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- Chapter 1. Junbing Zhu:
  "Cultural Diversity and Public Spending"

- Chapter 2. Junbing Zhu and Theocharis Grigoriadis:
  "Chinese Dialects, Revolutionary War & Economic Performance"

- Chapter 3. Akos Dombi, Theocharis Grigoriadis and Junbing Zhu:
  "Antiquity and Capitalism: The Finance-growth Perspective"

- Chapter 4. Junbing Zhu:
  "Chinese Diaspora and the Making of Southeast Asia"

To my family and friends

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Contents

English Summary

Chapter 1: Cultural Diversity and Public Spending

Chapter 1 explores the effect of cultural diversity on local public spending under four different political institutions–direct and representative democracy, soft and repressive authoritarianism. The analysis is done by modelling on the various preferences of cultural groups, the antagonism among cultural groups and motivations of politicians. In the analysis, we divide cultural diversity into three intervals: 1, The low level when a majority group exists; 2, The intermediate level without a majority group, but two large groups; 3, The high level with at least three large groups. The results show that the relationship between public spending and cultural diversity is related to political systems and the interval of cultural diversity. The monotone decreasing relationship is found only under soft authoritarianism. Under direct democracy or representative democracy with rent-seeking politicians, public spending decreases with cultural diversity when cultural diversity is low or high, but the relationship is inverted U-shaped at intermediate cultural diversity. When politicians are accountable under representative democracy, the relationship is also related to the population composition across electoral districts. If all districts have the same composition of cultural groups, public spending decreases monotonically at low and intermediate diversity, but rise and fall in public spending alternate at high diversity. If different groups concentrate in different districts, the alternation of rise and fall appears from the intermediate diversity. Under repressive authoritarianism, decrease and increase in public spending alternate from the low diversity, but the increase is not continuous when diversity not high.

Chapter 2: Chinese Dialects, Revolutionary War and Economic Performance

Chapter 2 explores the effects of dialectal diversity on economic performance by drawing evidence from Chinese prefecture-level cities. Considering dialectal distances, we compute five indices of Chinese dialectal diversity: 1. Dialectal fractionalization; 2. Adjusted dialectal fractionalization; 3. Dialectal polarization; 4. Adjusted dialectal polarization and 5. Periphery heterogeneity. Our primary dataset is a panel of 5-year average data over the period from 2001 to 2015 including 274 cities. The basic approach used is the fixed effect regression. To solve the endogeneity problem, dialectal diversity is instrumented by historical migration, the average attitude, and the share of land with an altitude below 500 meters. We find that dialectal fractionalization, dialectal polarization, and periphery heterogeneity have a positive effect on both the level of income per capita and economic growth. Adjusted dialectal fractionalization exhibits a positive effect only on the change in economic growth over time. However, adjusted dialectal polarization does not show any robust effects. Furthermore, the experience of being governed by the Chinese Communist Party during the revolutionary war promotes the positive effect of dialectal diversity in eastern China, while it has a negative impact in central and north-eastern regions of the country.

Chapter 3: State Antiquity and Capitalism: The Finance-growth Perspective

Chapter 3 investigates the impact of antiquity on capitalism through the finance-growth nexus. We define antiquity as the length of established statehood (i.e., state history) and agricultural years. We argue that extractive institutions and deeply entrenched interest groups may prevail in societies with ancient roots. The paper offers an in-depth analysis of one particular channel through which extractive institutions may impair economic growth: the finance-growth channel. We propose that in countries with ancient statehood, the financial sector might be captured by powerful economic and political elites leading to a distorted finance-growth relationship. We build a model in which the equilibrium relationship between companies and banks depends on the entrenchment of the economic elites and the length of established statehood. To validate our argument empirically, we run panel-threshold regressions on a global sample between 1970 and 2014. The regression results are supportive and show that financial development – measured by the outstanding amount of credit – is negative for growth in states with ancient institutional origins, while it is positive in

relatively younger ones.

Chapter 4: Chinese Diaspora and the Making of Southeast Asia

Chapter 4 examines the relationship between the population share of the Chinese diaspora and economic growth in Southeast Asia through empirical analysis. We run pooled OLS and 2SLS regressions using a dataset over the period from 1959 to 2014. In IV regressions, the population share of the Chinese diaspora is instrumented by historical variables, the number of product categories per unit area in the 1930s and the dummy of the massacre by colonists. Regressions are done for the whole sample, subsamples differing in the economic environment of doing business and the sample without Singapore respectively. We also use an alternative instrumental variable, the dummy of the port along the sea route of Zheng He's voyage, in the robustness check. Results show that, since the independence of countries in Southeast Asia, the relationship between the population share of the Chinese diaspora and economic growth is positive, and the relationship is stronger in developing countries. However, when the economic environment of doing business is discriminatory against ethnic Chinese, countries with a higher share of the Chinese diaspora are inclined to have lower economic growth. This is the consequence of the efficiency loss because of the deprivation and weakening of the Chinese diaspora economy.

German Summary

Kapital 1: Cultural Diversity and Public Spending

Kapitel 1 untersucht die Auswirkungen der kulturellen Vielfalt auf die lokalen öffentlichen Ausgaben unter vier verschiedenen politischen Institutionen - direkte und repräsentative Demokratie, sanfter und repressiver Autoritarismus. Die Analyse erfolgt durch Modellierung der verschiedenen Präferenzen kultureller Gruppen, des Antagonismus zwischen kulturellen Gruppen und der Motivationen von Politikern. In der Analyse teilen wir die kulturelle Vielfalt in drei Intervalle ein: 1. Das niedrige Niveau, wenn eine Mehrheitsgruppe existiert; 2, die mittlere Ebene ohne Mehrheitsgruppe, aber zwei große Gruppen; 3, das hohe Niveau mit mindestens drei großen Gruppen. Die Ergebnisse zeigen, dass das Verhältnis zwischen öffentlichen Ausgaben und kultureller Vielfalt mit politischen Systemen und dem Intervall kultureller Vielfalt zusammenhängt. Die monoton abnehmende Beziehung findet sich nur unter sanftem Autoritarismus. Unter direkter Demokratie oder repräsentativer Demokratie mit mietsuchenden Politikern sinken die öffentlichen Ausgaben mit der kulturellen Vielfalt, wenn die kulturelle Vielfalt niedrig oder hoch ist, aber das Verhältnis ist bei mittlerer kultureller Vielfalt umgekehrt U-förmig. Wenn Politiker unter repräsentativer Demokratie rechenschaftspflichtig sind, hängt das Verhältnis auch mit der Bevölkerungszusammensetzung in den Wahlbezirken zusammen. Wenn alle Bezirke die gleiche Zusammensetzung kultureller Gruppen haben, sinken die öffentlichen Ausgaben bei geringer und mittlerer Vielfalt monoton, aber steigende und fallende öffentliche Ausgaben wechseln sich bei hoher Vielfalt ab. Wenn sich verschiedene Gruppen in verschiedenen Bezirken konzentrieren, ergibt sich der Wechsel von Aufstieg und Fall aus der mittleren Vielfalt. Unter dem repressiven Autoritarismus wechseln sich Abnahme und Zunahme der öffentlichen Ausgaben von der geringen Vielfalt ab, aber die Zunahme ist nicht kontinuierlich, wenn die Vielfalt nicht hoch ist.

Kapital 2: Chinese Dialects, Revolutionary War and Economic Performance

In Kapitel 2 werden die Auswirkungen der dialektalen Vielfalt auf die Wirtschaftsleistung untersucht, indem Beweise aus Städten auf Präfekturebene in

China herangezogen werden. Unter Berücksichtigung der dialektalen Abstände berechnen wir fünf Indizes der chinesischen dialektalen Vielfalt: 1. Dialektale Fraktionierung; 2. Angepasste dialektale Fraktionierung; 3. Dialektale Polarisation; 4. Angepasste dialektale Polarisation und 5. Peripherie-Heterogenität. Unser primärer Datensatz besteht aus einem Panel von 5-Jahres-Durchschnittsdaten für den Zeitraum von 2001 bis 2015, einschließlich 274 Städten. Der grundlegende Ansatz ist die Regression mit festem Effekt. Um das Endogenitätsproblem zu lösen, wird die dialektale Vielfalt durch historische Migration, die durchschnittliche Einstellung und den Landanteil mit einer Höhe unter 500 Metern instrumentiert. Wir stellen fest, dass sich die dialektale Fraktionierung, die dialektale Polarisierung und die periphere Heterogenität sowohl auf das Pro-Kopf-Einkommen als auch auf das Wirtschaftswachstum positiv auswirken. Die angepasste dialektale Fraktionierung wirkt sich nur positiv auf die Veränderung des Wirtschaftswachstums im Zeitverlauf aus. Die angepasste dialektale Polarisation zeigt jedoch keine robusten Effekte. Darüber hinaus fördert die Erfahrung, während des Unabhängigkeitskrieges von der Kommunistischen Partei Chinas regiert zu werden, die positiven Auswirkungen der dialektalen Vielfalt in Ostchina, während sie sich in den zentralen und nordöstlichen Regionen des Landes negativ auswirkt.

Kapital 3: State Antiquity and Capitalism: The Finance-Growth Perspective
Kapitel 3 untersucht die Auswirkungen der Antike auf den Kapitalismus durch den Zusammenhang zwischen Finanzwachstum und Finanzwachstum. Wir definieren die Antike als die Länge der etablierten Staatlichkeit (d. h. Staatsgeschichte) und der landwirtschaftlichen Jahre. Wir argumentieren, dass in Gesellschaften mit alten Wurzeln extraktive Institutionen und tief verwurzelte Interessengruppen vorherrschen könnten. Das Papier bietet eine eingehende Analyse eines bestimmten Kanals, über den Rohstoffinstitutionen das Wirtschaftswachstum beeinträchtigen können: des Finanzwachstumskanals. Wir schlagen vor, dass in Ländern mit alter Staatlichkeit der Finanzsektor von mächtigen wirtschaftlichen und politischen Eliten erobert wird, was zu einer verzerrten Beziehung zwischen Finanzen und Wachstum führt. Wir bauen ein Modell auf, in dem die Gleichgewichtsbeziehung zwischen Unternehmen und Banken von der Verankerung der Wirtschaftseliten und der Länge der etablierten Staatlichkeit abhängt. Um unsere Argumentation empirisch zu

bestätigen, führen wir zwischen 1970 und 2014 Panel-Schwellen-Regressionen für eine globale Stichprobe durch. Die Regressionsergebnisse sind unterstützend und zeigen, dass die finanzielle Entwicklung - gemessen am ausstehenden Kreditbetrag - das Wachstum in Staaten mit alten institutionellen Ursprüngen negativ beeinflusst, während es bei relativ jüngeren positiv ist.

Kapital 4: Chinese Diaspora and the Making of Southeast Asia

Kapitel 4 untersucht die Beziehung zwischen dem Bevölkerungsanteil der chinesischen Diaspora und dem Wirtschaftswachstum in Südostasien. I führen gepoolte OLS und 2SLS-Regressionen unter Verwendung eines Datensatzes im Zeitraum 1959-2014 durch. Bei IV-Regressionen wird der Bevölkerungsanteil der chinesischen Diaspora durch drei historische Variablen bestimmt, die Anzahl der Produktkategorien pro Flächeneinheit in den 1930er Jahren und die Attrappe des Massakers durch Kolonisten. Regressionen werden für die gesamte Stichprobe durchgeführt, Teilstichproben mit verschiedenen wirtschaftlichen Rahmenbedingungen der Geschäftstätigkeit, und die Stichprobe ohne Singapur geteilt werden. Bei der Robustheitsprüfung verwenden wir auch eine alternative Instrumentenvariable, die Attrappe des Hafens entlang des Seewegs von Zheng He. Die Ergebnisse zeigen, dass seit der Unabhängigkeit der südostasiatischen Länder die Beziehung zwischen dem Bevölkerungsanteil der chinesischen Diaspora und dem Wirtschaftswachstum positiv ist und die Beziehung in den Entwicklungsländern stärker ist. Wenn das wirtschaftliche Umfeld für die Geschäftstätigkeit jedoch diskriminierend ist, neigen Länder mit einem höheren Anteil an der chinesischen Diaspora zu einem geringeren Wirtschaftswachstum. Dies ist die Folge des Effizienzverlustes aufgrund der Benachteiligung und Schwächung der chinesischen Diaspora-Wirtschaft.

List of Tables

List of Figures

Introduction

The dissertation analyzes a broad range of research questions about the relationship between non-economic factors and economic outcomes under the framework of comparative economic systems. The first two chapters focus on the effect of cultural diversity on public spending and economic development. The third and fourth chapters study the impact of state antiquity on economic growth.

Chapter 1 is a theoretical analysis of the relationship between cultural diversity and public spending. The widely accepted view is that cultural diversity undermines public spending. For one thing, citizens with different cultural backgrounds have different preferences for public goods which cannot be satisfied completely by public policies (Alesina and Spolaore, 1997; Alesina et al., 1999; Alesina et al., 2004). For the other thing, there is antagonism between different groups that makes individuals of one group care less about the welfare of other groups (Habyarimana et al., 2007; Lind, 2007). However, the existing theoretical research based on a single mechanism provides no explanations for the coexistence of a negative relationship and a positive relationship between cultural diversity and public spending in empirical studies. There is also not enough discussion about what public goods are provided, which determines the allocation of public resources among different cultural groups. Alesina et al. (1999) propose that public goods provided are those preferred by the voter with median income. But the outcome of voting on the allocation of public goods should be decided by the political power of different groups, instead of their income distribution. Furthermore, the distribution of political power and the decision on public spending are all affected by political institutions (Mueller, 2003; Holyoke, 2009).

The first novelty of this study is the joint modeling of two mechanisms based on various preferences and antagonism in the individual utility function. Given the amount of public spending, individual utility from the consumption of public goods is determined by the extent to which their preferences are satisfied. The extent of satisfaction is decided by the allocation of public resources among public goods preferred by different cultural groups and their cultural distances. Thereby, in the utility function, the preference for the composition of public goods is transformed into

a parameter showing the extent of satisfaction, and the multidimensional problem can be solved as a unidimensional one. Besides, individuals of one group care less for the utility of other groups, but the antagonism against other groups is assumed the same regardless of their cultural distances. The second contribution to literature is that the discussion is conducted with a more general setting of cultural diversity. In the analysis, cultural diversity is defined by cultural fractionalization which rises as the distribution of the population over groups becomes balanced. I divide cultural diversity into three intervals: 1, The low level with a majority group, at which cultural diversity increases as the majority group becomes smaller and only one of the other groups becomes larger; 2, The intermediate level with no majority group but two large groups, at which the population of both groups decreases until a third large group with comparable population size; 3, The high level with at least three large groups.

The third contribution to literature is that I analyze how political regimes shape the relationship between cultural diversity and public spending. In different political systems, incentives for the behavior of both the public and politicians are different. Under direct democracy, all cultural groups have equal political rights to participate in the process of public decision-making and their population size determines their political power. Following the idea of Alesina et al. (1999), I assume that the referendum on allocation is after the one on the spending level. But the public makes predictions about the composition of public goods when voting on the spending level. Besides, voting on what public goods to be provided is issue-specific (Bernhard, 2012; Mehoney, 2007), which makes it difficult to form a stable coalition among groups. Under representative democracy, public decisions are made by politicians elected by the public. On the one hand, politicians may care for reelection and commit to their policy programs. In this case, the behavior of political representatives is defined based on the citizen-candidate model and they have the same preferences with their supporters. On the other hand, politicians may act as rent-seekers. They have the incentive to spend more on public goods to abstract more rents (Barro, 1973). However, the spending level should be acceptable to the majority compared to the case when there is no tax and public goods. Under soft authoritarianism, autocrat decides public goods provision and prevents rebellion through bargaining with the public. In a repressive authoritarian state, the autocrat maximizes his private interest and keeps the public spending as low as possible. Facing the threat of rebellion, the cheaper way

between repression and public goods provision is adopted to keep his political power.

In solving the equilibrium of public goods provision, decisions on the level of public spending and the composition of public goods follow a two-step procedure. First, citizens make predictions or politicians reach an agreement about the composition of public goods taking the public spending level as given. Second, the level of public spending is decided based on the extent of satisfaction. Through the analysis of the interactions of citizens and politicians, I find that the relationship between public spending and cultural diversity is monotonous only under soft authoritarianism. Under the other political systems, although public spending starts with decreasing with cultural diversity at the low level, rise and fall in public spending alternate as cultural diversity increases to the intermediate and high level. Therefore, this study provides theoretical evidence shows that the relationship between cultural diversity and public spending is related to the level of diversity and political systems.

Chapter 2 is based on joint work with Theocharis Grigoriadis. We investigate the effects of dialectal diversity on economic development by drawing evidence from Chinese prefecture-level cities. As the dialect is a dimension of culture, we firstly show that dialects have a significant relationship link with individual values and behavior through regressions based on the dataset of Chinese Family Panel Studies (2010). In literature, cultural diversity may cause communication difficulties, social conflicts, distorted policies, and inefficiency in governance, which hinder economic development (Easterly and Levine,1997; Garcia-Montalvo and Reynal-Querol, 2005a; Goeren, 2014). However, cultural diversity may benefit the economy by increasing innovation (Pan et al. 2017), diversity in labor skills, and market specialization (Alesina et al., 2000). Given the long history of diversity, Chinese society is very inclusive of people from different dialect groups, and there are few obstacles to their communication, which may undermine the negative effect of cultural diversity on economic development. Furthermore, the writing system is common for all dialects, and the official language, Putonghua, has been promoted since the 1950s, reducing communication difficulties among different cultural groups.[1] Although studies have

[1] It is true that some people do not master the writing or Putonghua. They may also have difficulty in understanding other dialects or being understood themselves. But these are mainly old people and they account for a very small part of the population in prefecture-level cities. Their economic activities are

found negative effects of both ethnic diversity at the provincial level (Dincer and Wang, 2011) and dialect diversity at the prefectural level (Xu et al., 2015) in China, the discussion is not sufficient. Firstly, cultural diversity is not well measured. On the one hand, ethnic diversity cannot sufficiently reflect cultural diversity in China, because ethnic minorities use Han dialects as the main language after being assimilated by the Han culture in history. On the other hand, the number of Han dialects used in each city (Xu et al., 2015) can reflect neither the population distribution among groups nor dialectal distances. Secondly, Xu et al. (2015) use only economic data in 2010. Thirdly, Xu et al. (2015) instrument dialectal diversity by the railway index in the period of the Republic of China which can be explained as an indicator of traffic conditions in history. However, the index may affect economic development through trade and freight traffic, which may lead to bias in estimations.

The first contribution of this chapter is that we use five indices to explore the effect of dialectal diversity on economic development at the prefecture-level. These indices are dialectal fractionalization, adjusted dialectal fractionalization, dialectal polarization, adjusted dialectal polarization, and peripheral heterogeneity. Dialectal fractionalization reflects the probability that two randomly selected persons are from two different dialect groups, which increases in the number of groups and the balance of population distribution. Dialectal polarization represents the deviation of the population distribution across groups from a bimodal distribution, which indicates the tension between the two largest groups. Adjusted dialectal fractionalization and polarization are computed by adjusting the former two indices with dialectal distances. Periphery heterogeneity depicts the interaction between the largest group and other groups considering the dialectal distance between them. By comparing the effect of different indices, we can find whether dialectal distances have a role in explaining differences in economic development.

