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Cultural border, administrative border, and regional economic development: Evidence from Chinese cities

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ABSTRACT

Current province-level administrative division in China breaks the distribution of local culture and many cities are separated from their respective local culture regions to locate in other provinces. These cities encounter potential cultural conflicts with the mainstream culture of the provinces they belong to, but also face various local protectionism barriers with cities in the neighboring province that share the same border and local culture with them. As a result, transaction costs could be higher whichever side they trade with, leading to potential harm to their economic development. Using dialect as a proxy for local culture, we find that the cultural segmentation caused by the misalignment between cultural and administrative borders can significantly hamper economic development of the segmented cities. This negative effect is aggravated by greater local protectionism in neighboring provinces but alleviated by a longer history of being administrated by the same province with the current provincial capital. These findings support the hypothesis that cultural and administrative border misalignment works together with local protectionism to bring about substantial economic loss. The results thus highlight the importance of both formal and informal institutions in affecting transaction costs and economic growth, and also shed light on the potential interactions between the two types of institutions.

1. Introduction

The substantial variations in natural resources and geographic conditions across various Chinese regions, combined with a number of large-scale migrations throughout Chinese history, have resulted in a multitude of local cultures in China, each with its own distinctive characteristics in dialect, customs, social norms, and codes of ethics. The current system of administrative division in China does not sufficiently take into account of such cultural differences, thus often dividing up a region belonging to the same local culture to two or more provinces. As the local culture of the provincial capital city usually defines the mainstream local culture in a province, substantial differences may exist between the local culture of a region that has been separated from its own local culture and the mainstream local culture of the province that the region belongs to administratively. In the current paper, we will refer to such separation of a region from its own local culture as cultural segmentation caused by the misalignment between cultural border and administrative border, and we will explore the potential impact of such segmentation on regional development.

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As shared cultural values help establish mutual trust, which in turn lowers transaction costs and promotes trade, we would expect a culturally segmented region to suffer lower economic development when the following two conditions hold: Inter-regional trade is important and the region faces local protectionism. The reason is that no matter whether the region chooses to trade with other regions located in the same province but from a different local culture or to trade with regions that share the same local culture but belong to a different administrative unit, it will face higher transaction costs, compared to regions not culturally segmented. The higher transaction costs will lead to less trade and less economic cooperation with other regions, which will in turn lead to less benefit from the division of labor and specialization. The inability to enjoy the comparative advantage through trade will potentially result in slowed economic growth for the culturally segmented region. We, therefore, propose the following hypothesis: *Cultural segmentation caused by the misalignment of cultural and administrative borders, if combined with local protectionism, will lead to less economic development level in the segmented regions*.

Using regional dialect as the proxy for local culture, we empirically study how economic development relates to cultural segmentation among Chinese prefectural level cities, and we make the following findings: A city with a local culture different from the mainstream culture of the province where it is located has a per capita GDP level that is on average 15% below the other cities in the same province, even after controlling for various factors. Furthermore, the income gap increases with the severity of local protectionism in the city's neighboring province, but declines with the time length the city has been administered by the same province with the current provincial capital. These findings thus provide empirical support for the hypothesis above relating economic development and cultural segmentation.

More generally, the empirical patterns found in our study highlight the important roles of both formal and informal institutions (for example, cultural borders) in influencing transaction costs and economic growth (North, 1990, 1991). They also help shed light on the interesting ways in which the two types of institutions interact with each other. While formal institutions (such as local protectionism) may be the source of the growth disadvantage of culturally segmented regions, informal institutions (such local cultural communities) tend to reshape themselves around administrative borders to regain their growth potentials (Hofstede, 1980, 2001).

The remainder of the paper is structured as follows: In Section 2, we review several strands of literature that the current paper contributes to, including research linking formal and informal institutions to development, that on local protectionism, as well as that relating administrative division to growth. Section 3 develops the theoretical hypotheses to be tested, while Section 4 discusses the historical reasons for cultural segmentation within Chinese provinces and introduces the measure for cultural segmentation. Econometric models and empirical data are discussed in Section 5, while empirical results and the related discussion on potential mechanisms are offered in Section 6. Section 7 compares and evaluates alternative explanations for the observed patterns, and Section 8 includes a short conclusion and some potential policy implications.

2. Literature review

In this section, we review related research and position our study in the existing literature. The first important line of research the current study relates to is the institutional economics literature regarding the roles of formal versus informal institutions. Although culture can be defined more broadly (see, for example, Hoebel, 1966, or Geertz, 1973), a more relevant concept is the much narrower one, which refers to the customs, social norms, and ethic rules shared by people that inhabit the same region and interact with one another for a long period of time. Thus defined, the concept is close to that of informal institutions proposed by North (1990), where he divides institutions into formal ones versus informal ones, with formal institutions including statutory laws and regulations, whereas informal institutions including customs, social norms, and behavioral rules.

Because informal institutions enjoy the wide recognition and acceptance by the society at large, they are often self-enforced, without having to be implemented or even supported by government agencies, as required for formal institutions. As a result, informal institutions, including culture, have often been argued to play a crucial role in determining human behaviors, even more so than formal institutions (McMillan & Woodruff, 1999; Michalopoulos & Papaioannou, 2011, 2014).[2] Yet convincing empirical findings are still scarce in support of the important roles of formal and informal institutions in lowering transaction costs and facilitating exchange. In addition, there are no empirical studies to our knowledge that explore how formal and informal institutions interact with each other in influencing economic growth. In the current study, we will examine the Chinese setting, which provides a unique opportunity for shedding light on these issues.

The second strand of related literature is the one on culture and development. Existing research has established the connection between the two in three steps: First, various studies have provided evidence that cultural heterogeneity leads to a lower level of trust, where Delhey and Newton (2005) use social divisions as the measure, while others use ethnicity heterogeneity (Knack, 2003; Knack & Keefer, 1997; Zak & Knack, 2001; Zerfu, Zikhali, & Kabenga, 2009). Second, many papers have shown the link between trust and transaction costs and trade, using different approaches. While Axelrod (1984) and Gambetta (1988) make theoretical arguments, Ostrom and Walker (2003), Buchner, Gonzalez, Guth, and Levati (2004), and Bjørnskov (2009) rely on experimental findings. Third, empirical evidence has been provided using cross-country data to show the correlation and causality between trust and international trade, investment, and economic growth (Mezias, 2002; Park & Ungson, 1997; Spolaore & Wacziarg, 2009). In particular, Guiso, Sapienza, and Zingales (2009) and Tabellini (2010) are two studies that very carefully address the endogeneity issue.

[2] Also see Beugelsdijk and Maseland (2011) for a comprehensive review on the link between trust and economic growth.

Against the sizable literature on culture and development, only a small number of studies explore the issue tangentially in the context of China, by looking at the effects of cultural distance on the performance of foreign invested firms in China (Li, Lam, & Qian, 2001; Luo & Peng, 1999; Pan, Yin, & Lu, 2008). The current study aims to fill in this gap by using local dialect as the measure of cultural difference to explore its impact on regional development. Furthermore, the findings in our study will provide empirical support for the line of economic arguments outlined above, going from culture to trust, then to trade, and to growth.

Next, the current paper relates to the literature on local protectionism. Previous studies have provided evidence and explanations for the existence of local protectionism and the prevalence of market segmentation based on economic and fiscal decentralization (Shen & Dai, 1990), property right protection (Zhang & Ma, 1999), promotion tournament (Zhou, 2004), and lack of judicial independence (Long & Wang, 2014). Other studies have empirically examined the degree and trend of market segmentation, as well as its impact on regional economic development (Lu & Chen, 2009; Poncet, 2003, 2005; Young, 2000). While these studies concentrate on the effects of a region's local protectionism on its own economic growth, the current research inquires how local protectionism in the neighboring provinces affects cities located in the same province but have different local cultures, with the focus on the culturally segmented cities.

Finally, our study extends the research on how local autonomy and regional administration impact economic growth. While many economic studies have addressed related issues (Chen, 2006; Law, Li, & Long, 2014; Shi & Zhou, 2007; Wang & Nie, 2010), they have largely ignored the role of culture in regional economic development. Several studies in geography have argued that the discrepancy between administrative jurisdiction and cultural region delineation may have hampered regional economic development of China (Jin, 2003; Jin & Wang, 2006; Liu, Jin, & Zhou, 1999), but they do not offer any empirical evidence. The current study thus helps fill in the void by empirically examining the existence and magnitude of the impact of misalignment of cultural and administrative borders on the affected regions.

3. Hypothesis development

Based on the existing theories and empirical findings summarized above, we now develop the hypotheses to be empirically tested below. To begin with, people from similar cultures can develop mutual trust more easily, thus lowering transaction costs and promoting productivity through trade. In contrast, conflicts due to cultural differences may increase transaction costs, thus hindering specialization and economic growth. Although most of the people living in the regions of our sample belong to the same ethnicity, *Han*, people of different local cultures in China usually have distinctive dialects, customs, social norms, and codes of ethics. The differences in these characteristics can generate social division within each province and reduce mutual trust. Accordingly, we believe that if trade partners hold the same or similar cultures, then comparable social habits, ethnic rules and behavior norms can help promote trust and hence transaction costs between them would be lower compared to those among people holding very different local cultures.

Despite the importance of culture as an informal institution in affecting economic behaviors, having a culture different from its administrative region's mainstream culture does not imply that a sub-region's economy will necessarily fare worse than its neighbors in the same administrative region that are part of the mainstream culture. Cultural segmentation would not have an important impact on a region's economic development, when the region is an agriculture based economy or a free market economy with little intervention from the government. If an economy is agriculture based, little interaction exists among regions. As cultural segmentation does not impact the intra-region interactions between people within the same region, thus there will be little negative impact on the regional agricultural activities, which defines economic development.

