial capital status but not the other two (Appendix Table A.8, columns (1)-(4)). When allowing each shock to impact the population in the dynasty following it, we obtain similar estimates to our baseline analysis (columns (5)-(8)). Together with our IV estimates, we find that our findings are not driven by war shocks.

Urbanization as an Outcome Because it is difficult to define cities over such a long period, our primary analyses focus on a prefecture's population density. In additional es- timations, however, we also consider alternative outcomes using urbanization data for the latter half of the millennium (1580, 1820, 1964, 2000), which test whether our results hold after data from the first half of the millennium are excluded.

We find that provincial capital status has a similarly strong impact on urbanization (Appendix Table A.9) as on population density, being associated in these years with an 12 percentage point higher urbanization ratio, that is, 68 percent of the mean (columns (1)-(2)). When population is divided into urban and non-urban, the impact of capital status is more important for the former than the latter (columns (3)-(6)), with the coefficients of 0.7 for log urban population, and 0.18 for log rural population.

Grid-Level Analysis To build a panel dataset, we choose to fix prefectures using the 2000 boundary information in our baseline analysis. In addition, we can map all our data onto 1-degree × 1-degree grids by by assuming an evenly distributed population within each prefecture. We now have 361 grids instead of 261 prefectures.

The grid-level analysis again generates patterns close to our prefecture-level analysis (Appendix Table A.10), indicating that our findings are robust to alternative boundary definitions.

14We do not have population data for the Yuan dynasty.

Heterogeneous Effects We are interested in whether the importance of provincial capital status varies greatly across regimes. Limited by the number of changes, we first examine the cross-sectional correlations between provincial capital status and population density period by period. After controlling for geographical and agricultural variables (X_i) and region fixed effects (π_m) in our baseline specification, we find that the coefficients of provincial capital on logged population density ranges from 0.42 to 0.68 (presented in Appendix Figure A.6). Based on these cross-sectional correlations, we find that provincial capital status is important in each regime and appears to be slightly larger in modern China. Using the panel same specification as our baseline analysis, we can divide the data into pre- and post- 1820 to examine whether the importance of capital status change varies by modernization. Specifically, we examine the coefficient of $ProvCapital \times (Year > 1820)$. Consistent with the cross-sectional pattern, we find that the coefficient of $ProvCapital \times (Year > 1820)$ is insignificantly positive and small in magnitude (Appendix Table A.11, column (1)).

An auxiliary prediction of our baseline finding is that the impact of provincial capital status is less important for prefectures that enjoy natural advantages because for them, resources brought by capital status is less critical. Thus, we can use this hypothesis as a sanity check of our baseline findings. To test it, we proxy natural advantages by agricultural suit- ability (provided by Galor and Özak (2016)) and land quality. When dividing prefectures into high and low calorie suitability (based on the median value), we find that capital status matters less for the high group (Appendix Table A.11, column (2)). Similarly, capital status matters less for the group with gently sloping land (columns (3) and (4)). Moreover, these heterogeneous patterns appear to be similar before and after 1820 (columns (5)-(7)).

5 Discussion of Underlying Factors

We have documented that capital status clearly matters for economic development proxied by population density and urbanization. What, then, explains this politico-economic link? One can conjecture that many factors alter along with political status including jobs, people and resources, which makes it impossible to enumerate each one. We thus takes an alternative approach by focusing on three factors, on a spectrum from being very malleable to being very persistent.

First, we discuss the channel of reallocating public offices (Section 5.1), which can be considered mechanical and is among the most malleable ones. Then, we turn to the other end of the spectrum by examining human capital (Section 5.2) and transportation networks (Section 5.3). We focus on these two, partly because they are less malleable, partly because we can build a panel dataset to examine the impact of capital status change.

Using this approach, we have to miss some factors. For instance, Chen et al. (2017) argue that firms in provincial capitals get cheaper loans from the government. For this type of analysis, one has to rely on cross-sectional variation in capital status. In addition, it is challenging to find a historical counterpart on access to credit. Therefore, instead of listing every possible factor, we only focus on three factors to illustrate the logic.

5.1 Relocation of Public Offices: Back-of-envelope Analysis

Public offices move with provincial capitals. However, considering the size of public employment in history and today, it seems difficult for this channel to explain a large part of our findings. For instance, in the mid-19th century, the gentry and their immediate family members accounted for around 2% of the population (Chang 1955). Since the gentry class provides the talent pool for public employment, this number is likely to be an upper bound of the size of public employment. For modern China, the size of public employment is es- timated to be around 3-3.5% of population in the 2000s (Local Fiscal Statistical Materials 2000-2007, Ang 2012).

Unfortunately there are no comparable prefecture-level data by occupation from his- tory to today. To gauge the importance of this factor, we conduct a back-of-envelope analysis using cross-sectional census data in 2000. Public employment in our data refers to that in all administrative and social organizations, and that in public institutions (including physi- cians and teachers in public hospitals and schools). Since some of the jobs in the social organizations are private, our estimate of public employment is slightly higher than those in the existing studies. Specifically, our estimate is 5.9% of total employment or 4.4% of population.

Provincial capital status is associated with over 61% higher total employment (Table 6, column (1)). Capital status indeed matters for public employment, with coefficients of 0.98 for log employment in administrative and social organizations, and 1.26 for log employment in public institutions. However, given the small share of public employment in the total employment, this factor can only explains around 11% of the impact on total employment (0.068/0.610). As expected, public employment is dramatically affected by capital status, with an elasticity close to 1. However, due to its small share in the total employment, it is difficult for this channel alone to account for a large part of our baseline finding.

Public employment can also affect private employment. For instance, the historical and sociological discourse on administrative cities often emphasizes that merchants and artisans moved to political centers to serve the bureaucrats. Existing estimates of the spillover effect of public employment on total private employment are less than one (e.g., Faggio and Overman

(2014), Becker, Heblich, and Sturm (2018)).15 While it is possible that this spillover effect is larger in the Chinese context due to its political centralization, one has to assume a ten-fold multiplier effect for this channel to explain our finding.