The second novelty is the empirical analysis based on a panel dataset covering the period 2001-2015. A fixed-effect model and 5-year average data are used in the estimation. We also examine the effect on economic growth by controlling income in the lagged period in regressions. To overcome the endogeneity, we use historical

primarily in local neighbourhoods and they encounter few communication difficulties.

migration, land altitude, and the share of land with an average altitude below 500 meters as instruments of dialectal diversity in FE-2SLS and IV-GMM regression. Historical migration indicates the frequency of receiving immigrants during the five waves of migration within China from the Jin Dynasty to the Qing Dynasty.

The third contribution of this study is that we also analyze how the governance of the Chinese Communist Party during the revolutionary war affects the effect of dialect diversity from the perspective of collectivist value and the efficiency in economic resource allocation. Citizens in prefecture-level cities with more prolonged exposure to the governance of the Chinese Communist Party are more deeply affected by the collectivist value system. Besides, the longer exposure to the Party's governance leaves a higher proportion of cadres from the native population in local government. On the one hand, local cadres have stronger capacities in dealing with the interest conflicts between different groups because they have a better knowledge of local conditions and a better reputation among residents (Li et al., 2014). On the other hand, local cadres may allocate economic resources according to their kinship instead of skills of different groups when economic resources are limited, which causes efficiency loss. Then we also consider the influence of economic resource constraints in different regions since the economic reform in China.

The results show that dialectal fractionalization, dialectal polarization, and periphery heterogeneity have a positive effect on both the level of economic development and economic growth. Adjusted dialectal fractionalization shows a positive effect only on economic growth, while adjusted dialectal polarization does not show any robust effects. The result implies that dialect distances are relevant, but the effect of dialectal distance between two polarized groups is not different from that between other groups. Moreover, the experience of being governed by the Chinese Communist Party during the revolutionary war promotes the positive effect of dialectal diversity in eastern China. At the same time, while it has a negative impact in central and north-eastern regions of the country. The results indicate that, in China, efficiency in allocating economic resources is a potential channel through which dialectal diversity affects economic growth.

The third chapter is joint work with Theocharis Grigoriadis and Akos Dombi, which explores the impact of state antiquity on capitalism through the finance-growth nexus. State antiquity is defined as the length of established statehood and agricultural

years within the present-day territory of a country. According to the literature on the deep-roots of economic development, we conjecture that historical legacies are relevant in explaining the contemporary differences in socio-economic outcomes (Spolaore and Wacziarg, 2013). However, different from a large part of this literature, our focus is on how capitalism functions instead of the long-run effect on the economic development of state antiquity. The general conclusion about financial development is that it is beneficial for growth (Levine, 2005). However, the relationship is also affected by the level of economic development, financial development, and institutions. At the same time, an extensive history of statehood tends to result in profoundly entrenched interest groups who are prone to capture the financial sector.

This study is based on the research of Borcan et al. (2018), according to which a much too long history of statehood might be detrimental to economic development because of the probable emergence of extractive institutions and deeper entrenchment of interest groups in the society. For example, although Italy and South Korea have very different cultural and institutional backgrounds, they have one thing in common: their banking sectors have frequently suffered from the collusion of political and economic elites. The main contribution of this study to the literature is that we elaborate on a particular channel proposed in the seminal paper of Dombi and Grigoriadis (2020), the finance-growth nexus, through which extractive institutions may manifest themselves in societies with ancient roots. We follow a two-step strategy to seek supporting evidence. First, we develop a theoretical model on the interaction between banks and enterprises to show how antiquity may support soft-budget constraints in lending, which impairs the finance-growth nexus. The model has two equilibrium regimes: younger countries with an economic elite too weak to capture banks in their lending activity and older countries with an economic elite strong enough to capture the financial sector. Second, we examine whether financial development, measured by the amount of credit, is less favorable in more ancient societies through empirical analysis. The regression results support the idea that the finance-growth nexus is impaired in countries with a long statehood. We also present convincing evidence that the financial sector tends to allocate society's savings inefficiently in countries with a long-established statehood because of its likely capture by the economic and political elites. The impaired functioning of the financial sector is a devastating example of the heavy legacy of antiquity on capitalism.

This study builds on Dombi and Grigoriadis (2020) and stretches their results in several respects. First, we employ the extended index considering the ancient ages before the Common Era and the number of agricultural years, while Dombi and Grigoriadis (2020) adopt the state history index of the last two millennia from the research of Bockstette et al. (2002). The second improvement is that the analysis provides a profound theoretical foundation for the impaired financed-growth nexus in societies with ancient roots. Finally, our empirical results embrace the whole world and the last half-century. This study also contributes to the literature on corruption in lending by revealing the deep historical root of the underlying phenomenon, and the literature on development by elaborating on the finance-growth channel from the perspective of the suboptimal work of capitalism under the conditions of antiquity.

In Chapter 4, I examine the relationship between Chinese diaspora and economic growth in Southeast Asia through empirical analysis. The Chinese diaspora in Southeast Asia refers to Chinese immigrants there and their descendants. Although they constitute a minority group in countries except for Singapore, they have achieved great economic success. The first driving force of economic success is their cultural tradition, Confucianism, which endows them with stronger work ethic, abilities of business management, and incentives to learn new things (Wang, 1995). The second factor is the cooperative business network providing them with mutual support in the capital, information, markets, labor and security within a nation as well as across borders (Redding, 1990; Kotkin, 1992; Weidenbaum and Hughes, 1996; Koon, 1997; Guo, 1998; K.S., 2003; Chuah et al., 2016). The third factor is that their business is a critical part of the local economy which is a legacy of colonization to some extent.

Therefore, the Chinese diaspora has advantages in entrepreneurial abilities and mobilization of economic resources to conduct entrepreneurial activities. Since studies on entrepreneurship generally suggest that it has positive effects on economic growth (Stoica et al., 2020), the Chinese diaspora should be helpful for the economic growth of their residing country. According to the theory of Spolaore and Wacziarg (2013), a higher share of the population with superiority in technologies results in a higher growth rate. I conceive that the advantage in entrepreneurship has a similar effect to that in technology. Thus, we hypothesize that, in Southeast Asia, countries with a higher population share of the Chinese diaspora are associated with higher contemporary economic growth. There is research attributing the economic

performance in Thailand, Malaysia, and Indonesia to their Chinese minorities (Yoshihara, 1988). However, there is no empirical analysis of the effect of the Chinese diaspora on economic growth. Thus, the first contribution is that we provide an empirical analysis of the relationship between the Chinese diaspora and contemporary economic growth in Southeast Asia.

The second contribution to the literature is that we also provide evidence showing that the effect of the Chinese diaspora is conditional on economic institutions and the development level. In the second half of the twentieth century, economic nationalism and economic nationalization were implemented in most Southeast Asian countries to transfer the economic role of the Chinese diaspora to indigenous groups or the state. Economic policies were discriminatory against the business of the Chinese minority and their investment was limited. Business uncertainty and risks increased substantially, which caused capital outflow. Hence, the Chinese diaspora could not play to their strengths in economic activities effectively. Moreover, the discriminatory policies distorted the economic order by weakening the economic role of ethnic Chinese. Because the policies were focused on ethnic redistribution, the state capacity was undermined in leading industrialization (Jesudason, 1989; Bowie, 1991; Yoshihara, 1995), while there were no strong bourgeoisies advancing industrialization (Jomo, 2003). Then, both politicians and indigenous people engaged in rent-seeking behavior through transactions with the Chinese minority. Therefore, the deprivation the Chinese diaspora suffered and its weakened economic role distorted the existing economic order inherited from colonial development, which resulted in efficiency loss in the allocation of economic resources. I conjecture that a higher population share of the Chinese diaspora is associated with a greater loss in a discriminatory economic environment.

Besides, as Liang (2010) proposes that Confucian traits contribute to the follower mode growth but may become an impediment to the leading mode growth, I hypothesize that the effect of the Chinese diaspora is stronger in developing countries than in Singapore which has been a developed country for decades. To test the hypotheses, I run pooled OLS and 2SLS regressions using a dataset over the period 1959-2014. In IV regressions, the population share of the Chinese diaspora is instrumented by the number of product categories per unit area in the 1930s, reflecting the level of exploitation of economic resources, and the dummy of the massacre by

colonists. Regressions are done for the whole sample, subsamples of different economic environments, and the sample without Singapore respectively. Results show that, since the independence of countries in Southeast Asia, the relationship between the population share of ethnic Chinese and economic growth is positive, and the relationship is more substantial in developing countries. However, when the economic environment of doing business is discriminatory, countries with a higher share of the Chinese diaspora are inclined to have lower economic growth. The results imply that it is detrimental to implement discriminatory policies against an efficient fraction of the economy to promote the economic status of the rest in the economy, and they should find a better way to pursue the economic parity between the ethnic Chinese minority and indigenous groups.

Chapter 1

Cultural Diversity and Public Spending*

1.1 Introduction

In this chapter, the effect of cultural diversity on public spending is explored under both democratic and authoritarian regimes through model analysis. Cultural diversity is a common phenomenon around the world and reflects variations in values, norms, and attitudes towards economic activities, public affairs, and life. In literature, it is measured by ethnic diversity, linguistic diversity, or religious diversity, depending on the focus of the study. There have been studies showing that cultural diversity undermines public spending. On the on hand, citizens in a diverse community prefer lower public spending because their preferences for public goods are different and cannot be completely satisfied (Alesina and Spolaore, 1997; Alesina et al., 1999; Alesina et al., 2004). The example offered by Alesina et.al (1999) is that people from different cultures require different language instructions in public schools. Some prefer bilingual education, while others do not. This is also true in China. Since 2010, "Hold up the Cantonese" has been in progress. Therefore, utility from the consumption of public goods contributes less to the welfare of individuals. On the other hand, there is antagonism between different cultural groups, meaning that individuals from one group care less about the welfare of other groups (Habyarimana et al., 2007; Lind, 2007). However, theoretical analysis in the existing literature cannot explain why both negative and positive relationships emerge in empirical studies.

From the perspective of the procedure for deciding public spending, there are still two issues that need further investigation. The first one is how to decide the composition of public goods preferred by different cultural groups. As Alesina et al. (1999) propose, only the public good preferred by the voter with median income is

* This chapter is based on the single work of Junbing Zhu (Freie Universität Berlin), and "I" will be used throughout this chapter.

provided, and the median of spending levels preferred by all groups wins in the voting. However, the question is why voters choose the public goods preferred by the median voter in the dimension of the income distribution, especially when the society is highly fragmented. The outcome of voting on types of public goods, as the allocation of public resources among different cultural groups, should be determined by the voting power of different groups, instead of their income distribution. Therefore, the outcome should be unlike under different political regimes, which is the second issue discussed in this study. The problem persists regarding the choice of spending level. The decision on public spending is a result of the competition for public resources among different cultural groups, and it is also affected by the political influence these groups can exert on public choices, which is different under different regimes (Holyoke, 2009), while Alesina et al. (1999) focus on the procedure under direct democracy. Ghosh and Mitra (2016) consider two cases-democracy and dictatorship, but there are only two groups and two types of public goods-ethnic targeted public goods and common public goods. They take the population share of the dominant group as the measure of ethnic diversity, and the total spending on public goods is assumed as constant. Thus, they oversimplify the index of diversity and do not explain the relationship between the level of public spending and ethnic diversity. Furthermore, the political regime involved in their analysis is a representative democracy with two parties competing for support from citizens. Thus, the discussion about the relationship between cultural diversity and public spending under different political regimes is not enough.

In this paper, the model is built on citizens' behavior and their interactions with politicians in different political regimes. The Indiviaul utility is determined by the extent of satisfaction with the composition of public goods and antagonism against other groups, but their choice is conditioned on political institutions. In direct democratic countries, all cultural groups are endowed with equal political rights to participate in the process of public decision-making, and public decisions are supported by the majority in voting. Thus, the public choice entirely depends on the preferences of all residents. In representative democratic countries, people only vote for political representatives based on their preferences and policy packages, and the government is more powerful in making public choices (Wagschal, 1997). The public does not have enough political power to participate in public decision-making directly. Besides, the public decision is also related to different motivations hold by politicians

(Maskin and Tirole, 2004; Barro, 1973). The government has stronger power in making public choices under authoritarianism. According to the analysis of Mueller (2003), a dictator maximizes his private utility, given the wealth he obtains from residents. But under soft authoritarianism, the autocrat staying in political power also shows concern for the welfare of the society and relies on the bargain between the public and government other than repression in the game of public goods provision to seek social stability (Desai, 2007). However, this is not the case under repressive authoritarianism which relies more on political repression. Hence, the primary task of this paper is to discuss the effects of cultural diversity on public spending considering political systems and interactions between the public and politicians, which is also the main contribution of this study. The other novelty of this study is the general setting of cultural diversity based on cultural fractionalization, which is divided into three intervals-low, intermediate and high levels.

Through model analysis, I find that the relationship between public spending and cultural diversity is monotonous only under soft authoritarianism. Under direct democracy and representative democracy with rent-seeking politicians, public spending only decreases monotonically with cultural diversity when cultural diversity is low or high, but the relationship is inverse U-shaped when cultural diversity is intermediate. Under representative democracy when politicians are accountable, public spending decreases monotonically when diversity is low, and rise and fall in public spending take place by turn at high cultural diversity. At intermediate diversity, if all electoral districts have the same population distribution over cultural groups, the relationship is negative, and the coalition is formed between the first largest group and small groups with closer cultural distance. When the two largest groups concentrate in each half of electoral districts, the relationship is inverse U-shaped, and the coalition is formed between representatives of the two largest groups. Under repressive authoritarianism, public spending decreases monotonically when cultural diversity is very low, but after that rise and fall alternates as diversity increases. Hence, the relationship between cultural diversity and public spending has different patterns in different regimes, which may explain the inconsistent conclusions of empirical studies

The second section reviews the literature on previous studies on the effect of cultural diversity and political institutions on public goods provision and coalition formation in the process. The third section sets the basic model regarding the measure.

of cultural diversity and the utility function. In the fourth section, the relationship between cultural diversity and public spending is analyzed under democratic systems. The analysis of authoritarian regimes is in section five. The last section concludes.

1.2 Literature review

1.2.1 Cultural diversity and public goods provision

Most of the existing theoretical analyses indicate the negative effects of cultural diversity on public goods provision, and this seems to be widely accepted. From the theoretical perspective, Alesina et al. (1999) conclude that public spending is negatively related to cultural diversity by analyzing a linear function of the behavior of the median voter. Different from this linear utility model, Aelsina and La Ferrara (2004) take an abstract utility function and measure cultural diversity by the number of population groups. By maximizing the welfare of the whole population, they conclude that local governments in more diverse regions tend to impose lower tax rates, which results in less spending on public goods. However, the number of ethnic groups does not capture the change in the population distribution among different groups while cultural diversity increases. On the other hand, the common utility function for different groups neglects differences in their benefits from public spending and they do not discuss the interaction among different cultural groups regarding their heterogeneous preferences. Concerning the interaction among cultural groups, Alesina and La Ferrara (2000) show that people are less likely to participate in collective social activities. Lind (2007) introduces the antagonism between two groups into the model and concludes that the rise in both the antagonism and cultural diversity resulting from the change in population shares have a negative impact on the equilibrium tax rate. This factor has also been investigated by other researchers (Tajfel et al., 1971), but no one has discussed both mechanisms simultaneously in one model.

There is also empirical evidence showing the detrimental effect of cultural diversity on the state's capacity to provide public services. Easterly and Levine (1997) suggest that ethnic fragmentation in Sub-Saharan Africa can explain a significant part of the lower capacity of the state to deliver public goods and develop financial systems. La Porta et al. (1998) show that ethnolinguistic diversity is linked to the inferior quality

of government measured by government intervention, public sector efficiency, public goods provision, and political freedom using a cross-country dataset. Similarly, Mahzab et al. (2013) conclude that the most significant negative impact of ethnic diversity is on the health and sanitation sectors. From the perspective of human development measured by child mortality, fertility, education, and wealth, Gerring et al. (2015) also find negative impacts at the national level. Desmet et al. (2012) also provide supportive evidence for the negative effect, in which they take linguistic diversity as the index of cultural diversity. Moreover, Desmet et al. (2015) compare the efficiency of ethnic diversity and diversity of values in measuring cultural diversity and conclude that only a small part of cultural diversity can be explained by ethnic diversity and the variation in values within a country is a better predictor of civil conflicts. When the potential endogeneity of ethnic diversity is taken into account, the negative relationship still exists (Ahlerup, 2009). Studies in some particular nations also provide similar results, such as studies on rural western Kenya (Miguel and Gugerty, 2005) and the control of deforestation in Indonesia (Alesina et al., 2015).

However, some studies exhibit inconsistent results. Baldwin and Huber (2010) argue that there is no significant effect of cultural fractionalization on public goods provision. Wimmer (2015) claims that both contemporary ethnic heterogeneity and low public goods provision are legacies of a weakly developed state capacity inherited from the past. He shows that state capacity to deliver public goods is not systematically associated with linguistic diversity once considering the historically achieved level of centralization. Therefore, the relationship between cultural diversity and local public spending may have different patterns under different political institutions. Besides, a positive relationship between ethnic heterogeneity and public goods provision, especially welfare outcomes related to publicly provided goods and services, has been found in subnational Zambia (Gisselquist et al., 2016). The same relationship is also found in the research by Gibson and Hoffman (2013). Regarding the inconsistency between theoretical analysis and empirical results, Gisselquist (2014) argues that the influence of ethnic diversity is not straightforward and it is mixed for different kinds of public goods. The impact on the provision of education and roads is negative, and the effect on the provision of health and social security is positive. This implies that the level of public spending is also related to the structure of public goods, which is related to the allocation of public resources among public goods preferred by different

cultural groups.

1.2.2 Political institutions and public decision-making

Public institutions determine the relative power between the government and the public in the process of public decision making. Direct democracy gives the public the most influential power, and public choices are the reflections of the preference of the whole population (Matsusaka, 2007; Downs, 1957). Matsusaka (2007) states that governments face stronger voter sanctions under direct democracy and stronger pressure to provide public goods following the preferences of the public. Analysis based on the data of Swiss communes shows that direct participation of voters results in a higher quality of public goods supplied, with this being determined more by citizens than by the government (Frey, 1994). In the case of different interest groups, Papadopoulos (2001) put forward that powerful veto groups can use referendums simply as a threat. But its cost is high for minority groups, which may result in isolation and lack of adjustment in a society with cleavages. Hence, the public choice is mainly based on the preferences of the majority cultural group when there is one such group. Wagschal (1997) also holds the opinion that citizens cannot get an equal response even if they have equal rights in the process of public policymaking. However, Leblanc et al. (2000) point out that the majority rule of making public decisions contributes to under-provision of public goods because of the uncertainty for the public about their position in the future, which means that they will be either in the winning coalitions or left in the losing minority. Bernhard (2012) agrees with the description "ad hoc issue coalitions" put forward by Mahoney (2007). Such coalitions, with low levels of formalization, exist for the duration of a single campaign. Comparing with coalitions under representative democracy, Bernhard (2012) poses four features of coalitions under direct democracy: no room for bargaining, no institutionally designated leader, a larger number of potential coalition partners, and a resemblance to pre-electoral coalitions. All these features make it more challenging to reach an agreement among partners of a coalition when many cultural groups have a relatively large population size and a winning coalition must include more such groups. Acemoglu et al. (2006) state that the ruling coalition needs must be powerful enough and self-enforcing. Therefore, the coalition cannot be too large.