On the other hand, in a market economy free of governmental intervention, economic agents can make individual decisions based on market prices of inputs and outputs. Given that people from the same local culture share the same customs and social norms, leading to more trust and lower transaction cost, individuals may choose to trade more with others from the same local culture, regardless of whether they are located in the same administrative region or not. Hence, as long as the culturally segmented sub-region can trade with other administrative regions that share its own culture, the sub-region can still enjoy the benefit from division of labor and specialization. For example, the four cities north of the Yellow River in China's Henan province could choose to trade with Shanxi province, with which they share the same culture; while the northern region of Anhui province could transact mostly with Henan province, Shandong province, and the northern part of Jiangsu province, all of which share the same local culture.

The Chinese economy, however, has long been under the heavy intervention from the government, both at the central and at the local levels. Although economic reforms since the late 1970s have allowed market prices to largely determine the allocation of economic resources, various governments are still important in influencing the economy. China's governing system of political centralization and economic decentralization may have stimulated its local governments to promote economic development and achieve high GDP growth (Qian & Roland, 1998), but it has also created many negative effects. One key detrimental effect is local protectionism and the resultant market fragmentation. Local governments, in their pursuit of higher fiscal revenue gains and economic growth (Shen & Dai, 1990) and the consequent political promotion (Zhou, 2007), use economic, administrative, and even judiciary measures to erect inter-regional trade barriers to form segmented regional markets (Long & Wang, 2014; Zhou, 2004), leading to lost opportunities in gains from trade and specialization.

Within such a context, cultural segmentation caused by the misalignment between cultural border and administrative border will potentially have a negative impact on local economic development. Specifically, for a region that has been broken away from its original local culture, it faces differences in customs and social norms from the mainstream local culture of the province it belongs to. Such cultural differences may lead to a lower level of trust, which in turn may lead to more frequent conflicts with people from the mainstream culture of the province, thus raising transaction costs and reducing trade. At the same time, people living in the

isolated region will experience trade barriers due to local protectionism when trying to trade with people from the same local culture but located in a different administrative region, which also leads to high transaction costs and lower trade volume. The culturally segmented region is thus put between a rock and a hard place.

In our empirical study to explore the implications of culture on the economy, we divide Chinese cities into two groups, the treatment group consisting of cities that are segmented from their original culture in the neighboring province and thus have different cultures from the mainstream culture in their current province, and the control group including cities that share the mainstream culture of their own province. If local protectionism exists between the segmented city and the neighboring province that it shares the local culture with, cities in the treatment group will experience reduced trade and economic development in comparison to cities in the control group, as the very purpose of local protectionism is to deter inter-provincial trade. Therefore, we have the following main hypothesis:

Hypothesis. When there exists local protectionism, culturally segmented regions, i.e., regions that are misaligned with the mainstream culture in their respective provinces, will experience slower economic development.

This hypothesis has some additional implications that will help us empirically test its validity. First of all, as different provinces have different degrees of local protectionism, cities that are culturally segmented but border different neighbors may experience different degrees of the negative impact. If the neighboring province hosting the home culture of a segmented city only has a low degree of protectionism, then the transaction costs related to trade between the city and its home culture region will not raise much, thus the culturally segmented city can still trade with the neighboring province fairly easily and will not suffer much loss in trade and economic development due to its cultural difference with other regions in its own province. On the contrary, if the neighboring province above has a high degree of local protectionism, raising inter-provincial transaction costs to prohibitively high, then the segmented city will experience severe damages to total trade volume and its growth potential due to the differences with its own province's mainstream culture and the resultant lack of mutual trust. The impact of cultural segmentation thus closely relates to the degree of local protectionism, as outlined in the corollary below:

Corollary 1. *The negative impact of cultural segmentation on economic development increases with the degree of local protectionism in the neighboring province, with which the culturally segmented region shares the same local culture.*

On the other hand, being assigned to the same administrative unit should help the assimilation of different cultures. Since the segmented cities have been integrated to their current provinces at different points in time, the degree and impact of cultural segmentation may vary across cities, depending on the time length of their cultural assimilation. In particular, if a city that was originally segmented from its local culture remains in the same administrative unit for a long time, during which more political, cultural, and economic interactions have taken place thanks to the administrative division arrangement, thus helping to form mutual trust between the city and its brother regions in the same province, then it is likely that the original cultural separation will become less important. Admittedly, institutional evolution occurs at an extremely slow pace, especially those involving informal institutions such as cultural values and trust (North, 1991; Roland, 2004). But the time frame for our discussion does cover hundreds of years of the Chinese history, which may provide us an opportunity to explore the possibility of cultural assimilation, as summarized in the following corollary:

Corollary 2. *The negative impact of cultural segmentation on economic development decreases with the time length by which the culturally segmented region has been located in its current province.*

It is worth noting that the two corollaries stated above illustrate some interesting ways in which formal institutions and informal institutions interact with each other. Given that local protectionism measures are usually formal rules implemented by local governments, Corollary 1 suggests that formal institutions are the source of the economic disadvantage of culturally segmented regions. On the other hand, Corollary 2 implies that informal institutions (such as cultural communities) have the tendency to reshape themselves to adapt to the formal institutions to regain their growth potentials (also see Hofstede (1980) and Hofstede (2001)). With the theoretical hypotheses outlined, we will now embark on the empirical test of these predictions.

4. Cultural differences and their measurement

Before empirically testing the hypothesis and its corollaries outlined above, we first discuss the within-province cultural differences and their measurement in this section.

Prior to the Tang Dynasty, China followed a two layer administrative division system consisting of prefectures and counties below them. To overcome the problems caused by the large number of prefectures, a three layer administrative division system was adopted since Tang, where 15 *dao*s make up the top layer administrative units. As the territory of a *dao* was defined by the boundaries of the Yangtze River, the Yellow River, Qin Mountain, and other geographic barriers, each of the local cultures tended to be allocated in the same *dao*. Subsequently, the Northern Song dynasty adopted the same three layer administrative system but increased the number of top layer units within its territory in southern China to 24 and chose the new name of *lu*. And the same underlying logic was also embraced by *Liao*, the ethnic minority nation that ruled northern China at the time, as well as the Southern Song dynasty and its rival in the north, *Jin*, that came after.

Because local cultures usually form along the boundaries of geographic barriers (Li, 1995), the guidelines for administrative divisions used by Tang and several of its successor rulers imply that a local culture was almost never separated into multiple

administrative divisions, although the same administrative division could include more than one local cultures.[3] In particular, the cities of Hanzhong and Ankang in the modern southern Shaanxi region would not have been assigned to Shaanxi, according to the above guidelines, but instead assigned to Sichuan province, which shares the same culture with them. Similarly, the regions north of the Yangtze River in nowadays Anhui and Jiangsu provinces would also not have been assigned to the same province as regions south of the river, which have distinctively different cultures from theirs. So in this design, there would be no culturally segmented regions as defined earlier, where a region is separated from its own culture because it belongs to an administrative division different from the rest of its cultural group.

Yet starting from the Yuan dynasty, the guidelines for assigning administrative divisions drastically changed. Due to concerns of local resistance against alien rulers that make use of geographic barriers, the Yuan leaders purposefully avoided using such natural boundaries to define administrative divisions (Xu, 1999; Zhang & Zhang, 1996). Instead, within each *xingsheng*, the top layer administrative division of Yuan, there would be one or more geographic barriers, such as mountains or rivers. As described by Wei Yuan, the great Chinese geographer from the Qing dynasty, in his book "Sheng Wu Record", the Yuan system "combines regions north and south of the Yellow River to deprive the river of its strategic importance, merges regions north and south of the Dongting Lake to make the lake lose its strategic importance, amalgamates regions west and east of the Qiantang River to deny Qiantang's strategic importance, and puts together counties west and east of the Huai River so that Huai can no longer be a strategic location."

This system, Xie and Wu (2004) commented, "is intended to control the people, but not to nurture the people. Thus the *xingsheng* system is a military administrative division system in essence." The next Chinese dynasty of Ming copied this line of thinking in assigning its own administrative divisions, introducing a more finely divided system with *buzhengshisi* as the top layer units. As a result, many local cultures were broken up to multiple administrative divisions. For example, the region north of Huai River in Anhui province belongs to the Zhongyuan local culture, which is shared by Henan province and western Shandong province, but has been assigned to the Province of Anhui.[4] At the same time, Anhui province does not include the county of Wuyuan, which shares the same local culture, Hui culture, with southern Anhui province, but has been assigned to Jiangxi province.

Either due to its helpful role in maintaining national stability or thanks to the importance of path dependency, the Ming administrative division system has been largely maintained throughout the turmoil and revolutions of the Qing dynasty, the Republic era, till the present. Except for a few small adjustments in names and boundaries here and there, the basic logic and setup has remained intact. Thus the culturally segmented regions also remained separated from their own original local cultures. Regardless of why the Ming administrative division system has been inherited by the subsequent governments in China, one can plausibly argue that the reasons would not have much to do with economic considerations. Consequently, the intra-provincial cultural similarities or differences induced by the administrative division system should not be related to variations in regional economic conditions in the same province. In other words, relative to economic development, whether a region shares the same culture as the majority of regions in its province should be a highly exogenous factor.

Due to the difficulty in directly delineating a culture's scope of influence, we use regional dialects as the proxy to measure local cultures in our empirical study below.[5] There are two reasons for this approach: First of all, the regional dialect is one of the most evident and the most tangible features of any local culture; Secondly, detailed records exist regarding the usage of dialects across regions, all the way to the county level. Cultural and linguistic studies demonstrate the close correspondence between the usage of a certain regional dialect and the identity of the respective local culture, thus provide ample support for our adoption of this approach to measure local cultures.[6] Other studies that use dialects to measure local cultures include Zhou and You (1986), Li (1995) and Gong, Chow, and Ahlstrom (2011).