Next, we turn to two other factors to illustrate the importance of capital status in shaping underlying economic factors, which has not been considered in the existing discourse.

5.2 Change in Human Capital

In additional to being less malleable, we would like to examine human capital for another reason: it is useful to know whether talents move with capital status. To measure human capital in history, we employ the number of presented scholars (the highest degree in the imperial examination, known as Jinshi in Chinese) in the Qing dynasty. For modern human capital, we use the number of individuals with high school education and above. We nor- malize the former by population size in 1776 (mid-Qing) and the latter by population size in 2000.

Similar to our descriptive pattern in Figure 4, we divide all the prefectures into four groups based on a prefecture capital status in the Qing and in 2000 (“No-No”, “Yes-Yes”, “Yes-No”, and “No-Yes”). Figure 6 illustrates the pattern, where the x-axis indicates the standardized log Jinshi per capita in history, and the y-axis indicates the standardized log individuals with high school or above per capita in 2000. These two measures are positively correlated, indicating some persistence of human capital. However, we also observe that human capital varies systematically within gaining and losing capital status. For instance, those gaining capital status (the “No-Yes” group) are similar to the “Yes-Yes” group in 2000 in terms of modern human capital, even though they were at lower level in the Qing dynasty. In contrast, those losing capital status (the “Yes-No” group) were comparable to the “Yes-Yes” group in the Qing dynasty (when both were capitals) but performed worse in 2000, became more comparable to “No-No” group.

These patterns are confirmed by regression analysis in Table 7. Because we are using two different measures, it is not straightforward to calculate change in human capital. We employ two ways to deal with this change. One is to use the standardized measure for both periods; the other is to categorize human capital in both periods into deciles and use the change in decile rank as the dependent variable (a higher rank indicate more human capital). As shown in Table 7, gaining (losing) capital status is associated with better

15Using English data at the Local Authority level for 2003-2007, Faggio and Overman (2014) find that public sector employment has no identifiable effect on total private sector employment. Exploiting the relocation of the German federal government from Berlin to Bonn in the wake of the Second World War, Becker, Heblich, and Sturm (2018) find that each additional public sector job destroyed around 0.2 jobs in industries and created just over one additional job in other parts of the private sector.

(worse) human capital. Thus, human capital also moves with the change in a prefecture's political importance.

5.3 Change in Transportation Networks

We are interested in transportations for several reasons. First, due to the high fixed costs to build new transportation networks, one expects transportation networks to exhibit persis- tence (which is also true in our context). If they are also changed systematically by political hierarchy, it further illustrates the importance of politics for our finding.

Second, transportation networks are critical for the state to collect resources and in- formation. From history to today, the Chinese state has been the largest single investor in transportation and communications facilities. By examining the transportation networks, we can get a better understanding of the organization of the state.

Empirically, transportation networks experience great changes across regimes, due to two sets of reasons. First, it is costly to maintain routes. Due to the lack of maintenance, many land routes disappear; several parts of the Grand Canal were ruined for a long period (Brook 1998). Second, when a regime replaced the previous one, the ruler decided which parts of the transportation networks to be reconstructed, which is likely to depend on the regions' relative importance in the political hierarchy. As a result, we obtain a unique opportunity to systematically investigate changes in the transportation networks.

Historical and Modern Transportation The historical transportation networks were comprised of the Grand Canal, which connected various waterways, and a state courier system (supported by many post offices). The aim of transportation networks was primarily political: to maintain an adequate flow of information, revenues, and personnel on which the state relied (Brook 1998). Meanwhile, by facilitating the movement of goods and people, these networks contributed to economic development.

Modern transportation is much more complicated than their historical counterpart. We choose to focus on railroad networks because they are monopolized by the state. To compare a prefecture's spatial importance in the transportation networks across periods, we employ standardized network measures for each period.

To assess how the transportation networks vary with capital status, we digitize roads and waterway maps for three historical periods (represented by specific years) – the Song (1078), Ming (1587), and Qing (1820) dynasties16 – and the railroad map for the People's Republic (1990).

16These maps are collected in the Historical Atlas of China (Cheng and Hsu 1980).

Capital Status and Spatial Centrality Although we can easily count the number of landways, waterways, and railways in a prefecture, we also want to account for the relative importance of different links in the transportation network. To this end, we employ a centrality measure, defined for each prefecture i as follows:

$$\text{Centrality}_i = \sum_{j \neq i} \frac{1}{d_{i,j}} = \sum_{j \neq i} \frac{1}{d_{i,N_i} + d_{j,N_j} + (1/\theta) d_{N_i,N_j}}, \quad (5)$$

where $d_{i,j}$ indicates shortest distance between i and j in the transportation networks.[17] In practice, $d_{i,j}$ comprises of three parts: d_{i,N_i}

$_i$ (and d_{j,N_j}) indicate the straight line distance from prefecture i (and prefecture j) to the network (point N_i and N_j); d_{N_i,N_j} indicates the minimum distance between point N_i and point N_j within the network. Following Fogel (1964) and Donaldson and Hornbeck (2015), we allow for a adjustment factor of 1.4 between the shortest straight-line distance and kilometers traveled and assume that the transporta- tion cost is four times high without the network, i.e., θ takes a value of 5.6. As in this literature, we will show that our results are not sensitive to the choice of θ .

Again, a prefecture's centrality in the transportation networks exhibits some persis- tence. Our focus, however, is to test whether changes in capital status lead to changes in spatial centrality. To this end, we replace the dependent variable in our baseline estimation with logged centrality and use it with the four-period panel data used in the transportation analysis. Since centrality is an abstract measure, we report standardized coefficient in Ta- ble 8. A provincial capital's centrality is about 0.2 standard deviation higher than that of the non-capital prefectures (column (1)). Similar to our baseline finding, gaining provincial capital status increases centrality whereas losing capital status implies a loss of centrality (column (2)). The latter finding provides further evidence that our result is unlikely to be driven by an endogenous assignment of capital status to better connected locations (which is of more concern for new capitals). These findings remain robust to employing different values of θ (columns (3)-(8)).