In representative democratic countries, interest conflicts between different cultural groups are transformed into the choice of political representatives. The division between citizens and public decision-makers allows politicians to choose between different policy packages according to their motives (Persson et al., 2007; Maskin and Tirole, 2004). If they maximize their private interests, rent-seeking behavior can be expected, and they tend to choose higher spending than that preferred by the public (Cowen et al., 1993; Barro, 1973). However, political competition makes politicians favor the policy that maximizes support from voters (Ghosh and Mitra, 2016; Ansolabehere and Snyder, 2006; Maskin and Tirole, 2004; Polo, 1998; Barro, 1973). In addition to the motives of politicians, Mueller (2003) ascertained that the interests of elected representatives are related to the population distribution of different interest groups in each electoral district. Thus, the analysis of the public decision making should also consider the population distribution of electoral districts where political representatives are elected. With respect to coalition formation, the study of Acemoglu et al. (2006) still applies, which is consistent with the view of Riker (1962) concerning "minimal winning coalitions" that coalitions contain the minimum number of necessary members to get dominating power are more likely to be formed. Hence, coalition size is strictly controlled under representative democracy.

In contrast to the case of democratic countries, public choices are made mainly according to the preferences of the dictator and governors under dictatorship (Mueller, 2003). Desai et al. (2007) argue that the survival of a dictatorship is based on the contract between citizens and the ruler, which is called the "authoritarian bargain," under which there is a tradeoff between political rights and public goods. This is the case of soft authoritarianism because rulers provide public goods at the level that prevents the public from rebellion. Roy (1994) summarizes two features of soft authoritarianism. The first is that collective interests are more important than individual rights and most of the political powers are in the hand of the government. The second is that rulers use persuasion rather than coercion to keep support from the public. Thus, the government also faces constraints from the public when making public choices. Another way for the autocrat to stay in power is the use of repression (Desai et al., 2009). Contrary to the characteristics above, police and military power are used more often to secure stability. The demands of the public receive less response from the government under this regime compared to the other three types of regimes.

In the following analysis, this regime is called repressive authoritarianism.

1.3 The basic model

In this model, I assume that the total population is N, and there are K cultural groups. The population share of each cultural group is s_k such that $\sum_{k=1}^{K} s_k = 1$. The population distribution over cultural groups is represented as the vector $S = (s_1, s_2, ..., s_K)$. Besides, there are D electoral districts in each of them the population distribution over cultural groups is $S_d = (s_{d1}, s_{d2}, ..., s_{dK}),\ d = 1, ..., d, ..., D$. For any pair of cultural groups, k and j, the cultural distance between them is r_{kj} and $r_{kj} = r_{jk}$. There are in total $K(K-1)/2$ combinations of groups with cultural distances between each other. For any three groups k, j and h, $r_{kj} < r_{kh} + r_{jh}$ according to the property of a triangle. This relation is introduced by Desmet et al. (2009).

1.3.1 Utility function

To construct the utility function of individuals, I include the mechanisms of heterogeneous preferences and antagonism simultaneously. Firstly, the benefit of a cultural group from the consumption of public goods is related to the distance between the preference of the group and the actual public goods provided. People from different cultural groups prefer different public goods, but their preferences may not be satisfied entirely in reality. Therefore, if public goods are provided according to the preference of a particular group, other groups benefit less from consuming the same amount of public spending. Given the public spending level, the extent of satisfaction is associated with the distribution of public resources over public goods preferred by different cultural groups, which is the composition of public goods along with the preferences of different groups.

Let $F_k = (f_1, ..., f_j, ..., f_K)$, where f_j is the proportion of public goods provided according to the preference of cultural group *j* such that $\sum_{j=1}^{K} f_j = 1$. θ_k is defined as the extent to which the preference of group k is satisfied. Then, I assume that θ_k is

determined by the composition of public goods and cultural distances between group k and other groups, such that $\theta_k = \sum_{j=1}^{K} f_j(1-r_{kj})$. Thereby, $0 < \theta_k \leq 1$, meaning that all people prefer public goods to nothing and benefit more from public goods closer to their preferences. And θ_k takes different values when public goods are supplied according to the preferences of different cultural groups. Although the composition of public goods is a multidimensional problem, the decision of the public is unidimensional based on θ_k. In this model, the following assumption is introduced regarding the composition of public goods :

Assumption 1.1: No group has private information on the allocation of public spending, and all groups have the same prediction given the population distribution among all cultural groups, such that $F_k = F$.

Given the level of spending per capita on public goods, g , $g^{\sigma}(1 > \sigma > 0)$ is the utility from the consumption of public goods of an individual whose preferences are fully satisfied. The utility an individual from group k gains from the public good is $\theta_k g^{\sigma}$. The utility function of an individual without considering the utility of other individuals is:

(1) $u_k = y(1-t) + \theta_k g^{\sigma}$,

in which y is the individual income level and t is the proportional tax rate. The utility function is the same for all individuals in the same cultural group.

The second mechanism behind the effect of cultural diversity, group antagonism, is also considered. People from different cultural groups may not like to share public goods with each other and are more concerned about the welfare of their group. Let α and β be the extent to which an individual cares about the welfare of people from the same group and other groups, respectively. Naturally, $1 \geq \alpha > \beta$. Without losing the generality, we assume that $\alpha = 1$ and β takes the same value for all other groups. Let U_k be the individual utility including concern about the utility of others. Then

$$U_k = u_k + (Ns_k - 1)u_k + \beta \sum_{j \neq k}^{K} Ns_j u_j = Ns_k u_k + N\beta \sum_{j \neq k}^{K} s_j u_j = N(s_k u_k + \beta \sum_{j \neq k}^{K} s_j u_j).$$

Substituting u_k and u_j by (1), the individual utility becomes

(2) $U_k = Ny(1-t)[s_k + \beta(1-s_k)] + N\left[s_k\theta_k + \beta\sum_{j\neq k}^{K} s_j\theta_j\right]g^{\sigma}$.

As *N* is constant, to maximize U_k is the same as to maximize the following utility per capita:

$v_k = y(1-t)[s_k + \beta(1-s_k)] + (s_k\theta_k + \beta\sum_{j\neq k}^{K} s_j\theta_j)g^{\sigma}$.

Since $\theta_k = \sum_{j=1}^{K} f_j(1-r_{kj})$ and $\theta_j = \sum_{l=1}^{K} f_l(1-r_{lj})$, the average utility is

(3) $v_k = y(1-t)[(1-\beta)s_k + \beta] + \left[(1-\beta)s_k\theta_k + \beta\sum_{j=1}^{K} s_j\theta_j\right]g^{\sigma}$

Let $a_k = \beta + \beta(1-s_k)$ and $b_k = (1-\beta)\sum_{j=1}^{K} s_k f_j(1-r_{kj}) + \beta\sum_{j=1}^{K}\sum_{l=1}^{K} s_j f_l(1-r_{lj})$, be the coefficients showing the contribution of private goods and public goods consumption to the utility. Thus, $v_k = a_k y(1-t) + b_k g^{\sigma}$. Since $\beta < 1$, we can see that a_k is monotonically increasing in s_k. Keeping the distance between different preferences constant, the utility from public goods is determined by the relative population size of group k compared to other groups and the utility is increasing with the increase in the population of their own group. Furthermore, the population distribution among all groups determines the population size. But b_k is also related to θ_k in addition to the population distribution. With respect to the optimal choice of each group, the following assumption is introduced:

Assumption 1.2: Group k prefers $f_k > 0$ to $f_k = 0$.

A summary of all variables is in Table 1.1.

Table 1.1. The definition of variables

Variables	Definition
K	number of culture types, integer, ≥ 3
N	the total population, integer
D	number of electoral districts, integer
s	population share of a particular group, (0,1)
r_{kj}	cultural distance between culture k and culture j, (0,1)
f_k	the proportion of public goods according to the preference of group k, [0,1]
θ_k	the extent to which group k is satisfied with the public goods provided, (0,1]
g	public spending per capita
t	tax rate
g^{σ}	pure utility from consuming public goods
β	the extent to which individuals care about the utility of people from other groups, $\beta < 1$
a_k	$s_k + \beta(1-s_k)$, the contribution of private consumption to utility
b_k	$(1-\beta)\sum_{j=1}^{K} s_k f_j (1-r_{kj}) + \beta \sum_{j}^{K}\sum_{l=1}^{K} s_j f_l (1-r_{lj})$, the contribution of public goods to utility

1.3.2 Cultural diversity

In most studies on diversity, cultural diversity is measured by the ethnolinguistic fractionalization, $ELF = 1 - \sum_{k=1}^{K} s_k^{\,2}$. This index implies that cultural diversity increases as the number of groups increases, and the population distribution becomes more balanced among more groups. In the study of Desmet et al. (2007) and Greenberg (1956), the social aggregate cultural diversity is proxied by the index $GI = \sum_{k=1}^{K}\sum_{j=1}^{K} s_j s_k r_{kj}$, which is the result after the adjustment of fractionalization by cultural distances. This index poses a new issue of whether the directions of changes in ELF and GI are

consistent while the population distribution changes. There are some extreme cases when changes in ELF and GI are not consistent (see Appendix A.1). Therefore, we define the increase in cultural diversity in the following way such that both ELF and GI increase as the population distribution becomes more balanced:

1. *Low cultural diversity*: There is a majority cultural group M with the initial population share $\frac{K^2-K+1}{K^2}$ and its population share decreases, but it cannot be smaller than $1/2$. All other groups are much smaller with the average population size $\frac{1}{K^2}$.
2. *Intermediate cultural diversity:* There is no majority group but two large groups, L_1 and L_2 with much higher population shares than small Groups $L_i (i = 3,...,K)$. The population share of the larger one of them decreases and the other increases until $s_{L_1} = s_{L_2}$. Then the population of both groups decreases until a third large group L_3 emerges, with the result that only the population sum of the two large groups is larger than $1/2$. Furthermore, I assume that $r_{L_1L_2} < r_{L_1L_i} < r_{L_2L_i}$ for most small groups consistent with the assumption above.
3. *High cultural diversity*: s_{L_3} increases and the population distribution becomes balanced among more cultural groups.

1.4 Cultural diversity and public spending under democracy

This section is a static analysis of local public spending and cultural diversity under democratic regimes-direct democracy and representative democracy. Under democracy, citizens have much power in public policymaking and the government has the responsibility to meet the demand of the public. In the following discussion under different political regimes, we start with the first setup of direct democracy.

1.4.1 Direct democracy

Under direct democracy, public spending is completely determined by the results of public voting. Both the types of public goods, as the allocation of public resources, and the public spending level are determined by the majority rule through voting. The

choice of public spending is the median of spending levels preferred by all cultural groups. The timing of the game has the following structure: 1, The public predict the composition of public goods to provide; 2, The public vote on the tax rate by optimizing their utility function; 3, Tax revenue is raised to provide public goods. Given their prediction of the first step, the problem for individuals of group k is

$$\max_{g,t} \quad U_k = a_k y(1-t) + b_k g^{\sigma}$$
$$s.t. \quad g = ty$$

Then the public spending level preferred by group k is

(4) $g_k = (\sigma b_k / a_k)^{\frac{1}{1-\sigma}}$.

No matter what their prediction is about the composition of public goods, the public spending favored by group k is determined by (4). Since different groups do not benefit from public goods at the same level, they have different preferred spending levels, and Lemma 1 is introduced (The proof is in Appendix A.2).

Lemma 1.1: When s_k *is larger than* s_j, $g_k \geq g_j$ *if* $\theta_k \geq \theta_j$.

Because of the competition among different cultural groups over public resources, the other important problem is to decide what public goods are provided before choosing the spending level, which means that θ must be determined in the first place. People from all cultural groups know that preferences supported by the majority will be satisfied. Their decision in the first step of the game is mainly based on the information about the population distribution of cultural groups and it may be accompanied by uncertainty when the population is highly fragmented (Leblanc et al., 2000). According to Assumption 1.1, all groups have the same and correct information about the population distribution. The following discussion starts from the situation of low cultural diversity.

Low Cultural Diversity

If the whole population has the same cultural background, they have the same preference for public goods. Then $a = b = 1$ and $\theta = 1$ for all individuals. Therefore, the equilibrium public spending level in a homogeneous society is $g = (\sigma b/a)^{\frac{1}{1-\sigma}} = \sigma^{\frac{1}{1-\sigma}}$.

When there is a majority cultural group M such that $s_M > 1/2$, the population

becomes more diverse than a homogeneous one. Thus, public goods will be provided based on the preference of the majority after voting. Therefore, $\theta_M = 1$ and $\theta_j = (1 - r_{jM})(j \neq M)$ because $f_M = 1$ and $f_j = 0(j \neq M)$. For individuals in the majority group, their preferred spending level is

$g_M = (\sigma b_M / a_M)^{\frac{1}{1-\sigma}}$,

in which $a_M = s_M + \beta(1 - s_M)$ and $b_M = (1-\beta)s_M + \beta\sum_{j=1}^{K} s_j(1 - r_{jM})$. Because $s_M > 1/2$, g_M must be the median of the spending levels preferred by different cultural groups and it is chosen as the optimal public choice. Thereby, $g^e = g_M$ in equilibrium. As long as $s_M > 1/2$, the equilibrium public spending level is the one preferred by the majority group. Since $a_M > b_M$, $\sigma b_M / a_M < \sigma$. Then $g_M < g$. Furthermore, when the population share of the majority group decreases, the society becomes more diverse and this implies that g_M decreases according to Lemma 1.1.

Intermediate Cultural Diversity

In this case, there are two large groups, L_1 and L_2, of which L_1 has the same cultural background as M in the analysis above and a population share no higher than $1/2$. L_2 is the second large group. Both s_{L_1} and s_{L_2} are larger than $\sum_{i=3}^{K} s_{L_i}$ and far larger than the population share of each small group. Although there is no majority group, small groups cannot achieve a fair allocation of public resources due to their disadvantage in the population size. Hence, the interest conflict exists primarily between large groups, while small groups choose which one to support. Then, Lemma 1.2 is introduced firstly.

Lemma 1.2: There is no stable coalition formed by any pair of groups under direct democracy when there is no majority group.

Lemma 1.2 can be proved by contradiction. If there is any coalition, the coalition can be formed by the two largest groups or by one large group and small groups such that there are three possibilities of coalitions $(L_1, L_2), (L_1, L_i)$ and $(L_2, L_i)(i \geq 3)$. When small groups are in a coalition, there may be more than one of them. Firstly, suppose

that the coalition is (L_1, L_2). The allocation of public resources between the two groups is a zero-sum game. But the large group can benefit from deviation and seek support from small groups due to the advantage in bargaining over the allocation of public resources. Small groups would also prefer it if some public goods are provided according to their preference. Thus, the coalition between the two largest groups is not stable. Secondly, the other two possibilities are (L_1, L_i) and (L_2, L_i) which means that small groups cooperate with one large group on all issues about what public goods to provide. However, under direct democracy, voting is issue-specific (Bernhard, 2012; Mehoney, 2007). On some matters, small groups benefit more from supporting group L_1 , and on others, they benefit more from supporting group L_2 (Bernhard, 2012; Kriesi et al., 2008). The more similar the cultural backgrounds of the groups are, the more likely the support is given to each other. Hence, for some public goods, the choice of small groups is more like that of group L_1, while their selection of other public goods is more similar to that of group L_2. Even if the coalition is formed between one large group and small groups, the large group can expect the deviation of small groups in the future on later issues. Thus, (L_1, L_i) and (L_2, L_i) emerge on different voting issues. Therefore, the coalition of one large group and small groups is not stable across all voting issues, and Lemma 1.2 is proved.

In this case, large groups would insist on their preference for what public goods provide rather than compromising with small groups to get their support. Therefore, neither group would like to make an effort to form a coalition. Small groups make choices between proposals submitted by large groups, and no group can win in all voting. Suppose that the proportion of public resources spent on public goods preferred by group L_1 is f_{L_1} and similarly the proportion for group L_2 is f_{L_2}. Then

$$a_{L_1} = (1-\beta)s_{L_1} + \beta$$

$$b_{L_1} = s_{L_1}(1 - f_{L_2} r_{L_1 L_2}) + \beta s_{L_2}(1 - f_{L_1} r_{L_1 L_2}) + \beta \sum_{i=3}^{K} s_{L_i}(1 - f_{L_1} r_{L_1 L_i} - f_{L_2} r_{L_2 L_i}).$$

Similarly,

$$a_{L_2} = (1-\beta)s_{L_2} + \beta$$

$$b_{L_2} = s_{L_2}(1 - f_{L_1} r_{L_1 L_2}) + \beta s_{L_2}(1 - f_{L_2} r_{L_1 L_2}) + \beta \sum_{i=3}^{K} s_{L_i}(1 - f_{L_1} r_{L_1 L_i} - f_{L_2} r_{L_2 L_i}).$$

For small groups, and taking L_3 as one them, benefits from private consumption and public goods are related to a_{L_3} and b_{L_3}, and

$$a_{L_3} = (1-\beta)s_{L_3} + \beta$$

$$b_{L_3} = s_{L_3}(1 - f_{L_1} r_{L_1 L_3} - f_{L_2} r_{L_2 L_3}) + \beta s_{L_1}(1 - f_{L_2} r_{L_1 L_2}) + \beta s_{L_2}(1 - f_{L_1} r_{L_1 L_2}) + \beta \sum_{i=4}^{K} s_{L_i}(1 - f_{L_1} r_{L_1 L_i} - f_{L_2} r_{L_2 L_i}).$$

Then, $g_{L_1} = (\sigma b_{L_1} / a_{L_1})^{\frac{1}{1-\sigma}}$, $g_{L_2} = (\sigma b_{L_2} / a_{L_2})^{\frac{1}{1-\sigma}}$ and $g_{L_3} = (\sigma b_{L_3} / a_{L_3})^{\frac{1}{1-\sigma}}$. f_{L_1} and f_{L_2} depend on the support received by groups L_1 and L_2 from small groups. It is evident that the larger a group is, the less support from small groups it needs, which means it has stronger political power than the other group and wins in more referendums. Additionally, the closer a group to small groups in culture, the more cases it can win in the voting.