Specifically, we use the regional dialect as the proxy for measuring local cultures, where the whole country of China is divided into sixteen dialect groups. Fig. 1 shows the overview distribution map of Chinese dialects from the "The Chinese Language Atlas" compiled by the Chinese Academy of Social Sciences & Australian Academy of the Humanities, 1987, where Chinese dialects are classified into 16 categories. The regions in green are the mandarin regions, which include 8 mandarin categories, indicated by different numbers on the map. The regions in other colors are non-mandarin regions and we can identify each of the 8 non-mandarin categories by different colors. We then define the local culture of the provincial capital as the mainstream culture of each province, which in turn allows us to construct *cultural segmentation*, a dummy variable for each city located in the province with a value of 0 if the city shares the same dialect as the provincial capital, but 1 if it does not speak the same dialect.[7] Take Henan province as an example, the majority of regions in the province use Zhongyuan dialect, which is also spoken in the capital city, Zhengzhou. But Jin dialect is used in the four cities north of the Yellow River, Jiaozuo, Xinxiang, Anyang, and Hebi, and thus the *cultural segmentation* variable takes the value of 1 for these cities, but 0 for all other cities in Henan province.

[3] For example, Jiangnandong Lu included Hakka Culture as well as Hui Culture, whereas an example of the few exceptions to the rule of a local culture located in the same region is the local culture of Jin, which spanned Hedong Lu, Hebeixi Lu, and Jingxibei Lu.

[4] Similarly, the cities of Suzhou, Wuxi, and Changzhou in southern Jiangsu Province belong to the same Wuyue local culture as Zhejiang Province and use the same Wu dialect, but have been assigned to the Province of Jiangsu.

[5] The sixteen groups of regional dialects can be further divided into more disaggregated subgroups, but linguistic and cultural scholars generally view the subgroups as too disaggregated for representing local cultures (Zhou and You, 1986).

[6] Following the most commonly used criteria, the regions in China can be divided to the following local cultures: Guandong culture, Yanzhao culture, Sanjin culture, Qilu culture, Zhongyuan culture, Guanzhong culture, Ganlong culture, Hui culture, Bashu culture, Dianqian culture, Jianghuai culture, Jinchu culture, Wuyue culture, Lingnan culture, Bagui culture, Kegan culture, and Mintai culture (Chen, 1998; Li, 1995; Wang, 2008; Zhu, 2008). On the other hand, most linguistic studies recognize the following main dialect groups of the Chinese language: Dongbei dialect, Beijing dialect, Jin dialect, Northern dialect, Jiaoliao dialect, Zhongyuan dialect, Lanyin dialect, Hui dialect, Southwestern dialect, Jianghuai dialect, Xiang dialect, Wu dialect, Yue dialect, Ping dialect, Gan dialect, Hakka dialect, and Min dialect (see for example Zhan (1991), Zhan (2002), Zhou and You (1986), and Yan, 1994). It is easy to observe the close correspondence between the two lists.

[7] To focus on the impact of cultural segmentation, we exclude provincial capital cities from our research sample.

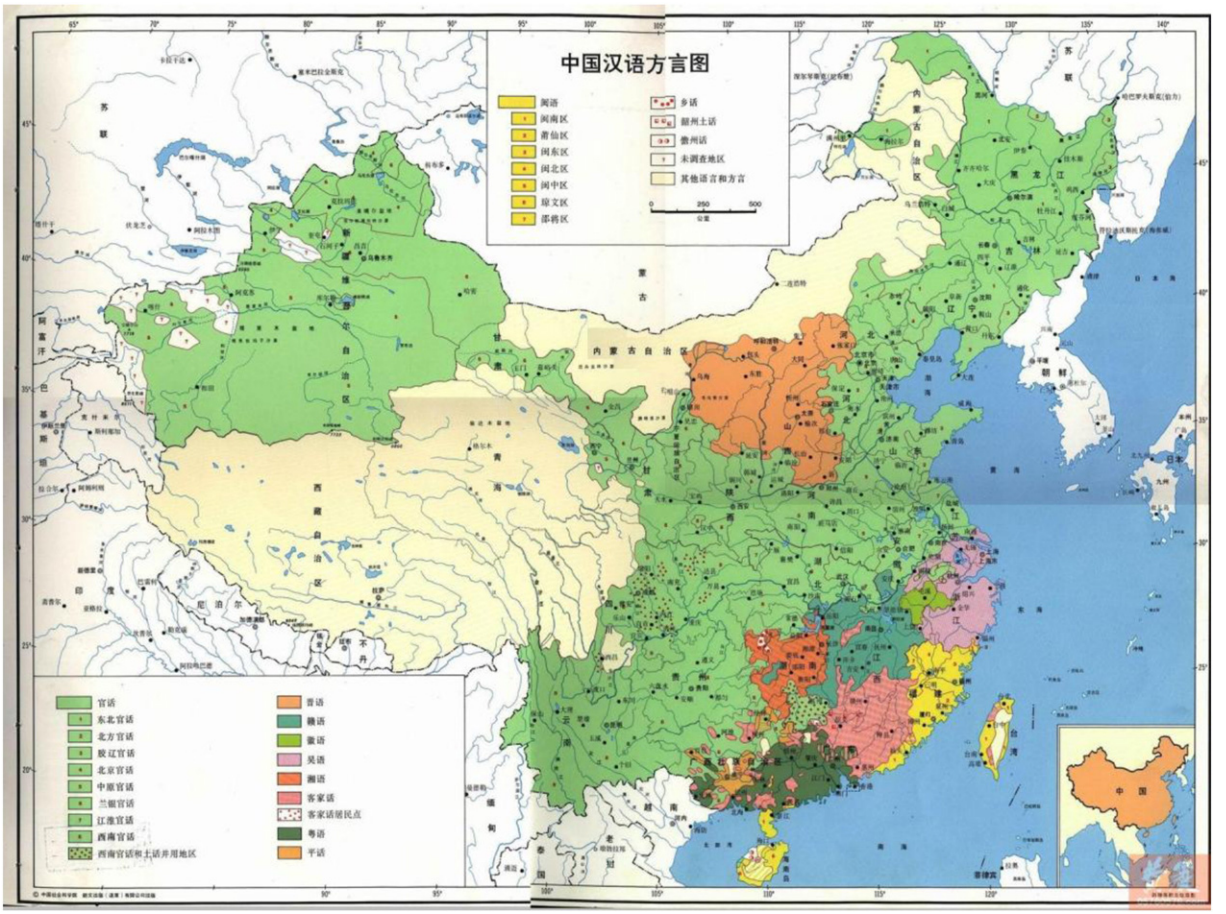

Fig. 1. Distribution of Chinese dialects. Notes: This is an overview distribution map of Chinese dialects in "The Chinese Language Atlas" compiled by the Chinese Academy of Social Sciences & Australian Academy of the Humanities (1987). In this map, Chinese dialects are classified into 16 categories. The green region is the mandarin region, and we can identify 8 mandarin categories by the numbers on the map. The regions in other colors are non-mandarin regions and we can identify each of the 8 non-mandarin categories by their respective colors.

5. Estimation models and data sources

We outline the estimation specifications and describe the data sources used in the empirical analysis in this section. To empirically examine the hypothesis and the corollaries above, we will use the following estimation specification:

$$\ln\,(pgdp)_i = \alpha_0 + \alpha_1 cultural\ \ segmentation_i + X_i'\beta + \varepsilon_i, \tag{1}$$

where $pdgp_i$ is the per capita GDP in city i, $cultural\ segmentation_i$ is the cultural segmentation dummy variable, X_i is a set of city level characteristics, while ε_i is the random error term. Starting with all Chinese cities at or above the prefectural level, we exclude the provincial and vice-provincial level cities as well as provincial capital cities to avoid the confounding effects of the various preferential treatments enjoyed by these cities. Cities from Xinjiang, Xizang, Qinghai, and Hainan are further dropped, because no prefectural level cities or only one prefectural city remain after the exclusion of the capital city, making it impossible to conduct within province comparisons. The final sample thus includes 249 prefectural level cities in China. Following the literature on economic growth, we use the city level per capita GDP (measured in logarithm) as the measure for regional development, where both GDP and population are figures corresponding to only urban areas in the city's jurisdiction to focus on industrial and commercial activities, which relate closely to inter-regional trade. And to control for fluctuations over a short period of time, we use the average per capita GDP levels in 2009 and 2010.[8]

As discussed above, *cultural segmentation* is the key variable of interest in the estimation, which takes the value of 1 for cities that speak a dialect different from that used by the capital city in the province, and 0 otherwise. We can see from Table 1, which provides summary statistics for the main variables used in our study, that 72 cities in our sample (accounting for 29% of the whole sample) are

[8] Using data from other years give very similar results, which will be available from the authors upon request.

Table 1
Descriptive statistics of key variables.