Since the capitals were assigned in the beginning of a dynasty whereas the transporta- tion networks were altered later, our finding on centrality is unlikely to be driven by reverse causality.

With four periods of data, we do not have the same power to conduct period-by- period tests as in Figure 5. Nevertheless, we separate the two periods before capital status change and show that centrality decreases (increases) only after the loss (gain) of capital status (Appendix Table A.12).

17One can also weight the distances by population and gets a measure similar to market potential (see more discussion on market potential and market access in Redding and Sturm (2008) and Donaldson and Hornbeck (2015). We focus on the unweighted measure to highlight the position in the transportation networks.

These findings show that even transportation networks vary with the political hierar- chy. Together with the earlier findings on public office and human capital, we argue that political capital status has a large impact on economic development because many under- lying economic factors flow with it. Once a prefecture lost its political advantages, these factors also moved away, which explains our finding on losing capital status.

6 Conclusions

Although political factors have long been argued to be important for economic geography, it is difficult to provide direct evidence of this claim without understanding what drives the political importance of certain regions. In the case of China, its combination of an enduring state, a distinctive political hierarchy, and many changes in national and provincial capitals make it a particularly advantageous context for examining the impact of politics on economic development. Our analysis demonstrates that both gaining and losing capital status affect regional development.

At the same time, given the growing literature documenting the persistence of economic activities, our finding of an association between losing capital status and worse development may appear surprising. Yet this observation is consistent with the underlying political logic we uncover. That is, we show that in a regime in which the political hierarchy guides the distribution of resources, the influence of political status goes beyond public offices, and matters for many underlying economic factors. Hence, not only do we throw important light on these observations by showing how political factors shape economic geography, but our approach offers a perspective on how to link the political economy literature with the research on both changes and the persistence of economic activities in the long term.

Our findings also have implications on the discussions on "the Oriental city" in history, sociology and other fields. In particular, it may be too narrow to consider "the Oriental city" simply as consumption-intensive parasite cities. In fact, important production factors also flow with political status such as human capital and transportation infrastructure.

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Notes: The shaded area indicate the prefectures in China proper (our sample). The dotted prefectures have ever been a provincial capital at least once during 1078-2000. This map is based on the prefecture boundaries in 2000: 63 out of 261 prefectures have ever been a provincial capital.

Figure 1: Capital-Ever Prefectures

31 Notes: This figure shows that provincial capitals are usually located away from provincial centroid toward the shaded region with a shorter hierarchical distance (weighted sum of distances to the national capital and the other prefectures within a province). We present two maps for the Song dynasty because provinces often had two capitals, one for fiscal affairs and one for judicial affairs and others. See Section 2.1 for more discussion.

Figure 2: Hierarchical Distance, National Capitals and Provincial Capitals

(a) Song

(b) Yuan and Ming

(c) Qing and 2000

Notes: The figure shows a strong negative correlation between a prefecture's rank in hierarchical distance (weighted sum of distances to the national capital and the other prefectures within a province) within a province and its probability of being a provincial capital, which confirms the pattern in Figure 2.

Figure 3: Rank in Hierarchical Distance and the Probability of Being a Provincial Capital

(a) Rank in Hierarchical Distance vs. Prob. of Being Capital

(b) ln Rank in Hierarchical Distance vs. Prob. of Being Capital

Notes: The figure shows that gaining and losing capital status is associated with a systematic change in a prefecture's economic performance (measured by population density in 980 and light density in 2000). An average "no-no" prefecture group was close to mean in both periods and an average "yes-yes" prefecture was above the mean in both periods. In contrast, an average "no-yes" prefecture was the below the mean in 980 yet became above the mean in 2000, indicating that gaining capital status is correlated with better economic development. An average "yes-no" prefecture was above mean and comparable to a "yes-yes" prefecture in 980 (when both were provincial capitals), but it became close to the mean and similar to a "no-no" prefecture in 2000 after losing capital status. Appendix Figure A.7 presents a similar pattern using population density in 2000 instead of light density.

Figure 4: Descriptive Patterns

Notes: This figure visualizes the results in Appendix Table A.4. It shows that there are no systematic differences before and after a prefecture gains or loses capital status. The reference group is the period before capital status changes.

Figure 5: The Impact of Capital Status on Population Density: Period by Period

(a) Before and After Gaining Capital Status

(b) Before and After Losing Capital Status

Notes: The figure shows that gaining and losing capital status is associated with a systematic change in human capital. An average "no-no" prefecture group was close to mean in both periods and an average "yes-yes" prefecture was above the mean in both periods. In contrast, an average "no-yes" prefecture was about 0.3 standard deviation higher than the mean in the Qing and became two standard deviation above the mean in 2000. An average "yes-no" prefecture was more than one standard deviation above mean and comparable to a "yes-yes" prefecture in the Qing (when both were provincial capitals), but it became close to the mean and similar to a "no-no" prefecture in 2000 after losing capital status.

Figure 6: Human Capital in the Qing Dynasty and 2000

Notes: This figure plots the transportation networks across regimes. In 1990, we focus on railway networks. We digitize the maps in the Song, Ming and Qing from Historical Atlas of China (Cheng and Hsu 1980)

.

Figure 7: Transportation Networks

(a) Song and Ming

(b) Qing and 2000

Table 1: Changes in Provincial Capitals, 1000-2000

			Ming		Qing		P.R.China (1964)		P.R.China (2000)	
			Capital	Non- capital	Capital	Non- capital	Capital	Non- capital	Capital	Non- capital
			15	246	19	242	21	240	24	237
Song	Capital	50	11	39	12	38	12	38	13	37
	Non-capital	212	4	207	7	204	9	202	11	200
Ming	Capital	15			14	1	13	2	13	2
	Non-capital	246			5	241	8	238	11	235
Qing	Capital	19					14	5	14	5
	Non-capital	241					7	235	10	232
P. R. China (1964)	Capital	21							21	0
	Non-capital	240							3	237

Notes: This table summarizes the change in provincial capitals across regimes. We omitted the Yuan dynasty from this table because we do not have population data in that regime.