Since group L_1 is closer to small groups in culture according to our assumption, the situation when s_{L_1} is equal or close to $1/2$ is the same as the one where group L_1 is the majority. Thus, $f_{L_1} = 1$, but $g_{L_1} < g_M$ because of the smaller population size. Besides, $g_{L_1} > g_{L_2}$ and $g_{L_i} (i \geq 3)$ is much lower due to the much smaller population. In this case, public spending is determined by the proposal of group L_1. If they propose g_{L_1}, then at most half of the population vote for it, and no proposal is passed through the voting, which means there will be no public goods provision. However, if group L_1 supports the proposal g_{L_2}, g_{L_2} can receive the support of the majority and be set as the level of public spending. Group L_1 would not vote for any level lower than g_{L_2} because of rationality.

As s_{L_1} becomes smaller, s_{L_2} increases closer to $1/2$, and society becomes more fractionalized. Group L_2 gets stronger political power. The support of small groups can make L_2 win resources for public goods they prefer in the voting. Thereby, $f_{L_2} > 0$ and θ_{L_2} increases. Furthermore, g_{L_2} also increases due to the rise in s_{L_2} and θ_{L_2}. At the same time, g_{L_1} decreases. But as long as $s_{L_1} \geq s_{L_2}$, $g_{L_2} < g_{L_1}$ and g_{L_2} is the choice by the public as g^e. Thus, the public spending level increases in this period, which will continue until $s_{L_1} = s_{L_2}$.

When $s_{L_1} = s_{L_2} < 1/2$, the increase in fractionalization means the decrease in s_{L_1} and s_{L_2}. Then s_{L_3} increases. But when group L_3 is not big enough, they cannot make a difference in the allocation of public resources and still make a choice between proposals of group L_1 and group L_2, g_{L_2} is the median of preferred public spending levels of the whole population. When s_{L_3} is sufficiently large, the support of other small groups $L_i (i \geq 4)$ is not critical for group L_1 and group L_2, and they have to seek cooperation with group L_3 if they want to be a winner in the voting. Then we encounter the situation when diversity is high.

High Cultural Diversity

When there are three large groups, L_1, L_2 and L_3, the population distribution becomes more balanced over these groups, and every large group has to seek support from another large group to be in the majority. Small groups may choose to support one of them, but their support cannot guarantee a large group winning in voting. Thus, the first problem is whether there is a stable coalition between large groups in voting about what public goods to provide. And the following lemma is introduced:

Lemma 1.3. When there are three large groups, there will be a stable coalition between group L_3 and another large group which is closer to group L_3 in culture.

If there is any coalition, there are three possibilities, (L_1, L_2), (L_1, L_3) and (L_2, L_3). However, all large groups have bargaining power and may switch to cooperate with the other one if their interests are not satisfied by the allocation of public resources. Thereby, groups in the coalition must not be too greedy to firm the cooperation. In this case, we assume the justified strategy for them is to allocate public resources proportional to their population sizes and no group is willing to accept a proportion of public resources lower than the relative population share. For each voting issue, two groups having more similar preferences over the issue cooperate in voting. Then, the three coalitions arise for different voting issues and public resources are allocated among the three groups. On the other hand, the interests of one group can be improved if the coalition is stable with another large group, and public resources are allocated between only two groups. Then, group L_1 and L_2 like to cooperate with group L_3 to make the majority coalition while receiving a higher

proportion of public funds. Group L_3 has two choices, but it is evident that they prefer to form a coalition with the group closer in terms of culture. We know that, in the basic setting, $r_{L_1L_3} > r_{L_1L_2}$. Then, the coalition of (L_1, L_3) emerges as the equilibrium in the game of public spending allocation. Consequently, the allocation of public resources among public goods preferred by different groups should be $f_{L_1} = \frac{s_{L_1}}{s_{L_1} + s_{L_3}}$, $f_{L_3} = \frac{s_{L_3}}{s_{L_1} + s_{L_3}}$ and $f_{L_2} = 0$. Firstly, since $s_{L_1} > s_{L_3}$, it holds that $f_{L_1} > f_{L_3}$ and $\theta_{L_1} > \theta_{L_3}$. Thus, $g_{L_1} > g_{L_3}$ according to Lemma 1.1. Next, it should be decided whether $g_{L_2} > g_{L_3}$. For groups L_2 and L_3,

$$a_{L_2} = (1-\beta)s_{L_2} + \beta;$$

$$b_{L_2} = s_{L_2}(1 - f_{L_1}r_{L_1L_2} - f_{L_3}r_{L_2L_3}) + \beta s_{L_3}(1 - f_{L_1}r_{L_1L_3}) + \beta s_{L_1}(1 - f_{L_3}r_{L_1L_3}) + \beta\sum_{i=4}^{K} s_{L_i}(1 - f_{L_1}r_{L_1l_i} - f_{L_3}r_{L_3l_i})$$

;

$$a_{L_3} = (1-\beta)s_{L_3} + \beta;$$

$$b_{L_3} = s_{L_3}(1 - f_{L_1}r_{L_1L_3}) + \beta s_{L_1}(1 - f_{L_3}r_{L_1L_3}) + \beta s_{L_2}(1 - f_{L_1}r_{L_1L_2} - f_{L_3}r_{L_2L_3}) + \beta\sum_{i=4}^{K} s_{L_i}(1 - f_{L_1}r_{L_1l_i} - f_{L_3}r_{L_3l_i})$$

.

When the difference between s_{L_2} and s_{L_3} is large, $\frac{b_{L_2}}{a_{L_2}} > \frac{b_{L_3}}{a_{L_3}}$ and thereby $g_{L_2} > g_{L_3}$. Thus, $g^e = g_{L_2}$ which is the median of spending levels preferred by different groups. Then decrease in s_{L_2} causes decrease in g_{L_2}. As the gap between s_{L_2} and s_{L_3} becomes smaller, $g_{L_3} \geq g_{L_2}$. Then, $g^e = g_{L_3}$ which will increase as s_{L_3} increases. After the point where $s_{L_1} = s_{L_2} = s_{L_3}$, s_{L_1}, s_{L_2} and s_{L_3} start to decrease. g^e can be g_{L_1} or g_{L_3}, but the decrease in g^e persists because of the decline in the population share of all three groups.

As the decrease in s_{L_1}, s_{L_2} and s_{L_3}, cultural diversity is higher, and the coalition of two groups of them cannot guarantee the majority winning in issues about what public goods to provide. Then, the situation more difficult for groups to form a stable

coalition and exert influence on public decision making. When a fourth large group involves, there are four possibilities of three-group coalitions. Furthermore, the coalition itself becomes more diverse. If any stable coalition emerges, any two groups of the coalition should have the same preference in the selection of another group in the coalition. However, it is difficult for citizens of two different cultural groups to achieve such an agreement (Svensson, 2007), which results in the uncertainty about the position of their group and a lower probability that they are in the winning coalition facing different voting issues (Leblanc et al., 2000). Hence, for each large group, this means lower θ as a result of the more dispersed allocation of public resources, and they prefer for lower public spending. Furthermore, the median of preferred spending levels should be g_{L_1}, g_{L_2} or g_{L_3}, since all large groups have the probability involving in some coalitions and the first three large groups account for the majority of the whole population. Thus, the fact that s_{L_1}, s_{L_2} and s_{L_3} decrease as cultural diversity increases causes decreases in public spending level. When the population distribution is more balanced, the situation is similar where there is a lower probability of each group in a winning coalition including more groups. Therefore, public spending level continues decreasing. Then, when cultural diversity is high, public spending decreases firstly as s_{L_2} decreases and then increases as s_{L_3} increases. As s_{L_3} starts decreasing, public spending also falls.

The relationship between cultural diversity and public spending can be seen in Figure 1.1. When diversity is low, public spending is the preferred spending level of the majority group, and it decreases as diversity increases. Once the majority disappears and diversity increases into the intermediate level, public spending is determined by the spending level favored by the second large group L_2. Then public spending changes as s_{L_2} changes. When diversity is high, the spending level favored by the third large group is firstly selected as the public spending level, and its change is the same as the change in s_{L_3}. As more large groups with matching population size appear, public spending continues decreasing. In short, it cane concluded as Proposition 1.1, which states the relationship between public spending and cultural diversity under direct democracy.

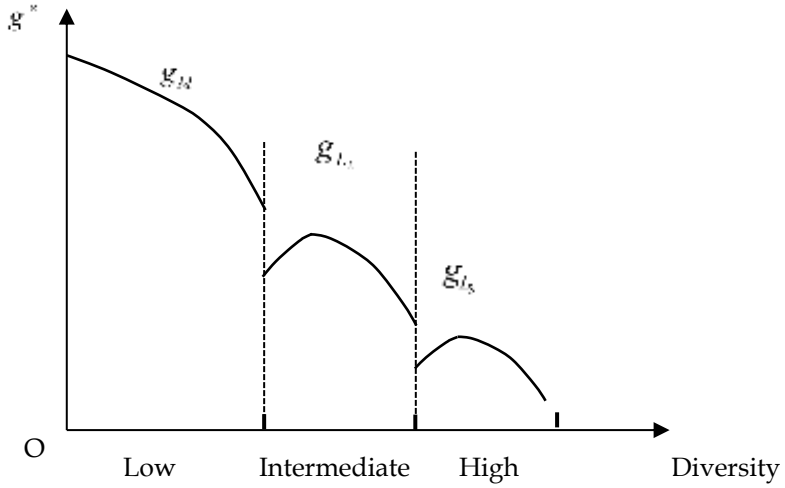

Figure 1.1. The relationship between public spending and cultural diversity under direct democracy

Proposition 1.1: Under the political regime of direct democracy, the relationship between public spending and cultural diversity is non-monotonic. Public spending decreases as the population share of the majority group decreases when cultural diversity is low. At the interval of intermediate diversity, there is no coalition between groups, and the relationship is inverted U-shape. As cultural diversity becomes high, coalitions appear between groups with more similar cultures. Public spending first increases then decreases as cultural diversity increases.

1.4.2 Representative democracy

Under representative democracy, instead of voting on single-issue directly, citizens choose a policy package by electing politicians as their representatives who make specific public decisions. Although public decisions are still made through the majority rule by representatives elected from each electoral district, demanders of public goods and decision-makers are separate. Thus, the interests of the public are not directly related to their representatives who have the chance to use political power to promote their private interests (Svaleryd and Vlachos, 2009; Ferejohn, 1986). According to the analysis of Maskin and Tirole (2004), the motivation of officeholders is divided into two types – a strong office-holding motive and a weak office-holding motive. With the strong office-holding motive, officeholders make public decisions

according to the preference of the public to pursue support for their reelection facing political competition and none of them would seek any rent (Polo, 1998). In the case of the weak office-holding motive, politicians would like to maximize their private utility and seek positive rents. It is also possible that the high diversity motivates politicians to take some strategic behavior to improve social welfare (Rugh and Trounstine, 2011). In the following, the analysis will be parted according to the type of politicians. Furthermore, I assume that the policy preference of political representatives is following the preference of the majority in the electoral district according to the citizen-candidate model. Thus, the composition of politicians preferring different public policies must be related to the distribution of the population of different cultural groups (Mueller, 2003).

Before discussing the game under representative democracy, I introduce two assumptions. Firstly, politicians and voters have perfect information about social preferences for public goods and cultural diversity of the local jurisdiction, but voters have limited information about the motivations of politicians. Secondly, the jurisdiction is divided into different electoral districts, and the distribution of the population is balanced across all districts. Regardless of politicians' motivations, the first step of the game is that representatives are elected from each district based on the majority rule. Then, elected representatives make decisions on public goods provision in the second step, and tax is imposed. Finally, public goods are provided.

1.4.2.1 Political accountability

When politicians are accountable, elected representatives make decisions according to the preference of the majority without seeking private interests. The preferred spending level of each group is also determined by the maximization of their utility. However, the composition of politicians representing different cultural groups may be different from the composition of the society in terms of cultural groups, which is related to the population distribution among cultural groups in different electoral districts. Thus, the median value of spending levels proposed by politicians may not be one of those preferred by all groups. In addition, the relative power of representatives may not be the same as that of groups. Thus, at the same level of cultural diversity, the composition of public goods is different from that found in direct democracy.

Low Cultural Diversity

In a culturally homogeneous society, the demands for public goods are also homogeneous for all citizens regardless of their regions. Therefore, elected politicians prefer the same policy package, and this is the same as that preferred by the public. Public spending in equilibrium is then the same as the case under direct democracy, and it would be $g^e = \sigma^{\frac{1}{1-\sigma}}$.

When cultural diversity is low, the majority group must be also the majority one in at least half of all electoral districts since each electoral district has the same population. Thus, politicians representing the preference of the majority group are elected in all districts, and public spending in equilibrium is the one favored by the majority group, $g^e = g_M = (\sigma b_M / a_M)^{\frac{1}{1-\sigma}}$. Therefore, the public decision made by the government only reflects the preferences of the majority group, and the public spending level decreases as population fractionalization increases. As long as the majority group is also the majority one in more than half of all electoral districts, the chosen public spending level by representatives is g_M and it decreases as s_M decreases.

But there is another case when the population share of the second large group – L_2 – is sufficiently large. It is possible that the majority group is concentrated in half of all electoral districts and the second large group is concentrated in the other half electoral districts. Group L_2 is the majority in their districts when $s_{L_2} > 1/4$. Thus, group M and group L_2 have the same number of representatives in the political body making policies. What the public can expect is that the government maximizes the joint utility of these two groups conditioned on the justice allocation of public resources between them (Deutsch, 1975). The majority group has to make a compromise to achieve an agreement with the group L_2 in the allocation of public resources – (f_M, f_{L_2}). Furthermore, only the combination (f_M, f_{L_2}) is acceptable that is proportional to the population share of these two groups. Therefore, $\frac{f_M}{f_{L_2}} = \frac{s_M}{s_{L_2}}$, such that each group gets public resources that are proportional to what they pay. The problem of maximizing the joint utility of these two groups is

$$\max_{g,t} \; v_M + v_{L_2} = (s_M a_M + s_{L_2} a_{L_2}) y(1-t) + (s_M b_M + s_{L_2} b_{L_2}) g^{\sigma}$$
$$s.t. \quad g = ty$$

Thus, $g_{ML_2} = (\sigma \frac{s_M b_M + s_{L_2} b_{L_2}}{s_M a_M + s_{L_2} a_{L_2}})^{\frac{1}{1-\sigma}}$ and this will be the spending level choosing by policymakers, $g^e = g_{ML_2}$. As s_M decreases, g_{ML_2} decreases (see the proof in Appendix A.3), and Lemma 1.4 states the relationship. Besides, since $\frac{b_M}{a_M} > \frac{b_{L_2}}{a_{L_2}}$ when $\theta_M = 1$, it follows that $g_{ML_2} < g_M$.

Lemma 1.4: When the joint utility of two groups is maximized, their preferred public spending level is monotonically increasing in the population share of the larger group if its population share is not smaller than $1/2$. *Otherwise, the relationship becomes negative at a point smaller than* $1/2$.

Intermediate Cultural Diversity

When cultural diversity is at the intermediate level and the majority group becomes the first large group L_1, the result is also related to the distribution of the population of different groups across districts. Firstly, we consider the case when $S = S_d$ meaning that the population distribution over cultural groups in each district is the same as that in the whole jurisdiction. To be elected as the representative of one district, politicians must seek support from at least one large group. For more support, nevertheless, they prefer to cooperate with small groups, according to the principle of the minimum coalition. They limit the total population of the coalition to be the majority but close to $1/2$ and they do not need to make many compromises to reach an agreement regarding the allocation of public spending. Therefore, the conflict in public goods provision is the conflict between L_1 and L_2. Before an election, politicians from each large group would propose policy platforms about public spending level and resource allocations, $(g_1, f_{L_1}, f_{1L_i})(i \geq 3)$ and $(g_2, f_{L_2}, f_{2L_i})(i \geq 3)$ in which g_1 and g_2 are determined by maximizing the weighted sum utility of all groups in the coalition taking their population shares as weights.

Since the design of policy platforms is based on preferences of L_1 and L_2 respectively, small groups are pivotal voters. Given (g_1, f_{L_1}, f_{1L_i}), the politician from the

second-largest group can propose f_{2L_i} higher than f_{1L_i} to get their support. The situation is the same for L_1. However, the behavior of politicians also faces the restriction imposed by the welfare of large groups. Once f_{L_1} and f_{L_2} are below some thresholds, coalitions will fail, and there will be no public goods. As the assumption about public resource allocation under direct democracy, thresholds are determined by the relative size of the population of groups in the coalition. As the total population of a coalition is close to $1/2$, thresholds of f_{L_1} and f_{L_2} are slightly lower than $2f_{L_1}$ and $2f_{L_2}$. Thus, the upper limits of f_{1L_i} and f_{2L_i} are close to $2s_{L_i}$. Since $s_{L_1} > s_{L_2}$ and it is assumed that $r_{L_1L_i} < r_{L_2L_i}\,(i \geq 3)$ for most small groups in culture, most small groups gain the same utility from policy platforms from (g_1, f_{L_1}, f_{1L_i}) and (g_2, f_{L_2}, f_{2L_i}) even when $f_{1L_i} < f_{2L_i}$ given the same level of public spending. Therefore, the politician from the group L_2 has to make more compromises in pursuing the coalition with small groups. Even when f_{2L_i} reaches its upper limit, the politician from group L_1 still has the space to adjust f_{1L_i} and make pivotal small groups to obtain at least the same welfare as that when they cooperate with group L_2. Thus, the political representative of group L_1 and some small groups are elected and the spending level in equilibrium is what maximizes the joint utility of these groups.

The maximization problem is below,

$$\max_{g,t} \; v_{L_1} + v_{L_i} = (s_{L_1}a_{L_1} + s_{L_i}a_{L_i})y(1-t) + (s_{L_1}b_{L_1} + s_{L_i}b_{L_i})g^{\sigma}$$
$$s.t. \quad g = ty$$

in which $s_{L_1} + s_{L_i} > 1/2$ and $s_{L_i}a_{L_i} = \sum_{i\geq 3} s_{L_i}a_{L_i}$, $s_{L_i}b_{L_i} = \sum_{i\geq 3} s_{L_i}b_{L_i}$. s_{L_i} is the population of all small groups in the coalition. Then the spending level $g_{L_1L_i} = (\sigma \frac{s_{L_1}b_{L_1} + s_{L_i}b_{L_i}}{s_{L_1}a_{L_1} + s_{L_i}a_{L_i}})^{\frac{1}{1-\sigma}}$ and $g^e = g_{L_1L_i}$. At the turning point at which the majority group disappears, $g_{L_1L_i}$ must be lower than g_M because public goods preferred by small groups are also provided. Since the large group is the primary interest body in the coalition, the change in the decision is mainly determined by the change in the choice of the large group, $\frac{s_{L_1}b_{L_1}}{s_{L_1}a_{L_1}}$.

Thus, g^e decreases as s_{L_1} decreases. Furthermore, when s_{L_1} and s_{L_2} both decline

and s_{L_3} is large enough, group L_3 may be excluded from both coalitions.