Variables	All cities	Culturally segmented cities	Culturally mainstream cities	t-Statistics
Per capita GDP (Yuan)	38350.08	34965.2	39726.98	−1.3651
	(24998.61)	(20705.81)	(26477.1)	
Protection	0.0349	0.0362	0.0344	0.7601
	(0.0171)	(0.0160)	(0.0175)	
History length (year)	772.2	801.3	760.4	0.9679
	(302.4)	(251.8)	(320.6)	
Distance to the big seaport (kilometers)	524.03	452.01	553.34	−1.8943*
	(384.62)	(355.39)	(393.09)	
Distance to the provincial capital (kilometers)	197.10	244.14	177.96	3.5629***
	(135.98)	(171.09)	(113.90)	
Distance to the nearest big city (kilometers)	165.09	185.51	156.78	2.1059**
	(98.29)	(88.28)	(101.14)	
Rail	2.55	2.54	2.56	−0.1024
	(1.23)	(1.33)	(1.19)	
State road	2.51	2.74	2.41	1.8131*
	(1.28)	(1.45)	(1.20)	
Highway	2.99	2.76	3.08	−1.6026
	(1.44)	(1.36)	(1.46)	
Mean of elevation (meter)	4.36	3.56	4.68	−1.4743
	(5.43)	(4.80)	(5.65)	
Std. dev. of elevation (meter)	1.25	1.24	1.25	−0.0712
	(1.17)	(1.04)	(1.22)	
Per capita foreign direct investment (U.S. dollar)	138.88	161.17	129.81	1.1273
	(199.12)	(215.94)	(191.76)	
Number of cities	249	72	177	

Notes:
1. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
2. Columns 1–3 give the means of the corresponding variable for the whole sample, the subsample of culturally segmented cities, and the culturally mainstream cities, respectively, while the numbers in parentheses are the standard deviations.
3. Column 4 gives the t-statistics of the difference between columns 2 and 3, i.e., the mean difference between culturally segmented cities and other cities.
4. See Table 2 for data sources and variable definitions.

in the culturally segmented group as shown in Fig. 2. Once Xinjiang, Xizang, Qinghai, and Hainan are excluded, the geographic distribution of the culturally segmented cities is largely random, without any obvious clustering. Combined with the historical fact that the administrative division system was designed mainly to control military strategic locations and to achieve political stability, this further provides support for our previous claim that economic considerations were largely absent in the design of the administrative division system. Consequently, we argue that the *cultural segmentation* variable is exogenous of local economic conditions, and thus the concern of reverse causality is mitigated in our study.

To accurately estimate the effect of cultural segmentation on regional economic development, we control for additional variables that may influence economic growth, such as whether the city used to be a national political center (*oncapital*) or regional political center (*oncapital*), as such statuses may capture some superior growth potential due to geographic location or human development history. The distance from the provincial capital plays a role in determining trade volume and thus growth potential, which tends to be negatively correlated with cultural segmentation. Thus we control for the log of distance between each city and its provincial capital city (ln *discapital*). As the distance to other large cities may also affect a city's trade and growth opportunities, we also include the log of distance between the city and the closest large city among the explanatory variables (ln *disbigcity*), where large cities are defined to be all provincial level cities, vice-provincial level cities, and provincial capital cities.[9]

To address the possibility that there is less willingness to invest in border areas due to externalities, which slows down economic growth (Liu & Shu, 1996), we control for a dummy variable that indicates whether a city is located at a provincial border (*bordercity*). As many of the culturally segmented cities in our sample also lie on the borders between provinces, failure to control for the border variable will lead to the omitted variable bias. We further control for variables that provide information on the city's geographic conditions, including average altitude (*elemean*), the standard deviation of altitude in the city's jurisdiction (*elestd*, which measures the ruggedness of the city), the latitude, the geographic size (in logarithm, ln *area*), whether there is a seaport or river-port in the city (*seaport* and *riverport*), the logarithm of the linear distance to the closest seaport (ln *disbigport*), as well as climate variables such as temperature and rain fall (both in averages and standard deviations). Distance is measured in straight line distance in the current study for two reasons. First of all, it is difficult to choose the most fitting transportation mode if one wants to construct the actual travel distance between two cities. More importantly, the actual travel distance is highly endogenous with regard to a region's economic development level, because regions that are more developed tend to have earlier access to highway or railway that connect to the large cities close by, leading to shorter actual travel distances for these same regions. Finally, we include province fixed effects in

[9] We do not use a uniform GDP or population threshold to define large cities to avoid assigning all large cities along the coast, which may confound the coastal versus inland effect with the cultural segmentation effect.

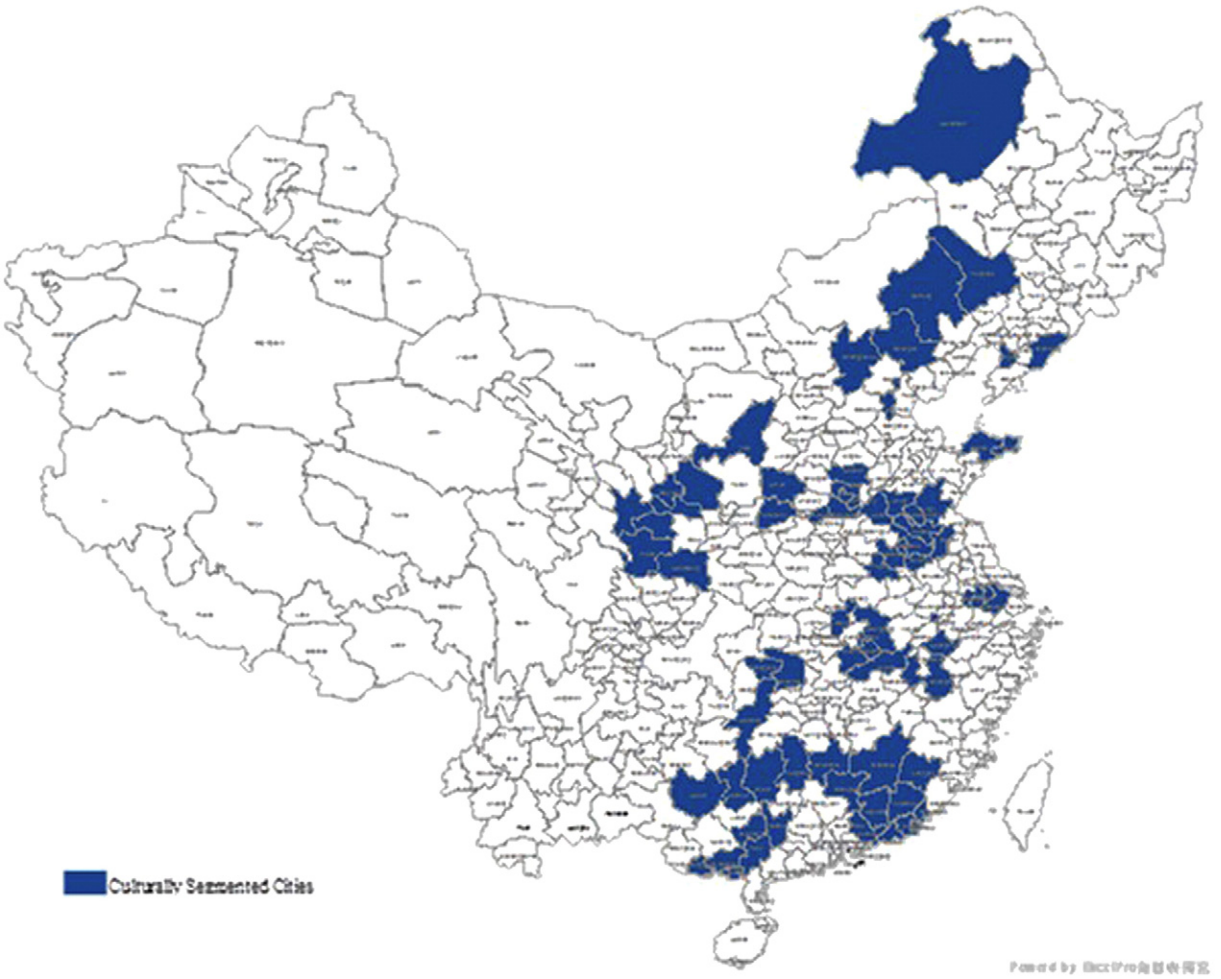

Fig. 2. Distribution of culturally segmented cities. Notes: 1. We identify the dialect of each prefecture level city using "The Chinese Language Atlas". 2. *Culturally segmented cities* are defined as cities using different dialects from the capital city in their respective province, while the language category of the capital of each province is regarded as the mainstream dialect or culture of the province.

the estimation to control for other unobserved variations among provinces. Table 1 offers the descriptive statistics for the main variables used in the study, while Table 2 describes the data sources.

Table 1 shows that there are 72 culturally segmented cities among the total of 249 cities in our sample. Generally speaking, culturally segmented cities have lower per capita GDP level and higher per capita foreign direct investment level, but the differences are not statistically significant. On the other hand, culturally segmented cities are significantly closer to big seaports but further away from provincial capitals and nearest big cities. In addition, the comparison of elevation levels (in both mean and standard deviation) suggests that culturally segmented cities are not more likely to be barren mountainous regions.

6. Empirical findings

In this section, we discuss the empirical findings of how cultural segmentation, as proxied by the usage of a different dialect, impacts the income level of a region neighboring a province that practices local protectionism. We use model (1) specified in Section 4 and cross-section city level data in conducting the empirical analysis.

Table 2
Data sources.