Table 2: Baseline Results – The Impact of Capital Status on Population Density

ln Pop Density Δln Pop Density Δln Pop Density (1) (2) (3) (4) (5) (6) (7) (8) (9)

Prov. Capital 0.518*** 0.472*** 0.470***

(0.110) (0.105) (0.104) ΔProv. Capital 0.436*** 0.418*** 0.431***

(0.110) (0.106) (0.106) Gaining Capital Status 0.523** 0.436* 0.513** (0.257) (0.233) (0.221) Losing Capital Status -0.392*** -0.409*** -0.390***

(0.114) (0.114) (0.117)

Year FE * Crop suitability Y Y Y Year FE * Geography Y Y Y Y Y Y Year FE * ln Area Y Y Y Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Y Y Y Pref. FE Y Y Y Year FE Y Y Y Y Y Y Y Y Y Observations 2,871 2,871 2,871 2,610 2,610 2,610 2,610 2,610 2,610 R-squared 0.859 0.873 0.882 0.653 0.691 0.715 0.653 0.691 0.715 # prefectures 261 261 261 261 261 261 261 261 261

Notes: This table shows that provincial capital status is associated with a higher population density. Crop suitability refers to the suitability of rice, wheat, millet, sweet potatoes and maize. Geographical controls include whether a prefecture contains a plain, a major river, whether it is on the coast, as well as its slope, elevation, longitude, and latitude. Region refers to the 9-physiographic macroregions defined by Skinner (1977). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 3: Robustness – Reducing Uneven Gaps and Using Different Subperiods (Dependent Var.: ln Pop Density)

Baseline +smaller gaps Gap: ca400 Gap: ca120 Excluding: Song Ming Qing PR China Ming/Qing

(1) (2) (3) (4) (5) (6) (7) (8) (9)

Prov. Capital 0.514*** 0.501*** 0.512*** 0.575*** 0.369*** 0.485*** 0.626*** 0.473*** 0.665***

(0.142) (0.131) (0.154) (0.143) (0.123) (0.138) (0.154) (0.172) (0.173)

Song 980 Y Y Y Y Y Y Y Y 1078 Y Y Y Y Y Y 1102 Y Y Y Y Y Y Y Ming 1393 Y Y Y Y Y Y Y 1580 Y Y Y Y Y Y Qing 1776 Y Y Y Y Y 1820 Y Y Y Y Y Y Y 1851 Y Y Y Y Y 1880 Y Y Y Y 1910 Y Y Y Y Y P R China 1953 Y Y Y Y Y 1964 Y Y Y Y Y Y 1982 Y Y Y Y Y 1990 Y Y Y Y Y 2000 Y Y Y Y Y Y Y Y Year FE*Ever-capital Y Y Y Y Y Y Y Y Y Year FE*Crop suitability Y Y Y Y Y Y Y Y Y Year FE*Geography Y Y Y Y Y Y Y Y Y Year FE*ln Area Y Y Y Y Y Y Y Y Y Year FE*Region FE Y Y Y Y Y Y Y Y Y Pref. FE Y Y Y Y Y Y Y Y Y Year FE Y Y Y Y Y Y Y Y Y Observations 2,871 3,915 783 1,566 3,132 3,393 2,610 2,610 1,827 R-squared 0.882 0.887 0.887 0.891 0.893 0.885 0.903 0.864 0.915 # prefectures 261 261 261 261 261 261 261 261 261

Notes: Column (1)-(4) shows that our results are robust to keeping subperiods of roughly equal length; columns (5)-(9) show that our results are also robust to dropping any specific regime. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 4A: Validity Check I – Hierarchical Distance and Pre-change Characteristics

Δln Hierarchical Distance (1) (2) (3) (4) (5) (6)

lag. ln Pop Density -0.024 -0.019

(0.024) (0.030) lag2. ln Pop Density -0.022 -0.011

(0.022) (0.017) lag. Δln Pop Density -0.001 -0.003

(0.016) (0.019) lag2. Δln Pop Density -0.031 -0.032

(0.037) (0.038)

All baseline controls Y Y Y Y Y Y Observations 2,610 2,349 2,349 2,349 2,088 2,088 R-squared 0.300 0.300 0.301 0.300 0.301 0.301 #prefectures 261 261 261 261 261 261

Notes: This table shows that the change in hierarchical distance is not significantly correlated with the levels and changes in population density in the past periods. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 4B: Validity Check II – Gaining vs. Losing Capital Status

	Seemingly Unrelated Regression		
	ΔCapital Status	Gaining Cap.	Losing Cap.
	(1)	(2)	(3)
Δln Hierarchical distance	-0.057***	-0.026***	0.031***
	(0.019)	(0.004)	(0.005)
All baseline controls	Y	Y	Y
Observations	2,610	2,610	2,610
R-squared	0.182	0.192	0.298
#prefectures	261	261	261

Notes: This table shows that ln rank in hierarchical distance matters for both gaining capital status and losing capital status. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 4C: Validity Check III – Three Most Prominent Regions Affected by the Two Principles of Boundary Devision

	(1)	(2)	(3)
Prov. Capital = 0/1	All	Three most prominent regions	The other regions
ln Hierarchical distance	-0.091***	-0.063**	-0.138***
	(0.022)	(0.031)	(0.035)
All baseline controls	Y	Y	Y
Observations	2,871	1,320	1,551
R-squared	0.197	0.262	0.224
#prefectures	261	120	141

Notes: Historians have documented that provincial boundaries within the three regions where the Yellow River, the Yangtze River, and the Qin Mountain are located are particularly affected by the two principles of dividing boundaries. This table shows that ln rank in hierarchical distance matters for capital status both within and outside the three regions. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 5: IV Results – Using Hierarchical Distance as an Instrument

(1) (2) (3) (4) (5) (6) (7) Dependent var.: ln Pop Density

Reduced-form IV Sample All Ever-Capital Never-Capital All All All All

Prov. Capital 0.700*** 0.709*** 0.877** 0.650***

(0.234) (0.202) (0.446)

(0.230) ln Rank in Hierarchical dist. -0.064*** -0.141*** 0.000

(0.022) (0.038) (0.029) ln Rank in H dist. KF * Post- 0.001

(0.024) ln Rank in H dist.