Secondly, when the population of L_1 and L_2 are concentrated in each half of electoral districts, political representatives are selected by majority groups in each district.[2] Thus, group L_1 and group L_2 have the same number of political representatives following the case where g_{ML_2} appears, the joint utility of these two groups is maximized. Thereby, $g^e = g_{L_1L_2} = (\sigma \frac{s_{L_1} b_{L_1} + s_{L_2} b_{L_2}}{s_{L_1} a_{L_1} + s_{L_2} a_{L_2}})^{\frac{1}{1-\sigma}}$. According to Lemma 1.4, $g_{L_1L_2}$ increases when the difference between s_{L_1} and s_{L_2}, $(s_{L_1} - s_{L_2})$, rises and decreases when the difference becomes smaller. Furthermore, $g_{L_1L_2}$ continues decreasing once both s_{L_1} and s_{L_2} start decreasing. Then, g^e increases as s_{L_2} increases until both s_{L_1} and s_{L_2} start falling. When the population of both large groups decreases, it can be easily implied that public spending in equilibrium decreases.

High Cultural Diversity

Similarly, we firstly discuss the case when $S = S_d$. Large groups must form a coalition if they want to win in the election and politicians design their policy packages accordingly. Since each group prefers to collaborate with a smaller group that is similar in culture, a coalition including group L_3 and group L_1 will be formed since $r_{L_1L_3} < r_{L_2L_3}$. Then, $g^e = g_{L_1L_3}$, which maximizes the joint utility of group L_3 and group L_1. At the turning point from intermediate cultural diversity to high cultural diversity, small groups in the coalition are replaced by group L_3 and thereby, there is no significant change in the population of the coalition. But when group L_3 is in the coalition, all the left public resources are used to provide public goods according to the preference of group L_3 except for those provided for group L_1. Thus, group L_3

[2] Suppose that there are two districts 1 and 2, the concentration of population means that the majority in district 1 are from group L_1 and the majority in district 2 are from group L_2. Then representative selected in these two districts would be from group L_1 and group L_2 respectively. Otherwise, when the population of one group is not the majority in the district, we do not view it as the concentration in the population.

prefers a higher spending level than small groups, meaning that $\frac{s_{L_3} b_{L_3}}{s_{L_3} a_{L_3}} > \frac{s_{L_i} b_{L_i}}{s_{L_i} a_{L_i}}$. Thus $g_{L_1 L_3}$ must not be lower than $g_{L_1 L_i}$ at the turning point. After the turning point, s_{L_1} and s_{L_2} decrease, while s_{L_3} increases. Then $g_{L_1 L_3}$ increases as cultural diversity increases according to Lemma 1.4.[3] But once $s_{L_1} = s_{L_2} = s_{L_3}$, both s_{L_1} and s_{L_3} start decreasing and $g_{L_1 L_3}$ must decrease until $(s_{L_1} + s_{L_3}) \leq 1/2$ and a fourth large group rises. Then in order to keep the population of a coalition close to $1/2$, a coalition of L_1, L_3 and small groups will be formed. Thus, public spending decreases because of the fall in the population of the coalition resulted from higher cultural diversity. The decrease continues until the fifth large group emerges when the fifth large group must be included in the coalition. After that, the population of the coalition also increases. But once their population decreases, the spending level favored by them also falls. Therefore, public spending increases when the number of large groups is odd and the population share of the new rising large group increases. Then, at high cultural diversity, rise and fall in public expenditure take place by turn.

Secondly, when different cultural groups are concentrated in different regions, the outcome is the same as the case above, and representatives of all three cultural groups are elected. What is different is that the coalition is formed between politicians. Furthermore, the coalition is only possible among political representatives of large groups because no representative of small groups can win the election. As political representatives of the new rising large group are always selected in the coalition, public spending level choosing by the coalition increases as their total population increases. Therefore, at the turning point from intermediate to high diversity, representatives of group L_2 are substituted by representatives of group L_3. Then

[3] If an increase in cultural diversity means that only s_{L_1} decreases, it must be that $g_{L_1 L_3}$ increases since s_{L_1} is smaller than $1/2$ and $(s_{L_1} - s_{L_3})$ is also small. Thus, since the increase in s_{L_3} is accompanied by a decrease in both s_{L_1} and s_{L_2}, $(s_{L_1} + s_{L_3})$ increases, which must result in the increase in the equilibrium public spending level.

$g^e = g_{L_1L_3} = (\sigma \frac{s_{L_1} b_{L_1} + s_{L_3} b_{L_3}}{s_{L_1} a_{L_1} + s_{L_3} a_{L_3}})^{\frac{1}{1-\sigma}}$. We know that $\frac{s_{L_3} b_{L_3}}{s_{L_3} a_{L_3}} < \frac{s_{L_2} b_{L_2}}{s_{L_2} a_{L_2}}$ at the turning point. Thus, there is a jumping decrease in g^e at the turning point, which is different from the case when $S=S_d$. After this point, public spending increases in the population share of the new rising large group in the coalition.

Compatibility Constraint

The above analysis of coalitions is based on the assumption that the spending level maximizing the joint utility results in a higher utility than the reservation utility of groups in the winning coalition. Citizens will not accept any level of public spending resulting in utility loss by paying for public goods. The reservation utility of a citizen of cultural group k is below:

$\underline{v}_k = a_k y$.

Let $\underline{v}_k = a_k y = v_k = a_k y(1-t) + b_k g^\sigma$ and $ty = g$. Then the reserved public spending they can accept is $\bar{g}_k = \left(\frac{b_k}{a_k} \right)^{\frac{1}{1-\sigma}}$, which is the highest public spending acceptable to citizens given the composition of public goods. It is undoubtedly higher than the level preferred by each group. Thus, for larger groups in the coalition, the upper limit of spending level must be higher than the one chosen by the coalition. However, this may not be true for smaller groups in the coalition. Suppose that group J_1 and J_2 form a coalition and group J_1 is the larger group. Then $g_{J_1J_2} = (\sigma \frac{s_{J_1} b_{J_1} + s_{J_2} b_{J_2}}{s_{J_1} a_{J_1} + s_{J_2} a_{J_2}})^{\frac{1}{1-\sigma}}$ and $\bar{g}_{J_2} = \left(\frac{b_{J_2}}{a_{J_2}} \right)^{\frac{1}{1-\sigma}}$. $\sigma \frac{s_{J_1} b_{J_1} + s_{J_2} b_{J_2}}{s_{J_1} a_{J_1} + s_{J_2} a_{J_2}}$ is bigger than $\frac{b_{J_2}}{a_{J_2}}$ when the difference between s_{J_1} and s_{J_2} is sufficiently large and σ is big enough, which means that $g_{J_1J_2} > \bar{g}_{J_2}$ and $g_{J_1J_2}$ is not acceptable to group J_2. Thus, at intermediate cultural diversity when σ is sufficiently large, $g_{L_1L_i} > \bar{g}_{L_i}$, and then $\bar{g}_{L_i}$ is selected instead of $g_{L_1L_i}$. As s_{L_1} decreases, s_{L_i} becomes larger relative to s_{L_1}, resulting in a larger f_{1L_i}, which leads to a higher $\bar{g}_{L_i}$. Thus, the level of public spending increases with cultural diversity.

Otherwise, $g_{L_1L_i}$ is chosen, and the compatibility constraint does not bound. But the selected public spending first increases and then decreases as cultural diversity increases no matter which of $\bar{g}_{L_i}$ and $g_{L_1L_i}$ is chosen by politicians.

According to the analysis above, the relationship between public spending and cultural diversity with accountable politicians is shown in Figure 1.2. Figure 1.2a shows the case when the population distribution of all cultural groups in each electoral district is the same as that in the whole jurisdiction. At low diversity, public spending is determined by the preference of the majority group and it monotonically decreases. At intermediate diversity, preferences of the first large group and small groups determine public expenditure, $g_{L_1L_i}(i \geq 3)$, which also decreases as cultural diversity increases. As cultural diversity become high, the coalition is formed between large groups and the new rising large group must be included when the number of large groups is odd. Furthermore, public spending $g_{L_1L_3}$ is positively related to the population share of the rising large group. If the number is even, small groups, instead of the rising large group, are in the coalition. Then, public spending, $g_{L_1L_3L_i}(i \geq 5)$, decreases until the number of large groups becomes odd again. Graph 1.2b illustrates the case when the population of large groups concentrates in different electoral districts. The difference from Graph 1.2a is that the relationship is inverted U-shaped at intermediate diversity, and there is always a jumping decrease in public spending when the new rising large group is in the coalition. Besides, at low diversity when s_M is sufficiently small, public spending is determined by the joint preference of group M and group L_2. Then, proposition 1.2 describes the relationship between cultural diversity and public spending under representative democracy when politicians are accountable to voters.

Proposition 1.2: When politicians are accountable to voters, the relationship between public spending and cultural diversity is non-monotonic and discontinuous: When $S=S_d$, the relationship is negative at low and intermediate diversity, and rise and fall take place by turn at high diversity; When the population of large groups concentrates in different electoral districts, the relationship is negative at low diversity, inverted U-shapes at intermediate diversity, and rise and fall in public spending take place by turn at high diversity.

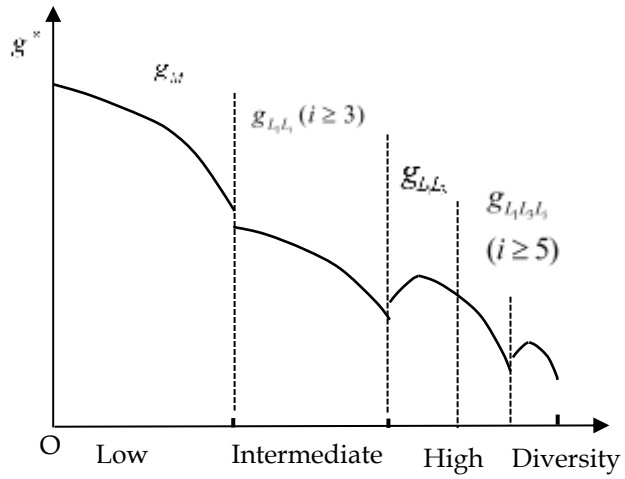

Figure 1.2a. $S=S_d$

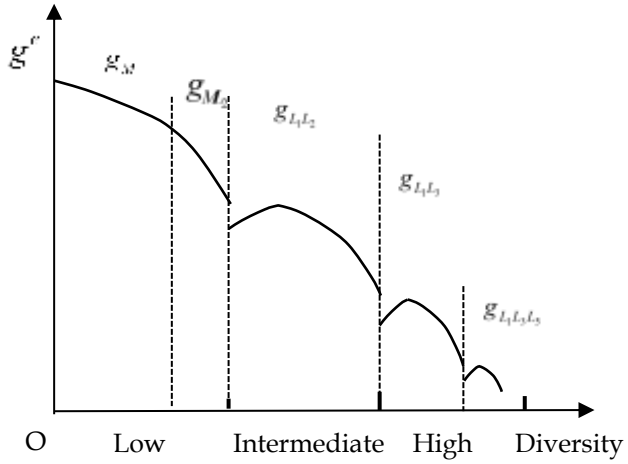

Figure 1.2b. Large groups concentrate in different districts

Figure 1.2. Public spending and cultural diversity when politicians are accountable

1.4.2.2 Rent-seeking politicians

Apart from the preference of the public, public spending is also affected by the behavior of politicians in office and the public budget constraint. The budget constraint of public spending is $Nty = Ng + \phi(g)$, where $\phi(g)$ is the rent politicians can obtain from the tax revenue. Politicians obtain rents by providing public goods and how much they can abstract from public spending is determined by the tax rate and the real cost of public goods. $\phi'(g)$ reflects politicians' power in rent-seeking. The

public policy vector is $q=\{t,\phi(g),g,F\}$, in which F is the vector showing the composition of public goods provided. We assume that the politician has no favor over public goods preferred by different cultural groups. Then the utility of a politician is $u_p = y(1-t)+\phi(g)+g^{\sigma}$.

The utility of politicians is not related to cultural diversity, although it must be considered when making choices of public spending. When politicians seek rent to promote private interests, promises of them in an election have no constraining force on their behavior. They maximize their private interests, which means $\phi(g)>0,\phi'(g)>0.$. The ability of politicians to extract rent is the result of their political power in the allocation of public resources. They can abstract a fraction of public funding and the amount of rent is positively related to the size of public spending (Barro, 1973). Thus, the spending level preferred by politicians is the solution to the problem:

$$\max_{g} \; u_p = y(1-t)+\phi(g)+g^{\sigma}$$
$$s.t. \quad Nty = Ng+\phi(g)$$

.

The optimal public spending preferred by politicians must then satisfy the condition $1=(1-1/N)\phi'(g_p)+\sigma g_p^{\sigma-1}$. Compared with public spending favored by each cultural group, it can be seen that g_p is larger than the spending level $g=\sigma^{\frac{1}{1-\sigma}}$ when the society is homogeneous since politicians benefit more from public spending. However, the decision of politicians should also satisfy the compatibility constraint. If the spending level is higher than the $\bar{g}_k$ of the majority population, politicians face the threat of impeachment and may get nothing. Hence, politicians must take the reserved spending level of the public into consideration when making public decisions.

Since $\bar{g}_k=\left(\frac{b_k}{a_k}\right)^{\frac{1}{1-\sigma}}$, the pattern of change in $\bar{g}_k$ as cultural diversity is the same as that of g_k, and $\bar{g}_k=1$ when the society is homogeneous. Since politicians do not concern about the reelection, we presume that politicians have strong power in rent-seeking, which means that $\phi'(g)$ is sufficiently large. Thus, $g_p>1$ and it is larger than any reservation spending level in all the cases of cultural diversity. As a result,

$g^e = \bar{g}_k = 1$ will be selected as the spending level. When there is a majority group, it can be shown that officials would like to provide public goods according to the preference of the majority group. Thus $g^e = \bar{g}_M$ is chosen, and it decreases as s_M decreases. At the intermediate level of cultural diversity, the upper limit of spending level is $\bar{g}_{L_1}$ and $\bar{g}_{L_2}$. The reserved spending levels of small groups are neglected because they are much smaller. Then $g^e = \bar{g}_{L_1} = \bar{g}_{L_2}$ in equilibrium since the government can increase the smaller one of $\bar{g}_{L_1}$ and $\bar{g}_{L_2}$ by increasing the fraction of public goods preferred by the corresponding group. Thus, the effect of the difference between s_{L_1} and s_{L_2} is offset by the difference between θ_{L_1} and θ_{L_2}. As cultural diversity increases, the difference between s_{L_1} and s_{L_2} decreases, which is accompanied by a decrease in the difference between θ and s. Hence, $\bar{g}_{L_1}$ (or $\bar{g}_{L_2}$) increases as cultural diversity increases. When the population of the two large groups starts decreasing, the level of public spending chosen by the government also decreases. This outcome is still true when a third large group emerges since group L_3 is not in the set of decisive cultural groups. Because the government chooses the spending level according to the preference of large groups, the equilibrium spending level decreases when cultural diversity increases further since the population size of a large group decreases when the number of large groups increases.

According to the analysis above, public spending chosen by rent-seeking politicians is the one acceptable to the majority and large groups. Figure 1.3 depicts the relationship between public spending and cultural diversity. At low diversity, $\bar{g}_M$ decreases as cultural diversity increases. At intermediate diversity, upper limits of public spending acceptable to large groups are the same and they increase in the population share of the second large group. Group L_3 exerts no influence on the decision of politicians at the initial phase of high diversity, and public spending decreases as the latter phase of intermediate diversity. After that, more large groups are influential, and public spending falls continuously due to the decrease in the population share of large groups. Then, the relationship is summarized in Proposition 1.3.

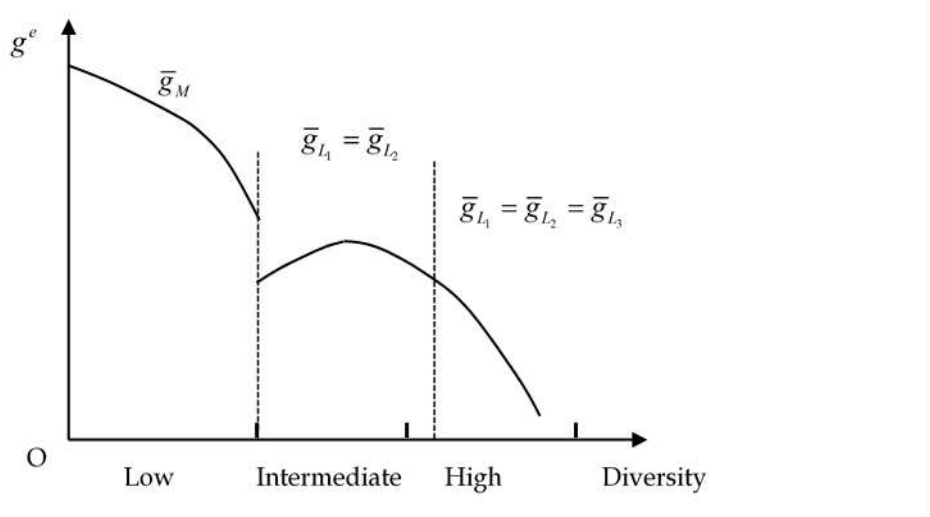

Figure 1.3. Public spending and cultural diversity when politicians are rent-seeking

Proposition 1.3: When political representatives are rent-seeking, the relationship between public spending and cultural diversity is negative at low cultural diversity, but it is inverted U-shaped when cultural diversity is intermediate. From intermediate to high diversity, public spending decreases continuously, and it decreases monotonically in cultural diversity after.

1.5 Public spending and cultural diversity under authoritarianism

Under authoritarianism, the public does not have much direct political participation in public decision-making, and public decisions are more like the plan of the government, or the dictator. Thus, the government's willingness to pay for public goods, other than the tax rate, is directly associated with local public spending, and their response to the diverse demands of public goods is critical. The authoritarian ruler likes to keep all available economic rents, impose policies according to their own preferences, and maintain their political power at the same time (Wintrobe, 2005). Thus, on the one hand, the autocrat chooses a tax rate to maximize his private utility. According to the analysis by Mueller (2003), the optimal tax rate is the inverse of the income elasticity[4]. On the other hand, the autocrat also produces public goods to enhance economic growth and raise the base for tax revenue. However, the level of public spending is lower compared with the case under democracy (Mcguire and

[4] Dennis C. Mueller, "Public Choice III", Cambridge University Press, 2003, P. 408

Olson, 1996). Thus, the ruler also faces the threat of rebellion if residents are not satisfied with public policies. To deal with the uprising factors in the society, the autocrat has two tools, the authoritarian bargaining about public goods provision and repression (Desai et al. 2009). Through bargaining, the autocrat provides public goods and private goods to gain support from citizens and keep social stability (Bueno de Mesquita et al., 2002). When bargaining by citizens is not allowed, the ruler chooses repression as an alternative approach to maintain social stability and stay in office. Accordingly, we call the regimes as soft authoritarianism and repressive authoritarianism.