Variables	Sources
Per capita GDP (Yuan)	*China City Yearbook*, 2010–2011
Distribution of local cultures (distribution of local cultures across Chinese cities)	Li (1995), Chen (1998) Wang (2008), Zhu (2008)
Distribution of Chinese dialects (distribution of sixteen categories of regional dialects)	*The Chinese Language Atlas*
Local protection of each province	*Survey of Chinese entrepreneurs conducted by the Enterprise Survey Team of the Chinese National Statistics Bureau, 2002*
Geographic and climate data (latitude, mean of temperature, standard deviation of temperature, mean of precipitation, standard deviation of precipitation, administrative area, mean of elevation, standard deviation of elevation)	Chinese Time Series Administrative Division GIS Data
History length (year) (the number of years being administrated by the same province with the current provincial capital in history)	*Administrative Division of Chinese Dynasties: 221 B.C–1991 A.D, The Chinese History Atlas. Vol. 4–7.*
Distance to the nearest big seaport (kilometers) (big seaports are the biggest ten seaports of China according to throughout capacity in the year 2010)	*People's Republic of China Transportation Atlas*, 2010
Distance to the provincial capital (kilometers)	*People's Republic of China Transportation Atlas*, 2010
Distance to the nearest big cities (kilometers) (big cities include all four provincial level cities, all provincial capitals and all five vice-provincial level cities)	*People's Republic of China Transportation Atlas*, 2010
Rail (the number of railways that connect a city to other prefectural level or provincial level cities)	*People's Republic of China Transportation Atlas*, 2010
National road (the number of national roads that connect a city to other prefectural level or provincial level cities)	*People's Republic of China Transportation Atlas*, 2010
Highway (the number of highways that connect a city to other prefectural level or provincial level cities)	*People's Republic of China Transportation Atlas*, 2010
Per capita domestic non-real estate investment (Yuan)	*China City Yearbook*, 2010–2011
Per capita domestic non-housing investment (Yuan)	*China City Yearbook*, 2010–2011
Per capita foreign direct investment (U.S. dollar)	*China City Yearbook*, 2010–2011
Ratio of fiscal revenue to GDP	*China City Yearbook*, 2010–2011
Ratio of fiscal expenditure to GDP	*China City Yearbook*, 2010–2011

6.1. Baseline results

Table 3 gives our main estimation results relating intra-provincial cultural differences to regional economic development, where the baseline findings are presented in column 1. When controlling for other factors, having a local culture that is different from the mainstream culture in the same province is correlated with a reduction in per capita GDP of about 15% and the difference is statistically significant at 10% level. Thus the potential impact of cultural segmentation on regional economic development is not only significant in the statistical sense but also important economically. Among the other control variables, ancient national political centers (such as Luoyang and Kaifeng) have per capita GDP levels 31% higher than other cities, while the history of being a local regional center in history does not have any significant effect. Having a seaport or river-port is correlated with a per capita GDP level 21% or 49% higher than other cities, respectively, with the difference statistically significant in both cases. The explanation for the river-port's larger positive effect on a city's income level is that the inclusion of the distance to the largest seaport and province fixed effects in the estimation, which most likely has absorbed the coastal city effect.

The size of the urban area in a city's jurisdiction is shown to be negatively and significantly correlated with per capita GDP, although the size of the correlation is small, with a size increase of 10% leading to a 0.7% decline in per capita GDP. This result could be due to the over-expansion of less developed cities into the surrounding rural areas due to lower land use efficiency and costs, thus probably should not be interpreted as a causal effect. The distance to the provincial capital has a small negative effect on a city's economic development level, with a distance increase of 10% correlated with a 0.6% decline in per capita GDP, but the effect is not statistically significant. This suggests that the city may interact more economically with other large cities close by. The climate variables do not have any significant effects on regional GDP level, consistent with the weak influence of climate conditions such as temperature and rainfall on modern industrial and commercial activities.

6.2. Robustness checks

The negative effect of cultural segmentation observed above may be due to the geographic isolation of the segmented regions, which leads to less developed transportation infrastructure. To control for this possibility, transportation conditions are included in column 2 in Table 3, where we include the numbers of railways, national roads, and highways that connect a city to other prefectural level or provincial level cities, named *rail*, *nationroad*, and *highway*, respectively. The access to additional national roads is shown to have no significant impact on regional development. Similarly, the access to additional railways does not have a significant effect on a city's per capita GDP, and nor does the access to additional highways, although the magnitudes of their effects are substantial. A possible explanation is that all the cities in our sample are at the prefectural level, with practically all of them connected to railways, national roads, and highways, thus giving little variation in access to transportation infrastructure among cities.

To directly take into account of the influence of geographic conditions, we further add the average and the standard error of altitude for each city in column 3. The coefficient for cultural segmentation becomes slightly larger (from 14.9% to 15.1%), suggesting that the finding cannot be explained by geographic differences. To provide more support for this argument, the correlation coefficient

Table 3
Cultural segmentation and economic development: baseline results.

Dependent variable: per capita GDP (Yuan)					
Independent variables	(1)	(2)	(3)	(4)	(5)
Cultural segmentation	−0.149*	−0.142*	−0.151*	−0.158*	−0.154*
	(0.080)	(0.084)	(0.086)	(0.087)	(0.086)
Ancient national capital	0.309*	0.286*	0.316*	0.299*	0.255
	(0.16)	(0.16)	(0.16)	(0.17)	(0.16)
Ancient provincial capital	−0.00701	−0.0309	−0.0346	−0.0387	−0.00533
	(0.14)	(0.14)	(0.15)	(0.15)	(0.14)
Latitude (degree)	0.0648	0.0626	0.120**	0.118**	0.122**
	(0.052)	(0.052)	(0.055)	(0.056)	(0.056)
Seaport	0.205*	0.262**	0.302**	0.314***	0.326***
	(0.11)	(0.12)	(0.12)	(0.12)	(0.11)
River port	0.488***	0.512***	0.533***	0.520***	0.489***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Distance to the nearest big seaport (kilometers)	0.0536	0.0493	0.0612	0.0599	0.0653
	(0.040)	(0.040)	(0.042)	(0.044)	(0.041)
Mean of temperature (degree)	0.00304	0.00218	0.00983	0.00978	0.0101
	(0.0054)	(0.0056)	(0.0068)	(0.0068)	(0.0066)
Standard deviation of temperature (degree)	0.00381	0.00344	0.0153	0.0133	0.0135
	(0.012)	(0.012)	(0.014)	(0.014)	(0.014)
Mean of precipitation (millimeter)	0.0387	0.0669	0.268	0.273	0.236
	(0.23)	(0.23)	(0.22)	(0.23)	(0.22)
Standard deviation of precipitation (millimeter)	−0.515	−0.483	−0.466	−0.301	−0.272
	(1.43)	(1.42)	(1.34)	(1.36)	(1.38)
Administrative area (square kilometers)	−0.0729**	−0.0750**	−0.0709**	−0.0716**	−0.0709**
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Distance to the provincial capital (kilometers)	−0.0621	−0.0446	−0.0223	−0.0375	0.228**
	(0.060)	(0.062)	(0.060)	(0.061)	(0.096)
Rail		0.0505	0.0533	0.0518	0.0559*
		(0.032)	(0.033)	(0.033)	(0.033)
National road		−0.00422	−0.00456	−0.00994	−0.0245
		(0.028)	(0.029)	(0.029)	(0.028)
Highway		0.0265	0.0298	0.0284	0.0372
		(0.029)	(0.030)	(0.030)	(0.030)
Mean of elevation (meter)			0.0573*	0.0563*	0.0613*
			(0.033)	(0.033)	(0.031)
Standard deviation of elevation (meter)			−0.126*	−0.123	−0.115
			(0.075)	(0.075)	(0.073)
Border city				0.0814	0.119
				(0.081)	(0.080)
Distance to the nearest big city (kilometers)					−0.357***
					(0.11)
Observations	249	249	249	249	249
R-squared	0.38	0.39	0.41	0.41	0.43

Notes:
1. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
2. Robust standard errors in parentheses.
3. All regressions control for provincial fixed effects.
4. See Table 2 for data source and definition of each variable.

between cultural segmentation and the average or the standard error of altitude is below 0.1. The effects of geographic conditions on economic development themselves are consistent with expectations. An increase of 100 m in the standard deviation of the city's altitude leads to a 12% drop in the per capita GDP, suggesting that mountainous regions are less prone to growth. The city's average altitude, on the hand, has a positive effect on per capita GDP (with an increase of 100 meters in the average altitude correlated with a 6% rise in the per capita GDP), probably due to the presence of more sunshine and mineral resources.

In column 4, we include the *border* dummy variable to address the border effect. The cultural segmentation effect not only survives, but also further increases to 15.8%. This is potentially because the border effect turns out to be positive here, although it is not significant statistically. One main assumption for the conventional view of border regions experiencing slower economic growth due to the lack of investment is the ambiguity in administrative divisions at these regions. But since the Chinese administrative division system was put in place during the early 1950s, there has not been a single occasion where a prefectural city at the border of two provinces was reassigned from one province to another province, thus violating a key condition for the negative border effect's existence.[10] On the contrary, the opportunities for inter-provincial trade may help explain the positive albeit insignificant border effect on economic development.

[10] In 1988, Hainan was separated from Guangdong province to become an independent province; and Chongqing was separated from Sichuan province in 1997 to become a provincial level city. But these two cases involve the wholesale reassignments of all prefectural cities in the affected regions.

Finally, we include the distance to the closest large city in column 5 to explore a city's economic relationship with cities other than the provincial capital. As discussed previously, for many cities the closest large city is not the capital city in their own province, but rather the vice-provincial level city in the province such as Shenzhen, Xiamen, or Qingdao. For other cities, the closest large city may be located in a neighboring province. For example, the Inner Mongolian cities of Hulunbeier and Tongliao are much closer to Harbin in Heilongjiang province and Changchun in Jilin province, respectively, than to Hohhot, their own provincial capital city. When local protectionism between provinces is not excessive and a city is far away from its own provincial capital, the city's affinity to a large city in the neighboring province may be really helpful for its development. The empirical result provides support for this possibility: a 10% reduction in the distance to the closest large city leads to a statistically significant increase of 3.6% in a city's per capita GDP, an effect much larger than that of the city's distance to its own provincial capital. At the same time, the effect of cultural segmentation remains unchanged.