NJ * Pre- 0.028

(0.047) ln Rank in H dist. BJ * Pre- -0.048 (0.044) All baseline controls Y Y Y Y Y Y Y Dependent var.: Prov Capital First-stage ln Rank in Hierarchical dist. -0.091*** -0.143*** -0.060*** -0.094***

(0.008) (0.011) (0.010)

(0.008) ln Rank in H dist. KF * Post- 0.086***

(0.012) ln

Rank in H dist. NJ * Pre- -0.054***

(0.011) ln Rank in H dist. BJ * Pre- 0.034** (0.017) All baseline controls Y Y Y Y Observations 2,871 693 2,178 2,871 2,871 2,871 2,871 R-squared 0.878 0.924 0.881 0.881 0.881 0.879 0.881 # Prefectures 261 63 198 261 261 261 261 F-Stat (first-stage) 125.8 172.7 35.4 130.0

Notes: This table presents the estimates using logged rank in hierarchical distance as an instrument. Columns (2)-(3) show that rank in hierarchical distance matters only in ever-capital prefectures but not never-capital prefectures, implying that capital status is critical for our IV finding. Columns (5)-(7) show that placebo hierarchical distances calculated based on placebo national capitals do not affect our IV estimates. These results include all the controls in our baseline specification (equation (2)). ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 6: Underlying Factors I – Provincial Capital Status and Public Offices in 2000

(A) Total employ. (B) Employ. in (C) Employ. in (D) =

Administ/Social org. Public institutions (A)-(B)-(C)

Effect on ln employment 0.610 2.24%*0.976=0.022 3.67%*1.256=0.046 94.09%*0.564=0.531 = (I) * (II)

(I) employment% 100 2.24 3.67 94.09

(1) (2) (3) (4) (II) Effect on ln (A) ln (B) ln (C) ln (D)

Prov. Capital 0.610*** 0.976*** 1.256*** 0.564***

(0.082) (0.082) (0.092) (0.081)

Crop suitability Y Y Y Y Geography Y Y Y Y ln Area Y Y Y Y Region FE Y Y Y Y Observations 261 261 261 261 R-squared 0.705 0.737 0.779 0.701

Notes: This table shows that public offices are affected by capital status but this channel only explains a small part of the impact on total employment. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 7: Underlying Factors II – Provincial Capital Status and Human Capital in the Qing Dynasty and 2000

(1) (2) (3) (4) (5) (6)

Standardized Decile ln (Jinshi per ln (high sch.+ (2)-(1) Jinshi per High sch.+ (5)-(4) capita, Qing) per capita, 2000) capita, Qing per capita, 2000 Prov. Capital 0.764*** 1.262*** 2.134*** 3.765***

(0.128) (0.210) (0.372) (0.363) Gaining Cap. Status 0.954*** 2.057** (0.287) (0.935) Losing Cap. Status -0.696** -1.535**

(0.284) (0.717)

Crop suitability Y Y Y Y Y Y Geography Y Y Y Y Y Y ln Area Y Y Y Y Y Y Region FE Y Y Y Y Y Y Observations 261 261 261 261 261 261 R-squared 0.507 0.586 0.540 0.437 0.602 0.464

Notes: This table shows that provincial capital status affects human capital. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table 8: Underlying Factors III – Provincial Capital Status and Spatial Centrality in 1078, 1580, 1820, and 1990

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\theta = 5.6$		$\theta = 2.8$		$\theta = 14$		$\theta = 28$	
	centrality	Δcentr.	centrality	Δcentr.	centrality	Δcentr.	centrality	Δcentr.
Prov. Capital	0.186***		0.141***		0.214***		0.227***	
	(0.048)		(0.033)		(0.062)		(0.070)	
Gaining Status		0.263***		0.196***		0.290**		0.294**
		(0.094)		(0.071)		(0.118)		(0.132)
Losing Status		-0.165**		-0.137***		-0.182**		-0.191**
		(0.067)		(0.053)		(0.078)		(0.085)
Year FE * Crop suit.	Y	Y	Y	Y	Y	Y	Y	Y
Year FE * Geography	Y	Y	Y	Y	Y	Y	Y	Y
Year FE * ln Area	Y	Y	Y	Y	Y	Y	Y	Y
Year FE * Region FE	Y	Y	Y	Y	Y	Y	Y	Y
Pref. FE	Y		Y		Y		Y	
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,044	783	1,044	783	1,044	783	1,044	783
R-squared	0.699	0.727	0.752	0.747	0.603	0.661	0.549	0.612
# prefectures	261	261	261	261	261	261	261	261

Notes: This table shows that provincial capital status affects the spatial centrality of a prefecture. θ captures the relative cost of traveling without and with the transportation networks. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

(b) The Yangtze River Example: Song

Notes: (a) presents the three most prominent regions where changes in provincial boundaries were driven by the evolution from "following the natural mountains and rivers" to "interlocking like dog's teeth". (b)-(d) present the Yangtze River example in more detail.

Online Appendix

Figure A.1: Two Principles of Provincial Boundary Devision and Boundary Changes

(a) The Three Most Prominent Regions Affected by the Two Principles

(c) The Yangtze River: Ming

(d) The Yangtze River: Qing

Notes: This figure presents two examples of provincial capital relocation. The cross indicates the provincial centroid, the hollow/solid star indicates the past/current national capital, and the hollow/solid square indicates the past/current provincial capital. Luzhou and Changsha were capitals in the Song. Both lost their capital status in the Ming. Changsha regained the capital status in the Qing but Luzhou didn't. These patterns are driven by the relocation of national capitals and redivision of provinces across regimes, which can be captured by the algorithm in equation (1).

Figure A.2: Examples of Provincial Capital Relocation

(a) Song

(b) Ming

(c) Qing

Notes: This figure shows that population density is strongly correlated with urbanization rates in both 1580 and 2000. The correlational coefficients are 0.440 in 1580 and 0.471 in 2000.

Notes: The figure plots the trends in population in our data.