1.5.1 Soft Authoritarianism

Under soft authoritarianism, on the one hand, the government takes conformity to national interests into first consideration and the public also must subject to collective interests (Roy, 1994). Then, bargaining between the ruler and citizens on public issues is based on this consensus. To set up the model, we assume that bargaining has no cost and define the utility of the ruler. Given the tax rate, the tax revenue per capita is ty. By choosing public spending g, the tax revenue left, as the private benefit for the autocrat, is $u_a = ty - g$. Therefore, the authoritarian ruler prefers public spending at the lowest level, g_a, to keep as much economic rent as possible. g_a is much smaller than ty. The expense is to meet the essential demand for public goods, such as national defense, public security and education, etc. which are required to promote economic development.

To stay in power under the regime of a soft authoritarianism, the autocrat would adjust public spending according to the preference of citizens. The bargaining game has the following set: 1, The government proposes the provision of essential public goods, g_a; 2, Citizens respond to the policy through bargaining over the allocation of public resources; 3, The government adjusts the allocation of public resources and public spending to g; 4, Citizens support the government if g is acceptable, but a protest breaks out if not.

For citizens, because the tax rate is fixed, they prefer to spend all the tax revenue on public goods, but it is possible only when they upend the current government successfully through rebellion. However, there is no guaranteed successful rebellion.

If the uprising fails, only essential public goods are provided. Let p_k denote the probability of a successful protest for group k. The probability is different for different groups as they have different bargaining power determined by the group size and cultural distances to other groups. Larger population size s_k and closer cultural distances lead to a larger coalition size that may involve in an uprising. Then, the larger coalition size results in a higher probability of a successful uprising. If the uprising successes, the new government would spend all tax revenue on public goods. If it fails, protesters are confined to the consumption of essential public goods. Hence, for the level of public spending, g, chosen by the autocrat, it is acceptable if

(5) $v_k(t,g) \geq p_k v_k(t) + (1-p_k) v_k(t, g_a)$,

in which

$v_k(t,g) = a_k y(1-t) + b_k g^{\sigma}$,
$v_k(t) = a'_k y(1-t) + b'_k (ty)^{\sigma}$,
$v_k(t, g_a^{*}) = a''_k y(1-t) + b''_k (g_a)^{\sigma}$, $k = 1,...,K$.

$v_k(t,g)$ is the utility for individuals in group k given public spending g, $v_k(t)$ is the utility when the protest is successful and $v_k(t, g_a)$ is the one when the protest fails.

To simplify the constraint, we should decide the allocation of public resources among public goods preferred by different groups first. On the one hand, the bargaining outcome of all groups with the government determines the allocation of public resources provided by the autocrat. The higher bargaining power one group has, the more public resources spent on public goods they prefer. The situation is the same if any protest is successful. Thus, $b_k = b'_k = (1-\beta) s_k \theta_k + \beta \sum_{i=1}^{K} s_i \theta_i$. Besides, $a_k = a'_k = (1-\beta) s_k + \beta \sum_{i=1}^{K} s_i$. On the other hand, any group faces punishment if they protest but fail. They lose the right to bargain and have no access to public goods other than the essential part. We also assume that the loss of power in public affairs makes them care only about their own welfare. Thus, $a''_k = s_k$ and $b''_k = s_k \theta''_k$. Since the essential public goods only satisfy the demand of public goods for production, θ''_k is much smaller than θ_k. Moreover, the allocation of public resources for essential public goods satisfies two constraints which are not affected by the bargaining power of each

group. First, the autocrat cares more about the preference of the largest group. Second, the allocation is more sensitive to the population distribution instead of bargaining power which means that $\frac{\Delta\theta_k''}{\Delta\theta_k} > \frac{\theta_k''}{\theta_k}$ when s_k decreases of increases. Then substitute $v_k(t,g)$, $v_k(t)$ and $v_k(t,g_a^*)$ in (5), the constraint on public spending imposed by group k becomes

$$g^\sigma \geq p_k(ty)^\sigma + (1-p_k)\frac{b_k''}{b_k}(g_a^*)^\sigma - (1-p_k)\frac{\beta(1-s_k)}{b_k}(y-ty).$$

Then, the policy-making problem for the ruler is

$$\max_g \ u_a = ty - g,$$

$$s.t$$

$$g^\sigma \geq p_k(ty)^\sigma + (1-p_k)\frac{b_k''}{b_k}(g_a)^\sigma - (1-p_k)\frac{\beta(1-s_k)}{b_k}(y-ty).$$

Let g_k denote the level of public spending, which satisfies $(g_k)^\sigma = p_k(ty)^\sigma + (1-p_k)\frac{b_k''}{b_k}(g_a)^\sigma - (1-p_k)\frac{\beta(1-s_k)}{b_k}(y-ty)$. In equilibrium, the ruler would choose the public spending level, $g^e = \max\{g_k, k=1,...k...,K\}$. Thus, for any group k, $(g^e)^\sigma \geq p_k(ty)^\sigma + (1-p_k)\frac{b_k''}{b_k}(g_a)^\sigma - (1-p_k)\frac{\beta(1-s_k)}{b_k}(y-ty)$. If public spending is lower than g^e, at least one group prefers protest than accepting the offer of the autocrat. Hence, based on the condition of the decision of public spending level and allocation of public resources, g^e is obtained by Lemma 1.5 (See the proof in Appendix A.4).

Lemma 1.5: At any level of diversity, g^e is determined by the constraint imposed by the largest group and it decreases as their population share decreases.

Low Cultural Diversity

When society is homogenous, all residents have the same preference for public goods. To keep public spending as low as possible, the ruler would provide public goods in

line with their preference completely and $\frac{b''}{b}=1$. Thus, the constraint on the behavior of the government is $(g^*)^\sigma = p(ty)^\sigma + (1-p)\frac{b''}{b}(g_a)^\sigma$. When there is one majority group, the majority group has the highest probability of a successful protest due to the absolute advantage in population size. Hence, g^e is equal to g_M satisfying the condition $(g_M)^\sigma = p_M(ty)^\sigma + (1-p_M)\frac{b_M''}{b_M}(g_a)^\sigma - (1-p_M)\frac{\beta(1-s_M)}{b_M}(y-ty)$. Due to the reduction in population size, $s_M<1$ and $p_M<p$. Thus, $g_M<g^*$. As cultural diversity increases, s_M decreases. Then, the bargaining power of the majority group becomes relatively weaker compared to other groups and p_M decreases. Besides, $\frac{b_M''}{b_M}$ also decreases according to Lemma 1.5. Hence, g_M decreases as cultural diversity increases.

Intermediate & High Cultural Diversity

When cultural diversity becomes intermediate, group L_1 is the largest group and more similar to small groups in cultural distances. Then, group L_1 has the highest probability of a successful uprising since the group has the largest population size and closer to most small groups in culture. Then, g^e is equal to g_{L_1} satisfying the condition $(g_{L_1})^\sigma = p_{L_1}(ty)^\sigma + (1-p_{L_1})\frac{b_{L_1}''}{b_{L_1}}(g_a)^\sigma - (1-p_{L_1})\frac{\beta(1-s_{L_1})}{b_{L_1}}(y-ty)$. According to Lemma 1.5, we know that $g_{L_1}<g_M$. Furthermore, as cultural diversity rises, s_{L_1} decreases and g_{L_1} also decreases. When group L_2 rises to the point where $s_{L_2}=s_{L_1}$, group L_1 also has the advantage of a majority group because they are more similar to small groups in culture. Thus, $g_{L_1}>g_{L_2}$. Then, g^e is still equal to g_{L_1}.

As cultural diversity becomes high, the population shares of group L_1 and L_2 fall at the same time. g^e is still equal to g_{L_1} and it decreases as s_{L_1} falls. Furthermore, as society becomes more fragmented, it is more difficult for different groups to form a

stable coalition. Thus, the probability of a successful protest decreases faster for groups whose population share declines.

Hence, under soft authoritarianism, g^e decreases as cultural diversity increases and changes faster when cultural diversity is higher. Besides, $g^e = \max\{g_k\}(k = 1,...,K)$. g^e makes the largest group, who has the highest probability of launching a successful uprising, indifferent between accepting the policy of the government and protest. The relationship is shown in Figure 1.4. At low diversity, $g^e = g_M$ because the majority group has the highest probability of protesting successfully. As diversity increases from low to intermediate, the majority group becomes the first large group. Therefore, from intermediate diversity, g^e is equal to g_{L_1} which decreases as cultural diversity rises, which is described by Proposition 1.4.

Proposition 1.4: Under the regime of a soft authoritarianism, public spending decreases monotonically in cultural diversity. The spending level makes the largest group, who has the highest probability of a successful uprising, indifferent between protest accepting the policy after bargaining.

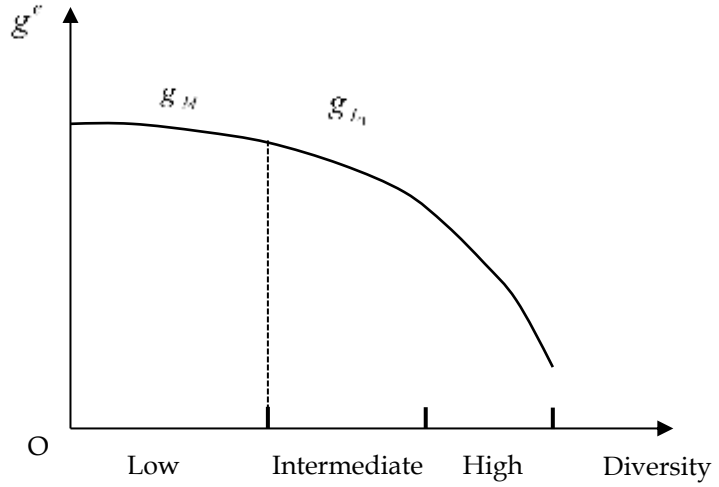

Figure 1.4. Public spending and cultural diversity under soft authoritarianism

1.5.2 Repressive Authoritarianism

Under the repressive authoritarian regime, the public does not have the rights to participate in the formation of public policies. What is different from the case under

the soft authoritarian regime is that the autocrat chooses repression as the means to keep the society stable and eliminate the threat of protest, instead of giving the public reserved social benefits through the bargaining process. But the repression also causes cost and we assume that the autocrat chooses repression only because the total cost of public goods and repression is lower than the cost of only providing public goods as the case under soft authoritarianism. Since the tax revenue is fixed, the ruler would like to keep public spending and regression cost as low as possible. However, the ruler has to provide public goods to promote economic development and gain support from a fraction of citizens. We still take g_a as the spending on essential public goods. More public goods are necessary to stay in power. To keep the spending level as low as possible, the autocrat chooses preferred groups and provide targeted public goods entirely according to their preferences. The preferences of other groups are suppressed and their consumption of public goods is also restricted to essential public goods. Let P denote the set of groups preferred by the autocrat. We assume that the population share of groups in P cannot be smaller than $\underline{s}$. Thus, $\sum_{i\in \mathrm{P}} s_i \geq \underline{s}$ and the rent for the autocrat is $u_a = ty - \sum_{i\in P} s_i g_i - \sum_{j\notin P} s_j g_a - \sum_{j\notin P} s_j g_{jO}$ at the per capita level. g_i is the public spending per capita for each preferred group and g_{jO} is the repression cost per capita of protesting groups.

For citizens, they are motivated to protest if their preferences are not satisfied or the level of public spending is too low. For each group k, their preference for the level of public spending is illustrated by the following condition,

(6) $v_k(t, g_k) \geq q_k v_k(t) + (1-q_k) v_k(t, g_a)$,

in which

$v_k(t, g_k) = a_k y(1-t) + b_k (g_k)^{\sigma}$,

$v_k(t) = a_k y(1-t) + b_k (ty)^{\sigma}$,

$v_k(t, g_a) = a_k'' y(1-t) + b_k'' (g_a)^{\sigma}$.

Similar to the case under soft authoritarianism, q_k is the probability of a successful protest for group k. $v_k(t, g_k)$ is their utility when the spending level per capita for the group is g_k. $v_k(t)$ is their utility after a successful rebellion and $v_k(t, g_a)$ is the utility when the rebellion fails. As the welfare of each group is totally determined by

the autocrat's decision, they do not care about the utility of each other. Then, $a_k = a_k'' = b_k = b_k'' = s_k$. Then, after substituting the utility function in (6), the constraint on public spending becomes

$(g_k)^\sigma \geq q_k(ty)^\sigma + (1-q_k)(g_a)^\sigma$.

Given the preference of citizens, the autocrat would choose preferred groups to maintain his power and obtains as many private benefits as possible based on the constraints imposed by citizens. As the situation under soft authoritarianism, we take the tax rate as given and the spending on essential public goods is g_a. The sequence of the interaction between the autocrat and the residents is: 1, Essential public goods are provided and public spending is g_a; 2, The autocrat chooses preferred groups and provide more public goods according to their preferences; 3, The government clamps down on protesters. Thus, his problem is

$$\max_{g_i, g_O} u_a = ty - \sum_{i \in P} s_i g_i - \sum_{j \notin P} s_j g_a - \sum_{j \notin P} s_j g_{jO}$$

$s.t$

$(g_i)^\sigma \geq q_i(ty)^\sigma + (1-q_i)(g_a)^\sigma, i \in \mathrm{P}$

$(g_{jO})^\sigma \leq q_j(ty)^\sigma + (1-q_j)(g_a)^\sigma, j \notin \mathrm{P}.$

$$\sum_{i \in P} s_i \geq \underline{s}$$

On the one hand, the autocrat provides targeted public goods to some group or groups for their support. On the other hand, the autocrat would choose a cheaper way between repression and public goods to prevent opponents from protests. Therefore, in equilibrium, $(g_i^*)^\sigma = q_i(ty)^\sigma + (1-q_i)(g_a)^\sigma$ for the targeted group i belonging to the set P. For other groups $j \notin \mathrm{P}$, we also have $(g_j^*)^\sigma = q_j(ty)^\sigma + (1-q)(g_a)^\sigma$ and $g_{jO} \leq g_j^*$. The level of public spending per capita is $g^e = \sum_{i \in P} s_i g_i + \sum_{j \notin P} s_j g_a$.

Since both the probability of a successful uprising and benefits from essential public goods are higher for groups with larger population share, we know that g_k^* increase in the population share of each group. Furthermore, we assume that $q_k = (s_k)^\eta$ and $\eta \geq 2$. Thus, $\frac{\partial^2 g_k^*}{\partial s_k^{\,2}} > 0$. Although the cooperation with other groups may increase in the probability of protesting successfully, the ruler would reduce the possibility of

coalition formation. Therefore, we only consider the effect of the population share in this case. The relationship between g_{kO} and s_k is similar to that between g_k^* and s_k. The relationship between g_k^* and g_{kO} is related to the autocrat's capacity of using repression which decides the level of $\underline{s}$. Therefore, $g_k^* > g_{kO}$ if $s_k < 1-\underline{s}$, $g_k^* = g_{kO}$ if $s_k = 1-\underline{s}$, and $g_k^* < g_{kO}$ if $s_k > 1-\underline{s}$. For the convenience of further analysis, we assume that $\underline{s} = \frac{1}{3}$. More assumptions about the relationship between g_k^* and g_{kO} are in the following:

Assumption 1.3:

$(g_k^* - g_{kO})$ *is largest when* $s_k = \frac{1}{2}$.

$g_{k_1}^* - g_{k_2}^* > g_{k_1O} - g_{k_2O}$ *if* $s_{k_2} < s_{k_1} \le \frac{1}{2}$. $g_{k_1}^* - g_{k_2}^* < g_{k_1O} - g_{k_2O}$ *if* $s_{k_1} > s_{k_2} \ge \frac{1}{2}$.

Thus, if there is a majority group becoming the opponent of the autocrat, the cost of repression per capita also grows faster. Figure 1.5 shows how g_k^* and g_{kO} change as the group's population share increases.

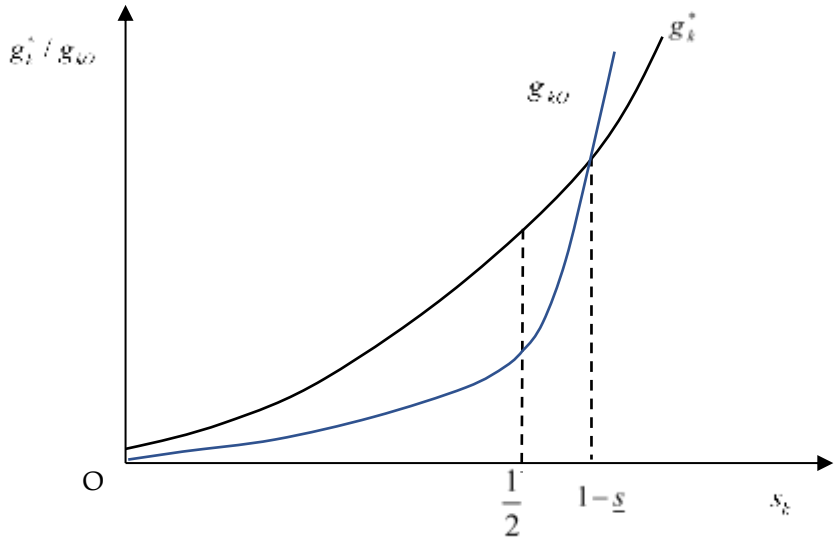

Figure 1.5. Public spending, repression cost and population share of each group.

Low Cultural Diversity

When society is homogenous, all residents have the same preference for public goods.

The ruler would not make all residents protesters. Thus, their lowest demand for public goods is satisfied. Thus, the constraint on the behavior of the autocrat is $(g^*)^\sigma = q(ty)^\sigma + (1-q)(g_a)^\sigma$. When there is one majority group with $s_M > 1-\underline{s}$, to obtain support from at least the proportion $\underline{s}$ of the whole population, the autocrat must choose the majority group as the preferred group and thus, $\mathrm{P} = \mathrm{P}_M = \{M\}$. Hence, g_M^* satisfies the condition $(g_M^*)^\sigma = q_M(ty)^\sigma + (1-q_M)(g_a)^\sigma$. Since $q_M < q$ and $\frac{\theta_M''}{\theta_M} < 1$, $g_M^* < g^*$. Thereby, $g^e < g^*$ because $g^e = s_M g_M^* + \sum_{i\geq 2} s_{L_i} g_a$ and $g_a < g^*$. Furthermore, g_M^* decreases as cultural diversity increases, which causes a decrease in g^e.