6.3. Mechanisms for the cultural segmentation effect

The findings in Table 3 show that there exists a negative relationship between cultural segmentation and regional economic growth, and the relationship is robust to the inclusion of various control variables. In other words, we have found empirical evidence in support of the hypothesis discussed in Section 4. Our interpretation of the finding is that the culturally segmented city experiences higher transaction costs in trading with mainstream regions in its own province, which, combined with the neighboring province's local protectionism, result in lower trade volume, less benefit from division of labor and specialization, and thus less economic growth. But following the logic of this interpretation, we will arrive at some additional implications (as stated in the two corollaries in Section 4), which we will empirically explore next to further test the validity of our argument.

6.3.1. Local protectionism and cultural segmentation's impact on economic growth

To review, Corollary 1 states the role of local protectionism in how cultural segmentation affects regional economic development as follows: *The negative impact of cultural segmentation on economic development increases with the degree of local protectionism in the neighboring province, with which the culturally segmented region shares the same local culture*. The reasoning goes like this: As long as the culturally segmented city can trade with regions sharing its home culture in the neighboring province, the negative impact of having high transaction costs within the city's administrative division can be tempered.

To test the role of local protectionism in the effect of cultural segmentation on economic growth, we calculate the local protectionism index for each province of China using the survey of Chinese entrepreneurs conducted by the Enterprise Survey Team of the Chinese National Statistics Bureau (the EST surveys) in 2002.[11] One of the survey questions asks the entrepreneurs to list the top five provinces with the most onerous administrative restrictions when they try to sell their products outside their own province. We first assign a score of 1 for each reference to a certain province based on all the responses. Then we sum up the scores for each province to get the province's total score, which corresponds to the frequency of each province being listed as having severe local protectionism. Such frequency, however, also depends on the province's economy size, because a larger economy attracts a larger number of non-local firms to trade with the province. To control for the size of the provincial economy, we thus further divide the total score computed above by the GDP of a province to get the province's local protectionism index.

Table 4 provides the empirical results when testing the hypothesis above, where column 1 presents the last column in Table 3 to facilitate comparison. We first add the degree of local protectionism in the neighboring province, which is significantly negative, meaning that local protectionism can generate severe negative effects on regional economic development. However, the estimate of our key variable cultural segmentation changes little and is still significantly negative at 10%, so its effect is not driven by a distribution of such cities biased toward provinces facing high neighborhood protectionism.

To test Corollary 1, we use the medium value of local protectionism degree (at 0.032) as the standard to divide the sample into two subgroups, cities bordering high protection neighbors and cities neighboring low protection provinces. Column 3 gives the results for the high protection group, where cultural segmentation is correlated with a 17.6% drop in per capita GDP, 15.4 percentage points higher than the average effect shown in column 1 and very close to being statistically significant. Column 4 corresponds to the low protection group, where cultural segmentation's effect is only 6.1% and far from statistical significance. Thus, the findings are largely supportive of the patterns predicted in Corollary 1, i.e., the impact of cultural segmentation is reinforced by local protectionism.

Further support for Corollary 1 is given in column 5 and column 6 of Table 4, in which we test the different effects of local protectionism of neighboring province for cities of non-mainstream culture (culturally segmented cities) and cities of mainstream culture. We can see that although local protectionism of neighboring province hinder economic development of all cities, culturally segmented cities are harmed significantly more, because they face intra-provincial cultural conflict and higher transaction costs. Specifically, the effect of one standard deviation increase in local protectionism on culturally segmented cities is 27.0%, while the same increase on main stream cultures is only 10.9%. And the difference is statistically significant.

Another factor that influences a region's trade and economic opportunities is the potential for international trade. For a city with more international trade opportunities, neither the impact of cultural segmentation from regions in its own province nor the potential damage from local protectionism of the neighboring province will be that important. Given that the coastal region has much more

[11] The Enterprise Survey Team of the Chinese National Statistics Bureau (the CNSB) conducted a series of firm level surveys between 1993 and 2003, focusing on different issues in different years. The 2002 survey had a focus on the entrepreneurs' evaluations of the business environment, which included the question on local protectionism.

Table 4
Cultural segmentation and local protectionism.

Independent variables	Dependent variable: per capita GDP (Yuan)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			High local protection of neighboring provinces	Low local protection of neighboring provinces	Cities of non-mainstream culture	Cities of mainstream culture	Coastal provinces	Inland provinces
Cultural segmentation	−0.154*	−0.144*	−0.176	−0.0609			−0.0467	−0.232**
	(0.086)	(0.082)	(0.11)	(0.16)			(0.12)	(0.11)
Local protection of neighboring province		−8.793***			−15.775***	−6.355**		
		(2.161)			(3.116)	(2.958)		
Observations	249	249	133	116	72	177	97	152
R-squared	0.43	0.47	0.57	0.61	0.86	0.47	0.49	0.39

Notes:
1. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
2. Robust standard errors in parentheses.
3. All regressions control for provincial fixed effects.
4. We use the medium value of local protectionism degree (of 0.032) as the standard to divide the sample into two subgroups, cities bordering high protection neighbors and cities neighboring low protection provinces. Column (3) gives the results for the high protection group and column (4) corresponds to the low protection group.
5. Column (5) and column (6) are the results for cities of non-mainstream culture and mainstream culture of each province, respectively.
6. Column (7) and column (8) are the results for coastal cities and inland cities, respectively. Cities located in the coastal provinces of Liaoning, Hebei, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong and Guangxi are assigned to the coastal sub-group, while other cities form the inland sub-group.
7. The explanatory variables include all the control variables in column (5) of Table 3: ancient national capital, ancient provincial capital, latitude, seaport, river port, distance to the nearest big seaport, mean of temperature, standard deviation of temperature, mean of precipitation, standard deviation of precipitation, administrative area, distance to the provincial capital, rail, national road, highway, mean of elevation, standard deviation of elevation, border city, and distance to the nearest big city.
8. See Table 2 for data source and definition of each variable.

international trade opportunities than the inland region in China, we can thus study how cultural segmentation influences economic growth differently in these regions to further examine the validity of our culture–trust–trade-development argument. Columns 7 and 8 present the results from such an examination, where the city sample is divided into the coastal subgroup in the former and the inland subgroup in the latter.[12] The results show that, when controlling for other factors and province fixed effects, cultural segmentation has a small and insignificant effect on per capita GDP in coastal cities, whereas among inland cities, those that are culturally segmented have per capita GDP levels 23.2% lower than other cities on average and the difference is significant at the 5% level. This indicates that the average negative impact of around 15% we observe for the whole nation is mostly driven by cultural segmentation's effects on inland cities, while coastal cities are rarely affected by being culturally segmented from the regions in their administrative divisions.

We can use Suzhou, Wuxi, and Changzhou to illustrate this point. All three cities are part of the Wuyue culture, where the Wu dialect is spoken, but administratively they belong to Jiangsu province, which has Jianghuai culture as the mainstream culture. Given that both Shanghai and Zhejiang, with which these three cities share a common local culture, practice certain degrees of local protectionism, we would predict slower economic growth in these cities.[13] Fortunately, located both along the coast and along the Yangtze River, the three cities of the Wuyue culture are able to enjoy ample opportunities from comparative advantage through international trade and investment. Instead of being locked out of the national supply chain due to local protectionism and regional cultural difference, these cities have immersed into the global supply chain and have become one of the most economically advanced regions in China. The story would have been completely different if the three cities were in inland China.

To summarize, the empirical findings in Table 4 are in support of the mechanism through which cultural segmentation impacts regional economic development. We argue that two conditions are needed for cultural differences to exert a significant impact on economic growth. On the one hand, some regions become culturally segmented due to the administrative division system, and find it difficult to trade with regions in their own administrative division due to cultural differences and the ensuing lower mutual trust. On the other hand, local protectionism among provinces raise transaction costs for inter-provincial trade, making it difficult for the culturally segmented cities to transact with regions in neighboring provinces from their original local cultures. Given the high transaction costs in both intra-provincial and inter-provincial trade, the cultural segmented cities have fewer opportunities to benefit from division of labor and specialization, thus hampering their economic growth potentials. Accordingly, if provinces become less protective of their local markets or if cultural factors are given more consideration in designing the administrative division system, the negative impact on economic development observed above could be alleviated.

6.3.2. Duration of administrative division and cultural segmentation's impact

Although informal institutions evolve much slower than formal institutions, the Chinese history of thousands of years may provide an opportunity for studying the evolution and assimilation of cultures. Regardless of how the administrative divisions were originally

[12] Specifically, cities located in the coastal provinces of Liaoning, Hebei, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong and Guangxi are assigned to the coastal sub-group, while other cities form the inland sub-group.
[13] Based on the local protectionism index we construct, Zhejiang ranks in the middle of the pack, while Shanghai is the second most protective region, only after Henan province.

designed, regions assigned to the same province will certainly have more political, economic, and cultural exchanges and interactions with one another. At the center of such interactions, the provincial capital will undoubtedly play a central role in the process of cultural assimilation, with the culture it belongs to as the mainstream culture to be emulated in the province. And plausibly the success of cultural assimilation would increase over time, with more political, economic, and cultural exchanges gradually weaken the hold of the minority cultures. Therefore, if our argument about how cultural factors influence economic development is valid, the following corollary can be derived: *The negative impact of cultural segmentation on economic development decreases with the time length by which the culturally segmented region has been located in current province* (Corollary 2). And we turn to test this prediction next.