Figure A.4: Pop Density vs. Urbanization in 1580 and 2000

Figure A.3: The Trends in Population

Notes: This figure maps the nine macroregions defined by Skinner (1977). Because provincial boundaries change over time, we also control for dummies of these macroregions and year fixed effects in our analysis to compare prefectures within the same macroregion.

Figure A.6: The Importance of Provincial Capitals Across Regimes (Cross-sectional)

Notes: This figure shows that the population density in provincial capitals is about 0.42-0.68 higher than the other prefectures. These results are obtained after controlling for the time-invariant prefecture characteristics and the region fixed effects.

Figure A.5: Macroregions in Skinner (1977)

Notes: This figure shows a similar pattern as in Figure 4. Here, we use logged population density instead of logged light density in 2000 (Figure 4).

Figure A.7: Pop Density in 980 vs. Pop Density in 2000

Table A.1: Summary Statistics & Data Sources

Sources Obs. Mean S.D. (a) economic development proxies ln Population density 1, 2, 3, 4 2871 4.06 1.76 Urbanization ratio (%) 3, 4 1044 15.45 15.89

(b) time-varying provincial capital status Provincial capital 2, 5 2871 0.10 0.31

(c) time-invariant prefecture characteristics Capital-ever dummy 2, 5 261 0.24 0.43 Whether a prefecture contains a plain 2 261 0.70 0.46 Whether a prefecture contains a major river 2 261 0.72 0.45 Whether it is on the coast 2 261 0.21 0.41 Slope 2 261 2.48 2.09 ln Elevation 2 261 5.52 1.60 Longitude 2 261 112.08 5.88 Latitude 2 261 30.63 5.18 ln Area 2 261 9.30 0.85 Wheat suitability 6 261 3.95 1.04 Rice suitability 6 261 3.04 1.08 Fox millet suitability 6 261 3.74 1.45 Maize suitability 6 261 4.49 1.05 Sweet potato suitability 6 261 3.53 0.95 ln Calories: Old World crops 7 261 12.33 1.37 ln Calories: all rops 7 261 12.34 1.39

(d) Instrument variable Rank in Hierarchical distance to national capital ($\lambda = 0.19$) 2 2871 8.23 5.78 ln Rank in Hierarchical distance to national capital ($\lambda = 0.19$) 2 2871 1.81 0.84

(e) Underlying factors ln Total employment in 2000 8 261 12.11 0.72 ln Total employment in government/party and social organization in 2000 8 261 8.29 0.67 ln Total employment in public institutions in 2000 8 261 8.76 0.71 ln Presented scholars per million population in the Qing Dynasty 9 261 3.43 1.41 ln High school or above per capita in 2000 8 261 -2.09 0.42 ln Centrality in the transportation networks, $\theta=2.8$ 2, 10 1044 -0.64 0.25

Notes: This table presents the summary statistics for the major variables in our analysis. Sources: 1. Liang (1980), Historical Statistics of Population, Land and Taxation in China.; 2. China Historical GIS (2007); 3. Ge Jianxiong (2000), China Population History; 4. Population Census 1953, 1964, 1982, 1990, 2000; 5. Treatise of the Nine Regions from the Yuanfeng reign (1078-1085); 6. FAO GAEZ (2012), http://fao.org/Ag/AGL/agll/gaez/ index.htm.; 7. Galor and Ozaka (2016); https://ozak.github.io/Caloric-Suitability-Index/; 8. Census 2000 (micro data); 9. Zhu, Baojiong, and Peilin Xie (Ed.) (1980), Index of Names of Jinshi Graduates in the Ming and Qing Periods; 10. Cheng and Hsu (1980), Historical Atlas of China.

Table A.2: Correlation b/w Prefecture Characteristics and Ever-Capital Status Dependent Var.: Ever-Capital=1/0

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	OLS	OLS	OLS	Probit
Plain	0.228***	0.238***	0.235***	0.233***	0.231***	0.248***	0.224***
	(0.046)	(0.056)	(0.060)	(0.060)	(0.060)	(0.061)	(0.048)
Main River	0.152***	0.113**	0.149**	0.162**	0.163**	0.169**	0.154***
	(0.050)	(0.056)	(0.066)	(0.068)	(0.068)	(0.066)	(0.056)
ln Area			-0.062	-0.055	-0.054	-0.099	-0.090
			(0.087)	(0.088)	(0.088)	(0.098)	(0.075)
Coastal			0.003	0.002	0.002	-0.003	-0.010
			(0.023)	(0.023)	(0.023)	(0.026)	(0.027)
Slope			0.034	0.032	0.032	0.028	0.030
			(0.039)	(0.039)	(0.039)	(0.046)	(0.042)
ln Elevation			0.014	0.007	0.006	0.014	0.015
			(0.012)	(0.014)	(0.014)	(0.013)	(0.014)
Latitude			0.005	0.010	0.011	-0.010	-0.010
			(0.015)	(0.016)	(0.016)	(0.017)	(0.016)
Longitude			0.003	-0.030	-0.033	0.003	0.005
			(0.039)	(0.047)	(0.046)	(0.039)	(0.040)
ln Calories: Old World Crops				0.032			
				(0.028)			
ln Calories: All Crops					0.035		
					(0.027)		
Suitability: wheat						-0.011	-0.007
						(0.047)	(0.043)
Suitability: rice						-0.065	-0.069
						(0.051)	(0.044)
Suitability: maize						0.084**	0.087*
						(0.041)	(0.047)
Suitability: sweet potato						-0.072	-0.067
						(0.054)	(0.048)
Suitability: millet						0.023	0.022
						(0.041)	(0.038)
Region FE			Y	Y	Y	Y	Y
Observations	261	261	261	261	261	261	261
R-squared	0.082	0.100	0.111	0.115	0.116	0.134	

Notes: This table presents the correlations between a prefecture's time-invariant characteristics and its ever-capital status. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.3: The Impact of Capital Status on Population Density: Ever-Capital Prefectures

Ever-Capital Pref. All Prefectures

ln Pop Density ln Pop Density Δln Pop Density

(1) (2) (3) (4) (5) (6) (7) (8)