When $s_M = 1-\underline{s}$, the autocrat has an alternative to providing public goods to small groups and $\mathrm{P} = \mathrm{P}_L$. Let $u_a(\mathrm{P}_M)$ denote the rent for the autocrat when he provides public goods to the majority group and $u_a(\mathrm{P}_L)$ be the rent when only small groups are in the set of preferred groups. Then,

$$u_a(\mathrm{P}_M) = ty - \left[s_M g_M^* + \sum_{i\geq 2} s_{L_i} g_{L_iO} + \sum_{i\geq 2} s_{L_i} g_a \right]$$

$$u_a(\mathrm{P}_L) = ty - \left[s_M g_{MO} + \sum_{i\geq 2, L_i \in P_L} s_{L_i} g_{L_i}^* + s_M g_a \right].$$

Since $g_M^* = g_{MO}$, $g_{L_i}^* > g_{L_iO}$ and $s_M > \sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i} = \underline{s}$, $u_a(\mathrm{P}_M) > u_a(\mathrm{P}_L)$. Hence, providing public goods for the majority group still results in higher rent for the ruler and $g^e = s_M g_M^* + \sum_{i\geq 2} s_{L_i} g_a$. Since g_a is also smaller than g_M^* and g_M^* decreases as s_M falls, g^e is smaller than the case when $s_M > 1-\underline{s}$.

When $s_M = \frac{1}{2}$, the autocrat still has two choices of providing public goods to group M or to small groups such that $\sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i} \geq \underline{s}$. Furthermore, since only group L_2 grows as the population share of the majority group decreases, the population share of small groups other than group L_2 is smaller than $\underline{s}$. Thus, group L_2 belongs to the set P_L. Because $\sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i} < \frac{1}{2}$ and $g_M^* - g_{MO} - g_a > g_{L_i}^* - g_{L_iO} - g_a (i \geq 2)$

according to the assumptions, $s_M(g_M^* - g_{MO} - g_a) > \sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i}(g_{L_i}^* - g_{L_iO} - g_a)$ because $s_M > \sum_{i\geq 2} s_{L_i} (i \geq 2)$.

Then, $s_M g_M^* + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j}(g_{L_jO} + g_a) > \sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i} g_{L_i}^* + s_M(g_{MO} + g_a)$.

Since

$$u_a(\mathrm{P}_M) = ty - \left[s_M g_M^* + \sum_{i\geq 2, L_i \in \mathrm{P}} s_{L_i}(s_{L_iO} + g_a) + \sum_{j\geq 3, L_j \notin \mathrm{P}} s_{L_j}(g_{L_jO} + g_a) \right]$$

$$u_a(\mathrm{P}_L) = ty - \left[\sum_{i\geq 2, L_i \in \mathrm{P}} s_{L_i} g_{L_i}^* + s_M(g_{MO} + g_a) + \sum_{j\geq 3, L_j \notin \mathrm{P}} s_{L_j}(g_{L_jO} + g_a) \right],$$

$u_a(\mathrm{P}_M) < u_a(\mathrm{P}_L)$. As $u_a(\mathrm{P}_M) > u_a(\mathrm{P}_L)$ when $s_M = 1 - \underline{s} > \frac{1}{2}$, it holds that $u_a(\mathrm{P}_M) = u_a(\mathrm{P}_L)$ at one point where $\frac{1}{2} < s_M < 1 - \underline{s}$. Let s_M^T denote the population share of the majority group at this point. Then $u_a = u_a(\mathrm{P}_L)$ when $s_M < s_M^T$. Then $g^e(\mathrm{P}_L) = \sum_{i\geq 2, L_i \in \mathrm{P}} s_{L_i} g_{L_i}^* + s_M g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}} s_{L_j} g_a$. As s_M decreases, both s_{L_2} and $g_{L_2}^*$ increase. Since $g_a \leq \min\{g_k^*\}(k = 1,...,k,...,K)$, $g^e(\mathrm{P}_L)$ also increases. But when s_{L_2} is large enough, the autocrat would reduce the number of small groups in P_L. Then, there is a sudden decrease in the population of preferred groups and the level of public spending decreases. Furthermore, when s_{L_2} increases, $s_{L_i} = \frac{1}{K^2}(i \geq 3)$. Therefore, s_{L_2} reaches $\underline{s}$ before s_M reduces to $\frac{1}{2}$. Thus, $P_L = \{L_2\}$ when $s_M = \frac{1}{2}$. Thus, the level of public spending is $g^e(\mathrm{P}_L) = s_{L_2} g_{L_2}^* + s_M g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j} g_a$ and it increases as society becomes more diverse and s_{L_2} increases.

Intermediate & High Cultural Diversity

In a society with intermediate diversity, the majority group becomes group L_1 and $s_{L_1} < \frac{1}{2}$. Group L_1 is the largest group. Since repression is still the cheaper way to keep the society in order, the autocrat would not choose both L_1 and L_2 as preferred groups. Since $s_{L_1} > s_{L_2} > \underline{s}$, $P_L = \{L_2\}$ and $g^e(\mathrm{P}_L) = s_{L_2} g_{L_2}^* + s_{L_1} g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j} g_a$. Thus,

$g^e(\mathrm{P}_L)$ increases until $s_{L_1} = s_{L_2}$. Then, both s_{L_1} and s_{L_2} decrease, and s_{L_3} increases. As long as $\sum_{i\geq 3} s_{L_i} < \underline{s}$,the set of preferrd groups is $P_L = \{L_2\}$ (see the proof in Appendix A.5). and $g^e(\mathrm{P}_L) = s_{L_2} g^*_{L_2} + s_{L_1} g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j} g_a = s_{L_1} g^*_{L_1} + s_{L_2} g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j} g_a$. But $g^e(\mathrm{P}_L)$ decreases.

As group L_3 becomes larger and $s_{L_1} = s_{L_2} = \frac{1}{3}$, $\sum_{i\geq 3} s_{L_i} = \frac{1}{3}$. Thereby, providing public goods to group L_3 and small groups is a better choice for the autocrat $\underline{s}$. Similar to the case when there is a majority group, $P_L = \{L_i (i \geq 3)\}$ results in higher rent for the ruler than providing targeted public goods to larger groups. Then, $g^e(\mathrm{P}_L) = \sum_{i\geq 3, L_i \in \mathrm{P}_L} s_{L_i} g^*_{L_i} + s_{L_2} g_a + s_{L_1} g_a + \sum_{i\geq 4, L_i \notin \mathrm{P}_L} s_{L_i} g_a$. As s_{L_3} increases when the number of preferred groups does not change, $g^e(\mathrm{P}_L)$ also increases, which is the same as the situation when $P_L = \{L_2, L_i (i \geq 3)\}$. At the point where the number of preferred groups declines, there is also a sudden decrease in $g^e(\mathrm{P}_L)$. Then $g^e(\mathrm{P}_L)$ increases until another group $L_i (i \geq 4)$ is excluded from P_L. The alternate rise and fall in $g^e(\mathrm{P}_L)$ repeats until $s_{L_1} = s_{L_2} = s_{L_3} < \underline{s} = \frac{1}{3}$.

Then group L_4 grows larger. When s_{L_4} is not large enough, $P_L = \{L_3, L_i (i \geq 5)\}$ and thereby, $g^e(\mathrm{P}_L)$ decreases as s_{L_3} falls. If s_{L_3} is small enough and s_{L_4} is large enough, $P_L = \{L_3, L_4, L_i (i \geq 5)\}$ to make the population share larger than and close to $\underline{s}$ (see the proof in Appendix A.5). Thus, $g^e(\mathrm{P}_L) = \sum_{i\geq 3, L_i \in \mathrm{P}_L} s_{L_i} g^*_{L_i} + s_{L_2} g_a + s_{L_1} g_a + \sum_{j\geq 5, L_i \notin \mathrm{P}_L} s_{L_i} g_a$. As s_{L_4} increases while s_{L_1}, s_{L_2} and s_{L_3} decreases, $\sum_{L_i \in \mathrm{P}_L} s_{L_i}$ increases and $g^e(\mathrm{P}_L)$ may decrease first. But the level of public spending increases as the difference between s_{L_3} and s_{L_4} is not large enough $\underline{s}$ (see the proof in Appendix A.6). And $g^e(\mathrm{P}_L)$ falls when s_{L_4} decreases. As the population distribution is balanced among more groups, the set of preferred groups includes only falling groups when the new rising group is not large enough and g^e decreases. Then, as the new rising group larger, they also receive public goods and g^e increases in the population share of the new rising group. Thus, fall and rise in g^e alternates as cultural diversity increases.

According to the analysis above, the relationship between g^e and cultural diversity is shown in Figure 1.6. The whole domain is divided into five parts. In domain I, $g^e = s_M g_M^* + \sum_{j\geq 2} s_{L_j} g_a$ and it decreases as cultural diversity increases. In domain II, $g^e(\mathrm{P}_L) = \sum_{i\geq 2, L_i \in \mathrm{P}_L} s_{L_i} g_{L_i}^* + s_M g_a + \sum_{j\geq 3, L_j \notin \mathrm{P}_L} s_{L_j} g_a$ and group L_2 belongs to the set of preferred groups. Then $g^e(\mathrm{P}_L)$ increases as the group L_2 grows. The sudden decrease is caused by the reduction in the number of preferred groups. $g^e(\mathrm{P}_L) = \sum_{i\geq 3, L_i \in \mathrm{P}_L} s_{L_i} g_{L_i}^* + s_{L_2} g_a + s_{L_1} g_a + \sum_{j\geq 4, L_j \notin \mathrm{P}_L} s_{L_j} g_a$ in domain III where group L_3 is the largest of all preferred groups. The changing trend is similar to that in domain II. In domain IV and V, $g^e(\mathrm{P}_L)$ increases as the population share of the new rising group rises, but decreases when the population share of all preferred groups falls. Then Proposition 1.6 follows.

Proposition 1.6: Under repressive authoritarianism, public spending is non-monotonous. When cultural diversity is low, the level of public spending decreases first and then increases. From intermediate diversity, rise and fall in public spending alternate as diversity increases.

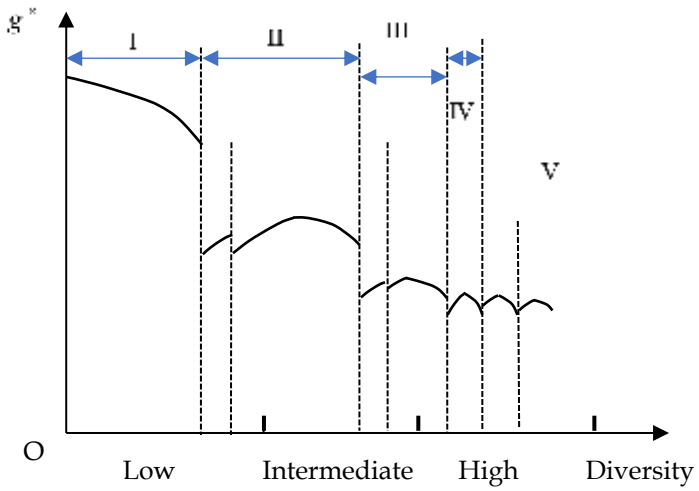

Figure 1.6. Public spending and cultural diversity under repressive authoritarianism

1.6 Conclusions

In this chapter, the effect of cultural diversity on local public spending under different political institutions is explored in detail considering the interaction between different

cultural groups as well as the interaction between the public and politicians. We find that this relationship varies according to different political regimes. In particular, the relationship is non-monotonic instead of being purely positive or negative. Under direct democracy, public spending only decreases monotonically with cultural diversity when cultural diversity is low or high. When cultural diversity is intermediate, the relationship is inverse U-shaped. Under representative democracy, the relationship depends on political motivations and the population distribution across electoral districts. When politicians are accountable, public spending decreases monotonically with cultural diversity when diversity is low. At the intermediate level, the relationship is negative, and the coalition is formed between the first largest group and small groups with closer cultural distance if all electoral districts have the same population distribution over cultural groups. Besides, there is a discontinuous decline in public spending from low to intermediate cultural diversity and discontinuous rise from intermediate to high diversity. When the two largest groups concentrate in each half of electoral districts, the relationship is inverted U-shaped, and the coalition is formed between representatives of the two largest groups. At high cultural diversity, rise and fall in public spending take place by turn as diversity increases. If political representatives are rent-seeking, public spending decreases as cultural diversity increases when diversity is low, but it increases in cultural diversity when cultural diversity is intermediate. From the point where the population of the largest groups starts decreasing, public spending decreases as cultural diversity rises further.

Under authoritarianism, the relationship between public spending and cultural diversity is mainly determined by the probability of rebellion, the public spending to offer economic bargaining and the cost of repression. We find that, under the soft authoritarianism, the level of public spending decreases monotonically as cultural diversity increases. Under the repressive authoritarianism, the level of public spending decreases first and then increases when there is a majority cultural group. Then, rise and fall in public spending take turns when diversity is intermediate and high.

Based on the analysis above, we know that both the direction and magnitude of the effect of cultural diversity on public spending is different under different political institutions and is also related to the characteristic of cultural diversity. We find that a monotonic decrease in public spending as cultural diversity increases only exists in

some situations. Therefore, if we put different countries together when carrying out an empirical analysis, the different effects are all mixed. Even if we include some related variables as control variables, the problem of heterogeneity cannot be fully resolved. Furthermore, another issue that deserves further discussion is the co-evolution of cultural diversity and political institutions. A society that is diverse in culture has higher requirements for the efficiency of public decision-making and the change in political institutions is usually the result of civil conflicts. It would, therefore, therefore be interesting to explore whether cultural diversity contributes to institution changes. This would require a long-term study, but it deserves attention.

Chapter 2

Chinese Dialects, Revolutionary War & Economic Performance*

2.1 Introduction

In this chapter, the relationship between Chinese dialectal diversity and economic performance is explored empirically at the level of Chinese prefecture-level cities[5]. Currently, China has ten major dialectal supergroups, including about 100 dialectal subgroups (see the list of dialects in Appendix B.1). Since the division of administrative areas is not based on dialects and there have historically been several waves of migration, it is common that citizens of one prefecture-level city belong to different dialect groups, which makes it possible to explore the effect of dialectal diversity on economic performance. Thus, in this study, dialectal diversity is taken as the index of cultural diversity. In economic studies, cultural diversity may hinder economic development by inducing communication difficulties, more social conflicts, distorted policies and inefficiency in governance. However, cultural diversity may benefit the economy by increasing innovation and market specialization. Given its long history of diversity, Chinese society is very inclusive of people from different dialect groups and there are few obstacles to their communication, which may undermine the negative effect of cultural diversity on economic development. Furthermore, the writing system is common for all dialects and the official language, Putonghua, has been promoted

* This chapter is a result of joint work with Theocharis Grigoriadis (Freie Universität Berlin). To honor his contribution, "we" will be used throughout this chapter.

5 There are four subnational levels in the Chinese administrative system: the provincial level, the prefecture level, the county level and the town level. The prefecture level includes prefecture-level city, league or autonomous prefecture and prefecture-level district. This study focuses on the dialectal diversity in prefecture-level cities.

since the 1950s, providing more pathways for different dialect groups to understand each other.[6] Hence, at the local level in China, the negative effect of dialectal diversity is reduced, and we expect a positive influence on economic growth.

However, studies have found negative effects of both ethnic diversity at the provincial level (Dincer and Wang, 2011) and dialect diversity at the prefectural level (Xu et al., 2015) in China. But the discussion can be improved. Firstly, cultural diversity is not well measured. On the one hand, ethnic diversity is not a good index of cultural diversity in China. Since many ethnicities have been assimilated by the Han culture, they use Han dialects as their only language or the main language. Thus, ethnic diversity only captures a small part of cultural diversity. On the other hand, the number of Han dialects used in each city (Xu et al., 2015) can reflect neither the fractionalization nor the polarization of the population. If one dialect is used only by a small fraction of the population, the equal treatment of all dialects will result in biased results. Although dialectal fractionalization is used in the robustness test by Xu et al. (2015), dialectal distances are not examined in their paper. Secondly, in the research by Xu et al. (2015), only data of the year 2010 is used. This cannot capture the actual effects of dialectal diversity because of unobserved factors. Thirdly, in the analysis of endogeneity of dialectal diversity, Xu et al. (2015) use the railway index in the period of the Republic of China as the instrumental variable because the railway index can be explained as an indicator of land quality. However, the index may affect economic development in other channels, such as trade and freight traffic.

Then, we perform an improved empirical analysis of the relationship between dialectal diversity and economic development. Contrary to conventional wisdom, we argue that linguistic fractionalization has a positive association with growth and development. We also make three main contributions to the research on dialectal diversity in China. First, five indices of Chinese dialectal diversity are calculated to measure dialectal diversity of prefecture-level cities: dialectal fractionalization,

[6] It is true that some people do not master the writing or Putonghua. They may also have difficulty in understanding other dialects or being understood themselves. But these are mainly old people and they account for a very small part of the population in prefecture-level cities. Their economic activities are primarily in local neighbourhoods and they encounter few communication difficulties.

adjusted dialectal fractionalization, dialectal polarization, adjusted dialectal polarization, and peripheral heterogeneity. Dialectal fractionalization represents the probability that two randomly selected persons are from two different dialect groups and it increases with the number of groups and the balance of population distribution. Dialectal polarization is used as the index reflecting the tension between the two largest groups. The polarization index mainly depicts how much the population distribution across groups deviates from a bimodal distribution and reaches its maximum when there are only two groups of equal size. Adjusted dialectal fractionalization and polarization refer to indices adjusted by dialectal distances, but the adjusted dialectal polarization puts a larger weight on the dialectal distances between the two largest groups. Periphery heterogeneity considers the interaction between the largest group and other groups and the dialectal distance between them. By comparing the effect of these, we can find whether dialectal distances have a role in explaining differences in economic development and whether the distance between which groups is more relevant.

Second, a panel sample covering the period 2001-2015 is constructed and the 5-year average is used in the estimation. Therefore, the novelty in the methodology is that a fixed-effect model is used, which reduces bias in estimations from unobserved factors. Third, the difference in the effect resulting from exposure to the governance of the Chinese Communist Party during the revolutionary war and resources for economic development is determined. Prefecture-level cities with a longer exposure to the governance of the Chinese Communist Party are more deeply affected by the communist value system. Therefore, citizens' values and beliefs are affected by the difference in treatment by communism. On the other hand, the long exposure to the Party's governance leaves a higher proportion of cadres from the native population in local government and this leads to different outcomes in dealing with the interest conflicts between different groups. Furthermore, we consider the effect on the efficiency of governance at the local level of the economic environment given resources and support from the central government to develop the economy.

We find that in China dialectal diversity is conducive to higher levels of growth

and development. [7] Analysis of the whole sample indicates that dialectal fractionalization and polarization as well as periphery heterogeneity have a positive impact on economic growth. Dialectal fractionalization adjusted by dialectal distances shows a positive effect only on the change in economic growth over time. But dialectal polarization adjusted by dialectal distances does not show any robust effect. Thus, the dialectal distance between two polarized groups is not relevant for economic performance. Furthermore, exposure to the governance of the Chinese Communist Party during the revolutionary war causes a difference in the effect of dialectal diversity. In eastern China, communist experience tends to inhibit the negative impact of dialectal diversity while inducing negative influences in central and north-eastern parts of China.