Studies in linguistics and regional cultures have established that the current patterns of Chinese dialects and local cultures took shape in the Song dynasty, thus we take Song as the starting point for the history of the regional dialect and its corresponding local culture to compute the assimilation duration till 2010, the last year covered by the current study. In other words, we define the earliest administrative amalgamation meaningful for our study of local culture and dialect to have happened at the establishment of the Northern Song, giving the longest history of cultural segmentation (and assimilation) at 1049 years.[14] The shortest history of cultural segmentation and assimilation (61 years) corresponds to the administrative amalgamation of Tongliao, Hulunbeier and Chifeng at the founding of People's Republic of China in 1949.

Table 5 presents the empirical findings corresponding to Corollary 2, where column 1 once again offers the results from Table 3, column 5 for comparison. Similar to Table 4, we divide the sample into two subgroups of short assimilation history cities and long assimilation history cities, using the medium value of assimilation history (784 years) as the dividing criterion. Columns 2 and 3 provide the results for the two groups, respectively. While culturally segmented cities with longer assimilation histories experience a smaller (10.9%) and insignificant effect of cultural segmentation on economic growth, the per capita GDP levels for those with shorter assimilation histories are 23.8% significantly lower on average. We also further investigate the effect of history assimilation on modern economic development for culturally non-mainstream and mainstream cities, with the results presented in column 4 and column 5. Interestingly, while there is a significant positive correlation between the history of assimilation and modern economic development for culturally non-mainstream cities that were segmented to their current provinces, column 5 shows that for culturally mainstream cities that share the same culture with their provincial capital city, the time length of assimilation has little correlation with their modern economic condition. In other words, cultural assimilation improves the economic performance of the segmented cities over time, which is in line with Corollary 2.

Alternatively, the findings in Table 5 suggest that the overall negative impact of cultural segmentation is mainly driven by cities that have relatively recent administrative amalgamation, thus supporting Corollary 2. Consequently, they are also consistent with our main argument that cultural differences lead to informal institutional conflicts and lack of trust, which in turn raises transaction costs and reduces trade, further resulting in slowed economic growth.

7. Discussion and additional results

This section discusses the potential concerns with the methodology adopted in the current study and conducts various tests to further explore the robustness of the empirical findings as well as compare alternative explanations for the patterns discovered.

One potential problem with using our proxy of local cultures is that it may be too crude a measure for the gradual and often subtle cultural changes across regions, since after all cultural differences are a relative concept. One example is Fujian province, where a defining feature of the Mintai local culture (which uses the Min dialect) is the substantial variation within the Mintai region, making it difficult to communicate among the dialect sub-groups of Mindong, Puxian, and Minnan. When using the measure of large dialect groups, as in our study, such differences within the Mintai region are thus neglected, the local culture proxy thus suffers from measurement errors. To address this concern, we provide the following response: As long as the within dialect group variation does not correlate with the dependent variable (i.e., economic development) or the explanatory variable of interest (i.e., cultural segmentation) in any systematic way, the measurement error can be considered as part of the exogenous random error. And as such measurement errors tend to bias the estimated coefficient toward zero, our empirical analysis would most likely provide an under-estimate of the real effect of cultural segmentation. Thus, the significantly negative correlation found between cultural segmentation and regional economic growth is especially convincing.

Yet in addition to providing supporting evidence for the detrimental effect of cultural segmentation on economic growth, the correlation between culture and the economy reported above is also consistent with a few alternative explanations. We will now discuss and compare these alternatives one at a time by providing additional econometric analyses. Tables 6 and 7 present the empirical results, where the first column in each table presents the baseline results from Table 3, column 5 for the ease of comparison.

7.1. Culture or geography?

The administrative division system adopted in the Tang and Song dynasties, where geographic barriers such as mountains and rivers served as the territory boundaries of administrative regions, largely preserved the totality of local cultures within the same administrative unit. In contrast, the Yuan dynasty and their successor rulers neglected the natural boundaries formed by geographic barriers in drawing their administrative divisions, thus the system not only broke up many local cultures into different regions but also often put important mountain ranges or wide rivers such as the Qin Mountain, the Yellow River, and the Yangtze River within the

[14] The longest history of cultural segmentation since Northern Song corresponds to the few exceptions to the general rule of allocating the same local cultural within a single administrative unit (also see footnote 2).

Table 5
Cultural segmentation and cultural assimilation.

Independent variables	Dependent variable: per capita GDP (Yuan)				
	(1)	(2)	(3)	(4)	(5)
		History length shorter than 784 years	History length longer than 784 years	Cities of non-mainstream culture	Cities of mainstream culture
Cultural segmentation	−0.154*	−0.238*	−0.109		
	(0.086)	(0.13)	(0.11)		
History length (year)				0.0012**	−0.00007
				(0.0004)	(0.0003)
Observations	249	124	125	72	177
R-squared	0.43	0.47	0.63	0.81	0.45

Notes:
1. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
2. Robust standard errors in parentheses.
3. All regressions control for provincial fixed effects.
4. We divide the sample into two subgroups of short assimilation history cities and long assimilation history cities, using the medium value of assimilation history (785 years) as the dividing criterion. Columns (2) and (3) provide the results for the two groups, respectively.
5. Column (4) and column (5) are the results for cities of non-mainstream culture and mainstream culture of each province, respectively.
6. The explanatory variables include all the control variables in column (5) of Table 3: ancient national capital, ancient provincial capital, latitude, seaport, river port, distance to the nearest big seaport, mean of temperature, standard deviation of temperature, mean of precipitation, standard deviation of precipitation, administrative area, distance to the provincial capital, rail, national road, highway, mean of elevation, standard deviation of elevation, border city, and distance to the nearest big city.
7. See Table 2 for data source and definition of each variable.

territory of a single administrative division. The implication of this feature of the administrative division system, which still applies in nowadays China, is that the same culturally segmented cities are often geographically separated from their provincial capitals. Given that the capital city is the economic and political center of each province and access to transportation infrastructure tends to hampered for geographically isolated regions, the negative impact of cultural segmentation on economic development discussed above may be due to geographic isolation instead.

To address this possibility, we add two measures for transportation costs to control for the impact of the city's geographic locations, the bus ticket price between the city and the provincial capital and the bus ticket price between the city and the closest large city. We choose bus ticket prices for the following reason: Bus ticket prices vary substantially depending on the locations and geographic conditions of the cities involved and are determined based on the actual transportation costs including tolls for tunnels and bridges as well as additional fees for detours on mountain roads. Thus they more accurately reflect the local geographic conditions of the cities studied. In contrast, railway ticket rates are uniformly determined by the former China Ministry of Railways on the basis of mileage, not taking into account the specific local geographic conditions. Similarly, airfares are largely determined by the mileage of distance

Table 6
Controlling geographic barriers and sub-sample without 4 provinces.

Dependent variable: per capita GDP (Yuan)			
Independent variables	(1)	(2)	(3)
	Whole sample		Sub-sample without cities of Anhui, Henan, Hubei, and Jiangsu
Cultural segmentation	−0.154*	−0.151*	−0.180
	(0.086)	(0.087)	(0.11)
Distance to the provincial capital (kilometers)	0.228**	0.167	0.188**
	(0.096)	(0.102)	(0.091)
Distance to the nearest big city (kilometers)	−0.357***	−0.220*	−0.300***
	(0.11)	(0.119)	(0.11)
Ticket price to provincial capital (Yuan)		0.001	
		(0.001)	
Ticket price to the nearest big city (Yuan)		−0.003**	
		(0.001)	
Observations	249	249	194
R-squared	0.43	0.44	0.44

Notes:
1. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
2. Robust standard errors in parentheses.
3. All regressions control for provincial fixed effects.
4. Column (3) drops the cities of Anhui, Henan, Hubei, and Jiangsu, which include both northern and southern dialects.
5. The explanatory variables include ancient national capital, ancient provincial capital, latitude, seaport, river port, distance to the nearest big seaport, mean of temperature, standard deviation of temperature, mean of precipitation, standard deviation of precipitation, administrative area, rail, national road, highway, mean of elevation, standard deviation of elevation, and border city.
6. See Table 2 for data source and definition of each variable.

Table 7
Investment and fiscal revenue & expenditure.

Dependent variables	Per capita GDP (Yuan)	Per capita domestic non-real estate investment (Yuan)	Per capita domestic non-housing investment (Yuan)	Per capita foreign direct investment (U.S. dollar)	Ratio of fiscal revenue to GDP	Ratio of fiscal expenditure to GDP
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Cultural segmentation	−0.154*	−0.122	−0.119	0.576**	0.0023	0.0158
	(0.086)	(0.092)	(0.092)	(0.24)	(0.0045)	(0.012)
Observations	249	249	249	249	249	249
R-squared	0.43	0.35	0.35	0.71	0.39	0.37

Notes:
1. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.
2. Robust standard errors in parentheses.
3. All regressions control for provincial fixed.effects.
4. The explanatory variables include all the control variables in column (5) of Table 3: ancient national capital, ancient provincial capital, latitude, seaport, river port, distance to the nearest big seaport, mean of temperature, standard deviation of temperature, mean of precipitation, standard deviation of precipitation, administrative area, distance to the provincial capital, rail, national road, highway, mean of elevation, standard deviation of elevation, border city, and distance to the nearest big city.
5. See Table 2 for data source and definition of each variable.

between any two cities instead of the local geographic conditions. Air travel is also rarely used between cities within the same province, thus making airfares less relevant to our analysis in this section.

Column 2 in Table 6 shows the results when the two transportation cost variables are included. While the bus ticket price for trips to the capital city does not have a significant effect, the ticket price for the closest large city has a significant negative impact on per capita GDP. The effect of the city's distance to the closest large city decreases substantially in magnitude, most likely because part of the effect is now captured in the ticket price effect. But more importantly, the negative cultural segmentation effect decreases slightly in size but remains significant. Thus cultural segmentation has an independent negative impact on a city's development that is separate from that of geographic conditions, further supporting our argument of culture affecting trust and transaction costs, which in turn influence trade and growth opportunities.