Prov. Capital 0.459*** 0.311** 0.580*** 0.514***

(0.146) (0.124) (0.161) (0.142) ΔProv. Capital 0.482*** 0.453***

(0.160) (0.141) Gaining Capital Status 0.456* 0.450** (0.255) (0.220) Losing Capital Status -0.504*** -0.455***

(0.176) (0.174)

Year FE * Ever-capital Y Y Y Y Y Y Year FE * Crop suitability Y Y Y Y Year FE * Geography Y Y Y Y Year FE * ln Area Y Y Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Y Y Pref. FE Y Y Y Y Y Y Y Y Year FE Y Y Y Y Y Y Y Y Observations 693 693 2,871 2,871 2,610 2,610 2,610 2,610 R-squared 0.888 0.926 0.860 0.882 0.654 0.716 0.655 0.716 # prefectures 63 63 261 261 261 261 261 261

Notes: This table shows that provincial capital status is associated with a higher population density within the subgroup of prefectures that have ever been a provincial capital (columns (1)-(2)). Our baseline finding also holds if we further control for all the ever-capital prefectures to exhibit different trends by controlling for ever-capital status status and its interaction with year dummies (columns (3)-(8)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.4: The Impact of Gaining and Losing Provincial Capital Status: Period-by-Period Results (Dependent Var.: ln Pop Density)

(1) (2) (3)

Pre-Gaining: -75+ -0.329 -0.239

(0.205) (0.202) Pre-Gaining: -75 ~-1 -0.064 -0.050

(0.081) (0.087)

Post-Gaining: 1 ~75 0.589** 0.563** (0.237) (0.237) Post-Gaining: 76 ~150 0.601** 0.569** (0.284) (0.286) Post-Gaining: 151 ~300 1.010** 0.857* (0.470) (0.484) Post-Gaining: 300+ 1.099* 0.921

(0.563) (0.591)

Pre-Losing: -75+ 0.124 0.046

(0.110) (0.110) Pre- Losing: -75 ~-1 0.001 -0.009 (0.053) (0.057) Post- Losing: 1 ~75 -0.512*** -0.391***

(0.144) (0.128)

Post- Losing: 76 ~150 -0.470*** -0.333***

(0.142) (0.128) Post- Losing: 151 ~300 -0.497* -0.340

(0.269) (0.267) Post- Losing: 300+ -0.611** -0.317

(0.273) (0.268)

Year FE * Ever-capital Y Y Y Year FE * Crop Suitability Y Y Y Year FE * Geography Y Y Y Year FE * ln Area Y Y Y Year FE * Region FE Y Y Y Pref. FE, Year FE Y Y Y Observations 2,783 2,783 2,783 R-squared 0.882 0.881 0.883 # Prefectures 253 253 253

Notes: Using the period before the capital status changes as the reference group, this table shows that there are no systematic differences in population density before the status change. The eight prefectures with multiples changes are excluded from this analysis. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.5: IV Estimates: Alternative Functional Forms of Hierarchical Distance

α = 1 α = 0.5 α = 2 (1) (2) (3) (4) (5) (6) (7) (8) λ = 0.19 (optimal) 0.1 0.2 0.3 0.4 0.5 0.25 (optimal) 0.10 (optimal) IV Estimates: ln Pop Density Prov. Capital 0.700*** 0.578** 0.805*** 0.666*** 0.747*** 0.810*** 0.738*** 0.713** (0.234) (0.246) (0.241) (0.241) (0.278) (0.301) (0.207) (0.284)

All baseline controls Y Y Y Y Y Y Y Y First-stage: Provincial Capital ln Rank in H dist. -0.091*** -0.086*** -0.088*** -0.085*** -0.071*** -0.066*** -0.102*** -0.073***

(0.008) (0.008) (0.008) (0.008) (0.008) (0.008) (0.008) (0.008)

All baseline controls Y Y Y Y Y Y Y Y Observations 2,871 2,871 2,871 2,871 2,871 2,871 2,871 2,871 R-squared 0.881 0.881 0.880 0.881 0.880 0.880 0.880 0.881 # Prefectures 261 261 261 261 261 261 261 261 F-Stat (Weak instrument) 125.8 111.8 118.7 117.4 87.6 75.0 162.7 84.0

Notes: This table shows that that our IV results are robust to different functional forms of hierarchical distance rank. These results include all the controls in our baseline specification (equation (2)). Standard errors are presented in the paraphrases. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.6: IV Estimates: Considering Distance to Market Centers

	(1)	(2)	(3)	(4)
IV Estimates: ln Pop Density				
rov. Capital	0.700***	0.630**	0.738***	0.722***
	(0.234)	(0.256)	(0.250)	(0.231)
ln Rank in H dist. to major econ region		-0.034		
		(0.026)		
ln Rank in H dist. to the East (Shanghai)			0.019	
			(0.026)	
ln Rank in H dist. to the South (Guangzhou)				0.018
				(0.023)
All baseline controls	Y	Y	Y	Y
Observations	2,871	2,871	2,871	2,871
R-squared	0.881	0.881	0.880	0.881
# Prefectures	261	261	261	261
F-Stat (Weak instrument test)	125.8	105.1	110.1	129.4

Notes: This table shows that our IV estimates are not affected by distance to national market centers. These results include all the controls in our baseline specification (equation (2)). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.7: Additional Results – Controlling for Lagged Population Density

Δln Pop Density (1) (2) (3) (4) (5) (6)

ΔProv. Capital 0.350*** 0.326*** 0.343*** 0.339*** 0.311*** 0.329***

(0.096) (0.085) (0.087) (0.094) (0.082) (0.084) lag. ln Pop Density -0.266*** -0.313*** -0.315*** -0.270*** -0.328*** -0.315***

(0.015) (0.011) (0.012) (0.024) (0.022) (0.020) lag 2. Pop Density -0.031 -0.033 -0.047**

(0.020) (0.021) (0.019)

Year FE * Crop suitability Y Y Year FE * Geography Y Y Y Y Year FE * ln Area Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Year FE Y Y Y Y Y Y Observations 2,610 2,610 2,610 2,349 2,349 2,349 R-squared 0.730 0.767 0.784 0.735 0.775 0.793 # prefectures 261 261 261 261 261 261