7.2. Culture or language?

The variable of interest in the current study is cultural difference among cities, yet we measure it by whether a city speaks the same dialect as the province's mainstream culture. Thus a natural question to ask is whether it is the difference in customs and social norms or the difference in the languages used that has caused the patterns observed above. When studying how cultural differences among EU members affect international trust, trade, and investment, Guiso et al. (2009) also highlight the contrast between the cultural effect and the informational effect. The cultural effect is due to the lack of trust and conflicts caused by differences in informal institutions such as customs and social norms, whereas the informational effect refers to the negative impact on international trade and investment due to language barriers and the resultant difficulty in communicating information.

In comparison with language barriers between countries, those among Chinese regions are much smaller. Thanks to the universal usage of *putonghua* (standard Mandarin Chinese) and the universal compulsory 9-year education since the early years of the People's Republic of China, the majority of the current population in their middle age and almost all Chinese youths can speak standard Mandarin Chinese fluently, thus enabling people from different regions to communicate without difficulty. As a result, the informational effect is not important in the Chinese context. In contrast, the cultural assimilation between different local cultures would take much longer than the history of new China to fully accomplish, thus the cultural effect remains to be important.

Additional evidence can be provided below for the above argument. A high degree of uniformity exists among dialects spoken in northern Chinese regions, and hence people ranging from the northeast to the northwest can understand one another, even when they speak their own dialects. In contrast, substantial variations exist among the southern dialects to the extent that people from two adjacent counties often have difficulty communicating when using their separate dialects. If the main reason for observing the negative impact of cultural segmentation is the informational effect, then we would expect that the differences between two city level dialects will not have any independent role in influencing the city's economic development whether the city is located in the northern or southern part of China. As discussed above, different dialects would not cause any communication difficulties in northern China, while in the south, communication is already difficult even between counties, speaking a different dialect from the other cities in the same province thus would not impose any additional challenge in conveying information. The only exception to this pattern is in the Chinese provinces spanning both the north and the south regions, including Jiangsu, Anhui, Henan, and Hubei, where the intra-provincial differences among city level dialects may play an important role in impacting regional development through the channel of informational effect, because these dialects may be from distinctively different dialect families of the north and of the south and thus people speaking these dialects would have difficulty communicating with one another, even though the cities may be located in the same province.

In other words, if the informational effect is the only channel through which cultural segmentation imposes an impact on economic development, then this channel would only work for the central provinces of Jiangsu, Anhui, Henan, and Hubei. Thus by excluding these provinces, we will have a cleaner case where the informational effect is absent. To verify this prediction, column 3 in Table 6 presents the estimation results with these four provinces excluded. In fact, the effect of cultural segmentation becomes

larger, with a negative effect of 18% on per capita GDP, and the effect is very close to being statistically significant (with a p-value of 0.106). Hence, we argue that the negative impact of cultural segmentation on regional economic development cannot be solely explained by the informational effect caused by language barriers.[15]

7.3. Culture or politics?

We address a third alternative explanation for the negative impact of cultural segmentation on regional development in this section, which focuses on the role of politics in economic development as follows: Since the culturally segmented cities do not belong to the mainstream culture of the province, their political status may be lower than the other cities in the same province. The lower political status will presumably lead to inferior treatments in investment, government spending, and other economic policies, which then lead to slower economic growth in these cities.

To explore the possibility that political discrimination rather than cultural differences has caused the lower income level in culturally segmented cities, we first compute the percentage of provincial CCP (Communist Party of China) standing committee members that come from culturally segmented cities in each of the 17 provinces that include these cities. On average, 50.5% of the provincial level CCP standing committee members come from culturally segmented regions, when excluding those members that are originally from outside the province; and the average percentage drops to 44.3% when including members originally from outside the province, still not significantly below 50%. Given that the population in non-mainstream regions is always substantially less than half of the total provincial population, there is no evidence for political discrimination in this regard. On the contrary, these regions seem to be over-represented on the provincial CCP standing committee.

Next, we compare investment and government expenditure data between the culturally segmented regions with the other regions. Columns 2 and 3 in Table 7 show that cultural segmentation is correlated with a 12.2% reduction in per capita non-real estate domestic investment and a 11.9% reduction in per capita non-residential housing domestic investment, although both effects are not statistically significant. On the other hand, column 4 shows that the per capita FDI level is 57.6% higher in culturally segmented cities and the difference is statistically significant, suggesting that foreign investors are not negatively affected by within province cultural differences but may instead take advantage of the void left by Chinese domestic investors potentially due to cultural differences.

Overall, there is no evidence that cultural segmentation has a significant negative effect on a city's total investment. Given the importance of investment in China's economic growth, the findings above do not support the view that the lower economic growth experienced by culturally segmented cities is due to discriminatory investment spending by the provincial governments. Columns 5 and 6 further show that there is no significant difference between culturally segmented cities and other cities in either the fiscal income to GDP ratio or the fiscal expenditure to GDP ratio, which are likely better indicators of government resources than investment figures. Thus the argument that discriminations in fiscal policies have caused the slower growth does not hold.

Political considerations offer yet another alternative argument for why culturally segmented cities are correlated with slow economic growth. As the leading goal of the Yuan rulers and their successors in drafting the administrative division system is to preserve political stability, the regions and the corresponding local cultures that were divided up were probably the same regions with the greatest proclivity for rebellion. If there is any merit for the Chinese saying “Bad surroundings produce unruly people”, then the culturally segmented regions may be more likely to have inferior natural conditions, which are less predisposed to grow economically. Consequently, one could argue that it is the substandard natural conditions that correlate with the cultural division rather than cultural segmentation itself that account for the slow economic growth in these regions.

We offer two responses to address this concern. First of all, we have already controlled for geographic and climate conditions in our estimations, including the mean and standard deviation of altitude, as well as the temperature and rainfall, and controlling for such variables does not change the cultural segmentation effect. This may be due to the fact that culturally segmented cities are not more likely to be barren mountainous regions, which should correspond to higher altitudes and larger standard deviations in altitude, as shown in the comparison of altitude mean and standard deviation in Table 1. The Chinese proverb cited above may be true, but the culturally segmented cities in our sample are not more likely to be located in regions with barren mountains and treacherous waters, compared to cities that locate within their own home cultures.

Secondly, we have presented results showing that both the reduction in the neighboring province's local protectionism and the longer history of cultural assimilation help reduce the negative impact of cultural segmentation on economic growth. These results are consistent with the mechanism through which cultural separation reduces mutual trust and raises transaction costs, which in turn hampers trade and growth, but they do not support the inferior natural condition story above, as the impact of those natural conditions should not change with how protective the neighboring province is and it also should not change over time.

8. Conclusion and policy implications

In fear of potential local challenges to central control, which could be derived from geographic barriers, the ethnic minority led Yuan dynasty designed its administrative divisions to purposefully break up regions that were located within the boundaries of natural barriers such as mountains and rivers. Such an administrative division system has led to cultural segmentation, where multiple regions with different dialects, customs, and social norms are allocated to the same province and simultaneously people sharing the same dialect, customs, and social norms are dispersed to multiple provinces. If we refer to the local culture of the provincial

[15] The loss in statistical significance is most likely due to the reduced sample size.

capital as the mainstream culture of the province, then regions that are located in the same province but speak different dialects and follow different customs and social norms are culturally misaligned and segmented. And the culturally segmented regions tend to have a lower level of trust with other regions in the same province due to cultural differences and potential informal institutional conflicts.

In agricultural societies or market economies without much governmental intervention, the within province cultural differences or cultural segmentation should not have much impact on regional economic growth. But in an economy heavily influenced by governments at various levels, as is the case of China, different regions face fierce local protectionism from one another and provinces erect various trade barriers to protect their respective local markets and their own local firms. This has led to market segmentation throughout the nation, implying higher trade costs between provinces as compared to those within the same province.

Consequently, a culturally segmented region faces higher transaction costs whether it trades with regions within or outside of its own province. Transaction costs are higher with other regions in its own province due to cultural differences and the resultant lack of mutual trust, and they are higher with regions that share the same culture but locate in other provinces due to local protectionism and the related trade barriers between provinces. Thus, opportunities in trade and the ensuing benefits from specialization and division of labor are reduced, leading to slower economic growth in culturally segmented regions.

The empirical findings from the current study are in support of the hypothesis above, showing significantly lower levels of per capita GDP in cities that have cultures different from their provinces' mainstream cultures. Furthermore, such a gap is larger for culturally segmented cities that are surrounded by provinces with a higher degree of local protectionism, also consistent with the theoretical prediction. On the other hand, the gap in per capita GDP is smaller for segmented cities that have located in their current provinces for a longer period of time, suggesting that cultural assimilation helps alleviate the impact of cultural segmentation, again consistent with the prediction from the culture–trust–trade–growth theory.

Finally, the empirical patterns summarized above imply that both formal and informal institutions are important in influencing transaction costs and economic growth in China, but there is asymmetry in how they interact with each other. While formal institutions (such as local protectionism) may be the source of the growth disadvantage of culturally segmented regions, informal institutions (such local cultures) gradually adapt to the formal institutions to regain their growth potentials. While responsive, the process of informal institutions' adaption is slow and gradual. Hundreds of years after its amalgamation into a different region, cultural differences continue to exert a significant impact on a region's economic development, suggesting that informal institutions often play a more important role than formal institutions such as administrative divisions. We thus recommend more consideration be given to cultural factors and other informal institutions when making decisions regarding formal institutions, so that potential economic loss due to misalignment in formal and informal institutions can be reduced.

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