Notes: This table shows that our findings hold when controlling for lagged population density. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.8: Additional Results – Controlling for War Shocks

Prov. Capital ln Pop Density (1) (2) (3) (4) (5) (6) (7) (8)

Prov. Capital 0.420*** 0.455*** 0.460*** 0.411***

(0.099)

(0.097) (0.104) (0.091) (ln Pop. in 1102- ln Pop. in 1393) * Ming -0.030*** -0.032*** -0.462*** -0.395***

(0.011) (0.011) (0.030) (0.021) (ln Pop. in 1580- ln Pop. in 1776) * Qing -0.007 0.002 -0.683*** -0.621***

(0.022) (0.025) (0.033) (0.047) (ln Pop. in 1910- ln Pop. in 1953) * PR China -0.036 -0.040 -0.307*** -0.071

(0.035) (0.038) (0.065) (0.101)

Year FE * Crop suitability Y Y Y Y Y Y Y Y Year FE * Geography Y Y Y Y Y Y Y Y Year FE * ln Area Y Y Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Y Y Pref. FE Y Y Y Y Y Y Y Y Year FE Y Y Y Y Y Y Y Y Observations 2,871 2,871 2,871 2,871 2,871 2,871 2,871 2,871 R-squared 0.157 0.155 0.156 0.159 0.894 0.905 0.883 0.914 # prefectures 261 261 261 261 261 261 261 261

Notes: This table shows that our findings hold when controlling for regime-shifting war shocks. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.9: Additional Results – The Impact of Capital Status on Urbanization (1580-2000)

(1) (2) (3) (4) (5) (6) Dependent Var. Urbanization ratio ln Urban Pop ln Rural Pop

Prov. Capital 12.588*** 12.192*** 0.716*** 0.663*** 0.184** 0.173* (2.419) (2.624) (0.189) (0.163) (0.093) (0.104)

Year FE * Crop suit. Y Y Y Year FE *Geography Y Y Y Year FE * Ln Area Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Pref. FE, Year FE Y Y Y Y Y Y Observations 1,009 1,009 1,009 1,009 1,009 1,009 R-squared 0.791 0.842 0.877 0.895 0.825 0.855 #Prefectures 261 261 261 261 261 261

Notes: This table shows that our findings hold when using urbanization as an alternative outcome. The data are available for 1580, 1820, 1964, and 2000. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.10: Additional Results – Grid-level Analysis (1-degree × 1-degree)

	ln Pop Density				Δln Pop Density	
	(1)	(2)	(3)	(4)	(5)	(6)
Prov. Capital	0.381***	0.379***	0.353***	0.338***		
	(0.079)	(0.080)	(0.070)	(0.065)		
ΔProv. Capital					0.291***	
					(0.061)	
Gaining Capital Status						0.246***
						(0.091)
Losing Capital Status						-0.324***
						(0.075)
Year FE * Crop suit.				Y	Y	Y
Year FE *Geography			Y	Y	Y	Y
Year FE * Ln Area		Y	Y	Y	Y	Y
Year FE * Region FE	Y	Y	Y	Y	Y	Y
Pref. FE, Year FE	Y	Y	Y	Y	Y	Y
Observations	3,971	3,971	3,971	3,971	3,610	3,610
R-squared	0.804	0.804	0.833	0.845	0.602	0.602
#Prefectures	361	361	361	361	361	361

Notes: This table shows that our findings hold when mapping the data to the grid level. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.11: Additional Results – Heterogeneous Effects

ln Pop Density (1) (2) (3) (4) (5) (6) (7)

Prov. Capital 0.451*** 0.757*** 0.753*** 0.947*** 0.772*** 0.734*** 0.957***

(0.105) (0.137) (0.169) (0.177) (0.150)

(0.164) (0.180) Prov. Capital * (Year>1820) 0.077 -0.073 0.125 -0.011

(0.119) (0.173) (0.213) (0.242) Prov.

Capital * High calorie suitability -0.463** -0.379** -0.516*** -0.429**

(0.180) (0.183) (0.184) (0.186)

Prov. Capital * Gentle slope -0.503** -0.430** -0.521*** -0.439**

(0.197) (0.199)

(0.196) (0.196) Prov. Capital * (Year>1820) * High calorie suitability 0.275 0.282

(

0.235) (0.232) Prov. Capital * (Year>1820) * Gentle slope -0.004 -0.043

(

0.254) (0.244) Year FE * Crop suit. Y Y Y Y Y Y Y Year FE *Geography Y Y Y Y Y Y Y Year FE * Ln Area Y Y Y Y Y Y Y Year FE * Region FE Y Y Y Y Y Y Y Pref. FE, Year FE Y Y Y Y Y Y Y Observations 2,871 2,871 2,871 2,871 2,871 2,871 2,871 R-squared 0.882 0.882 0.883 0.883 0.883 0.883 0.883 # Prefectures 261 261 261 261 261 261 261

Notes: This table shows that provincial capital status matters equally before and after 1820, but it matters less for those with more natural advantages (proxied by higher calorie suitability and gentle slope). Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.

Table A.12: Centrality – Separating the Two Periods before Provincial Capital Status Changes

Centrality (1) (2) (3)

Gaining Pre-2 0.097 0.103

(0.132) (0.131)

Gaining Post-1 0.309** 0.298* (0.148) (0.152)

Losing Pre-2 -0.005 -0.004

(0.102) (0.101)

Losing Post-1 -0.174*** -0.168***

(0.057) (0.057)

All baseline controls Y Y Y Observations 1,016 1,016 1,016 R-squared 0.696 0.696 0.699 #Prefecture 254 254 254

Notes: This table shows that there are no systematic differences in centrality before the capital status change – we only have four periods of data on transportation networks though. These results include all the controls in our baseline specification (equation (2)). The seven prefectures with multiple changes in these four periods are excluded from this analysis. Standard errors presented in the paraphrases are clustered at the prefecture level. ***: significant at 1%, **: significant at 5%, *: significant at 10%.