The organization of the paper is the following. The second section covers the literature review of the effect of cultural diversity on economic development and the experience of communism. In the third section, we discuss the relationship between dialectal and cultural diversity. The fourth section reports the data description and empirical strategy. A baseline fixed-effect regression and IV (instrumental variable) analysis are in the fifth section. The sixth section analyzes the differential effects from the long exposure to the governance of the Chinese Communist Party. The seventh section concludes.

2.2 Literature review

2.2.1 Cultural diversity & economic development

As early as in 1967, the effects of cultural diversity on economic development attracted attention. Adelman and Morris (1967) conclude that economic growth rates tend to be higher in less heterogeneous countries, based on the data of 72 less developed countries from 1957 to 1962 and their linguistic diversity. Through a re-analysis of data on 114 world polities from A Cross Polity Survey, Haug (1967) also finds that high cultural diversity is related to lower per capita GNP. The first economic study using modern econometric methods is by Easterly and Levine (1997), who adopt three

[7] See also Table B50 of Desmet et al. (2017) on the effects of diversity on log per capita income to corroborate our argument.

measures of ethnic diversity. The results of a cross-country analysis indicate that high ethnic diversity induces low schooling, political instability, underdeveloped financial systems, distorted foreign exchange markets, high government deficits, insufficient infrastructure, low income and low growth rates. The direct effects of ethnic diversity can also explain significant differences in economic growth across African countries and the Asian miracle. Thus, this paper initiates the study of both transmission channels and the direct effects of cultural diversity on economic development. The channel of government consumption is analyzed by La Porta et al. (1999). Cultural diversity tends to increase government consumption, but its effect depends on the utilization of the consumption. More recently, Alesina and La Ferrara (2004) find direct negative effects of both ethnic and linguistic diversity on economic growth, but the negative effect is mitigated by a higher initial income level. Goeren (2014) examines the direct and indirect effects of both ethnic fractionalization and polarization on economic growth through eight transmission channels: investment, civil war, human capital, government consumption, political instability, market distortion, trade openness and fertility. The dataset used is the updated version of the Barro–Lee data set on educational attainment and consists of 100 countries with 651 observations over the period 1960–1999. It does not only confirm that ethnic diversity has a strong direct negative effect on economic growth, but also establishes the indirect negative effect of ethnic polarization. Garcia-Montalvo and Reynal-Querol (2005a) also analyze the indirect effects of ethnic fractionalization and polarization through the channels of investment, government consumption and civil war. Taking child mortality, fertility, education and wealth as the outcomes of human development, Gerring et al. (2015) find that the negative effects of cultural diversity exist at national levels, while not at subnational levels.

However, Lian and Oneal (1997) argue that cultural diversity does not have significant effects on either economic growth or political instability. The reason for the difference may be that political institutions are not controlled in the research above. Collier (2000) develops a theoretical model with respect to government decisions under the influence of ethnic diversity. In this model, there is a tradeoff between economic growth and redistribution and the result depends on the political context. He finds that ethnic diversity leads to decisions reducing the growth rate in a dictatorship, while ethnic diversity has no effect in democracy. Empirical evidence is

also provided based on the data of 94 countries over the period 1960-1990 and World Bank projects in 89 countries and shows that the political environment exerts influences on the effects of ethnic diversity. Easterly (2001) holds a similar opinion that good institutions reduce the negative effects of ethnic diversity on economic growth by adding the interaction term of institutions and ethnic diversity to the regression model. Furthermore, he tests the effects of institutions on the effect of ethnic diversity on policy factors and obtains results consistent with Easterly and Levine (1997), showing that good institutions significantly mitigate the negative effects of ethnic diversity. Furthermore, the relationship is affected by the level of development.

With respect to the effects of cultural diversity within a specific country, Ottaviano and Peri (2006) demonstrate that the productivity of US-born citizens living in metropolitan areas is positively and significantly affected by a rise in the share of foreign-born citizens between 1970 and 1990. Alesina et al. (2000) employ ethnic diversity in a Dixit-Stiglitz production structure and find that diversity can increase total output because of more various ”intermediate inputs”, which can be interpreted as more diversity in individual skills. Diversity in skills may also increase overall productivity even when the cost of diversity is considered (Lazear, 1999 a, b). In addition, Ager and Brueckner (2014) examine the effects of immigrants to the US over the period 1870-1920 on economic growth. Measures of fractionalization and polarization are constructed and they find that fractionalization has a positive effect on output while population polarization decreases output. Based on the data covering the NUTS3 regions of 12 countries in Europe, the same relationship between diversity, in terms of the share of foreigners, and productivity is revealed (Bellini et al., 2008). But the problem here is that they use the percentage of foreign-born citizens as the measure of cultural diversity, but this may not capture the exact cultural differences. Moreover, immigrants may have some common characteristics that affect productivity. Nevertheless, Sparber (2010) takes racial diversity as the measure of cultural diversity and a fixed-effects analysis shows that racial fractionalization of employment creates gains in the productivity of US cities, but the effect at the state level is ambiguous because it is only significant in random-effects specifications. Above all, although cultural diversity is shown to have a negative effect on economic development across countries, the effect is not significant when controlling for the influence of political institutions.

2.2.2 Cultural diversity and endogeneity

There are two possibilities that induce the endogenous problem in analyzing the relationship between cultural diversity and economic development. Firstly, better economic development may decrease cultural diversity. Secondly, people may be attracted by economic development and thus the fractionalization of the society increases. These causal effects may result in over- or underestimation of the effects of cultural diversity on economic development. This is a critical problem in exploring the effects of cultural diversity, but there are merely a few papers taking it into consideration. Ahlerup (2009) finds that the underestimation of negative effects exists in the empirical analysis based on OLS estimation. The study is conducted at the national level and four instruments are chosen: the duration of human settlements, the diversity of vegetation types, the number of years since the date of independence and the migratory distance in kilometers from Ethiopia to the centroid of each country. Apart from these factors that affect diversity, Ahlerup and Olsson (2007) also explore how local pathogen loads may affect ethnic diversity. Leigh (2006) instruments neighborhood diversity with regional diversity based on the assumption that population mobility is constrained within the region. In the Chinese city study of Xu et al. (2015), dialectal diversity is instrumented by the railway index in the period of the Republic of China to identify its effect on income growth. When exploring the influence of diversity on openness and urbanization of Chinese cities, the mountain index (Li et al., 2017) and migration in history (Shao et al., 2017) are used as instrumental variables. Michalopoulos (2012) finds that geographical variation, captured by the variation in regional land quality and elevation, fundamentally determines the contemporary ethnolinguistic diversity. Geographical factors may, however, affect economic development through other ways than cultural diversity. Hence, taking both geographical and historical factors into consideration, migration in history and geographical factors with regard to altitude and slope are used as instrumental variables of dialectal diversity in this study.

2.2.3 The effect of communism

The effect of exposure to communism can be found in two strands of literature. One strand suggests that exposure to communism has a significant effect on the values and

attitudes of citizens. Eleches and Tucker (2017) conduct research about how communism influences citizens' attitudes and behavior and find that more exposure to communism leads to more opposition to democracy and capitalism, less civic participation, less support for markets, and more support for social welfare provided by the government. Through the analysis of East Germany and West Germany, Alesina and Schündeln (2007) also suggest that the effect of communism on the preference of citizens for government intervention in the economy is positive and significant. Reasons for such effects are path dependence and the communist ideology that individual fortunes are largely determined by the social condition as the responsibility of the government. Similarly, in post-communist countries, development is associated with less movement towards democracy and less market reform (Treisman, 2014). Therefore, after exposure to communism, citizens are more supportive of collectivism than individualism.

The other strand of literature indicates that conflicts due to heterogeneity of groups are less in regions with longer exposure to communism. On the other hand, the benefits from diversity are also limited because of groups' preference for unification. However, there are also researchers who put forward the idea that exposure to communism has no significant long-run effect on culture and development. Roland (2010) suggests that institutional evolutions, values, and beliefs in current transition countries are more affected by the long-run historical past than the experience of communism. In Germany, regardless of drastic political and economic changes, regional entrepreneurship culture tends to have had long-lasting effects over the period 1925-2005 (Fritsch and Wyrwich, 2014). Therefore, from the perspective of individual preference for collectivism, the experience of longer exposure to communism may depress the individual market and entrepreneurial activities and reduce the benefits of dialectal diversity or have no effect because of the lack of impact on cultural traits.

However, from a different perspective, Li et al. (2014) show that provinces with longer exposure to the governance of the Chinese Communist Party (CCP) during the revolutionary war have a higher proportion of native cadres and suggest that local cadres contribute to higher economic growth because they have a better knowledge of local conditions and a better reputation among residents. Thus, we suppose that the coordination cost should be lower in the areas facing conflicts between different dialect

groups when there is longer governance by the CCP. Accordingly, such experience should inhibit the negative effect of dialectal diversity on economic development resulting from interest conflicts. Hence, the longer exposure to the governance of CCP may reduce both the benefits and the loss of dialectal diversity at the same time and the combined influence may not be significant.

2.3 Dialects vs. cultural diversity

While it is a convention that dialectal identity is an important component of cultural identity, there is no direct evidence showing that dialect is a cultural trait of people in China. Desmet et al. (2017) argue that cultural diversity, as measured by the probability of answering a random question of the WVS differently, is positively associated with good policy outcomes (less conflict, more public goods and higher income per capita). We use the China Family Panel Studies (CFPS) to examine the relationship between dialectal and cultural diversity.8 The study is conducted at both individual level and family level, thus providing individual-level data on answers to questions on norms, values, and preferences as well as observable and individual characteristics. The dialectical areas of individuals involved in the survey are determined according to the individual's county. We ask whether there is a joint significant effect of dialects and how much variation in cultural attitudes can be explained by dialectal identities. For each question, the following specification is estimated:

$$Q_i = \alpha_0 + \sum_{d=1}^{D} \alpha_d X_i^d + \beta' C_i + \varepsilon_i ,$$

where i denotes a respondent, Q_i is the answer of the respondent to the question under consideration, $d = 1,...,D$ proxies dialect groups and X_i^d equals 1 if respondent i belongs to dialect group d and zero otherwise. C_i is a vector of control variables, including the gender dummy, age, the education level, ethnicity identity, the education level of the respondent's parents, and household income.

The data used is the first wave of the China Family Panel Studies in 2010, which

8 The data is from China Family Panel Studies (CFPS), funded by the 985 Program of Peking University and carried out by the Institute of Social Science Survey of Peking University.

is the most comprehensive of all waves we have. The survey was conducted in 117 prefecture-level cities in which at most 3 counties were covered. Of all the questions studied, we confine our attention to questions identified as views to norms, values, and attitudes, which leaves us with twenty-four questions in the end. Some questions have binary responses, some have an ordered response and the rest are the actual value of deposits, financial assets, and total assets of the respondent's family. Binary and ordered responses are readily used as dependent variables and we also compute the ratio of deposits in family assets and the ratio of financial assets in family assets. All dependent variables and their meanings are shown in Table 2.1. Furthermore, each respondent is matched with one dialect based on his county name; a total of fifty-three dialect dummies are included in the dataset. The matching between dialects and counties follows the Coding Scheme of the Language Atlas of China.[9] To show whether dialects have predicting power for individual values, attitudes, and behavior, we run the following regressions. Firstly, regressions are run in the whole sample for each question while controlling provincial dummies. Secondly, regressions are done in each province for each dependent variable.[10] All regressions are done through OLS. The p-value of joint significance test of dialects and the goodness of fit, R^2, are also reported. We also compute the increase in R^2 by controlling for dummies of dialects.

The results of all regressions are collected in Table 2.2 and Table 2.3. In Table 2.2, all regressions are done in the whole sample and the average observations are 24,006 when dialect dummies are controlled and 24,386 when they are not. We observe that all dialects are jointly significant at the 1 percent level. Furthermore, by including dialect dummies, R^2 rises in all regressions. For nine out of all the regressions, the addition of the dialect dummies increases the explanatory power of the estimation by more than 50 percent. In these regressions, dependent variables are Education-

[9] Lavely, William; Berman, Lex, 2012, "Language Atlas of China", https://hdl.handle.net/1902.1/19004, Harvard Dataverse, V1.

[10] It would be more useful to examine the relationship between dialect and culture in every Chinese city. However, the CFPS study selects only one county for each city and there is no variance in dialects in the subsample at the city level. Thus, we opt for regressions at the province level.

Achievement, Effort-Achievement, Social network-Achievement, Social network vs. Ability, Effort-Reward, Smart-Reward, Competition, Ratio of financial assets and Ratio of deposits. Therefore, dialect is an important determinant of responses to questions regarding cultural values and behavior.

Table 2.1. Variables for cultural identity

Variables	Meaning
Status-Achievement	The importance of social status in making achievements
Wealth-Achievement	The importance of wealth in making achievements
Education-Achievement	The importance of education level in making achievements
Talent-Achievement	The importance of talent in making achievements
Effort-Achievement	The importance of effort in making achievements
Luck-Achievement	The importance of luck in making achievements
Social network-Achievement	The importance of the social network in making achievements
Social network vs. Ability	View about the statement: Social network is more important than personal ability.
Wealth as achievement	View about taking wealth as achievement
Importance of money	View about the importance of money
Effort-Reward	View about the statement: More effort, more reward.
Smart-Reward	View about the statement: Smarter, more reward.
Attention-Society	Attention to social problems
Attention-Anti-corruption	Attention to news about anti-corruption
Attention-Law and regulation	Attention to news about law and regulation
Attention-Economy	Attention to economic news
Attention-Environment	Attention to environmental problems
Social sympathy	Whether the respondent donated anything last year
Fairness vs. efficiency	The attitude about fairness and efficiency
Attitude about competition	View about the statement: Fair competition is necessary for a good interpersonal relationship.
Trust	Willingness to trust the majority
Ratio of financial assets	The ratio of financial assets in family assets
Ratio of deposit	The ratio of deposit in family assets

Table 2.2. Joint significance of dialect dummies in questions from CFPS-the whole sample

Variables	p-value of joint significance test	R^2 with dialect dummies	R^2 without dialect dummies	ΔR^2	The ratio of rise in R^2
Status-Achievement	0.000	5.8	4.5	1.3	0.289
Wealth-Achievement	0.000	7.3	5.7	1.6	0.281
Education-Achievement	0.000	3.6	1.7	1.9	1.118
Talent-Achievement	0.000	8.3	6.2	2.1	0.339
Effort-Achievement	0.000	3.6	1.6	2.0	1.250
Luck-Achievement	0.000	6.0	4.3	1.7	0.395
Social network-Achievement	0.000	4.3	2.6	1.7	0.654
Social network vs. Ability	0.000	2.5	1.5	1.0	0.667
Wealth as achievement	0.000	4.8	3.6	1.2	0.333
Importance of money	0.000	4.9	3.5	1.4	0.400
Effort-Reward	0.000	5.0	3.0	2.0	0.667
Smart-Reward	0.000	4.8	2.8	2.0	0.714
Attention-Society	0.000	8.9	7.4	1.5	0.203
Attention-Anti-corruption	0.000	9.8	8.4	1.4	0.167
Attention-Law and regulation	0.000	7.5	6.3	1.2	0.190
Attention-Economy	0.000	9.9	8.6	1.3	0.151
Attention-Environment	0.000	9.9	7.8	2.1	0.269
Social sympathy	0.000	11.6	9.1	2.5	0.275
Fairness vs. efficiency	0.000	8.4	6.3	2.1	0.333
Competition	0.000	2.7	1.5	1.2	0.800
Trust	0.000	5.6	4.2	1.4	0.333
Ratio of financial assets	0.000	4.7	3.0	1.7	0.567
Ratio of deposit	0.000	4.3	2.4	1.9	0.792

Notes: p-value shows the joint significance of dialect dummies of each regression. R^2 is expressed in percentage terms. ΔR^2 is the rise in R^2 when dialect dummies are added in the regression. The ratio of rise in R^2 is obtained by the percentage of ΔR^2 in R^2 of regressions without dummies and it reflects the power of dialects in explaining the variation in values compared to control variables.

Table 2.3 displays the share of joint significant regressions and average R^2 in each province. There are, in total, 21 provinces and 23 regressions for each province. In terms of the joint significance of dialect dummies, more than 50 percent of 23 regressions have significant dialect dummies in 12 provinces, which account for more than half of all provinces. In Shanxi, Henan, Guangdong, and Gansu, the share is much higher (more than 80 percent). Except for Liaoning, Shandong, and Henan, the average R^2 of regressions is higher than 0.05 when dialect dummies are controlled for. The increase in R^2 is also significant for most provinces. Thus, in most provinces, the

explanatory power of dialects for variations in cultural values and attitudes and behavior persists as it does in the whole sample. Hence, according to regressions in the whole sample and selected provinces in the CFPS sample, dialects can explain cultural values and attitudes to a significant extent. Therefore, it is reasonable to proxy cultural diversity by dialectal diversity in China.

Table 2.3. Joint significance of dialect dummies in questions from CFPS-by province

Province	Number of regression	Share of regressions with jointly significant dialect dummies	R^2 with dialect dummies	R^2 without dialect dummies	ΔR^2	The ratio of rise in R^2
Hebei	23	0.696	5.748	3.548	2.200	0.620
Shanxi	23	0.826	6.222	3.274	2.948	0.900
Liaoning	23	0.652	4.552	3.752	0.800	0.213
Jilin	23	0.565	10.874	9.357	1.517	0.162
Heilongjiang	23	0.522	5.004	3.491	1.513	0.433
Jiangsu	23	0.435	7.239	6.304	0.935	0.148
Zhejiang	23	0.217	8.935	7.587	1.348	0.178
Anhui	23	0.348	6.226	5.017	1.209	0.241
Fujian	23	0.304	10.930	8.878	2.052	0.231
Jiangxi	23	0.565	5.941	3.532	2.409	0.682
Shandong	23	0.522	4.857	3.474	1.383	0.398
Henan	23	0.870	4.926	3.874	1.052	0.272
Hubei	23	0.348	7.787	5.843	1.943	0.333
Hunan	23	0.261	5.378	5.039	0.339	0.067
Guangdong	23	1.000	7.539	4.278	3.261	0.762
Guangxi	23	0.391	6.726	5.057	1.670	0.330
Sichuan	23	0.609	5.956	3.439	2.517	0.732
Guizhou	23	0.783	10.287	7.917	2.370	0.299
Yunnan	23	0.478	7.265	5.835	1.430	0.245
Shaanxi	23	0.435	5.387	4.330	1.057	0.244
Gansu	23	0.913	6.748	5.252	1.496	0.285

Notes: R^2 is the average of all regressions in each province and expressed in percentage terms. The ratio of rise in R^2 is obtained by the percentage of ΔR^2 in R^2 of regressions without dummies and it reflects the power of dialects in explaining the variation in values compared to control variables.

2.4 Data & Empirical Strategy

2.4.1 Data

The data used in this paper is from four main sources: the population census data, the Chinese Dialects Dictionary together with the Coding Scheme of the Language Atlas of China, the China City Statistical Yearbook and study reports and government documents.[11] To establish the data sample, single-year data of prefecture-level cities is collected firstly over the period 2001-2015.[12] Since changes occurred in jurisdiction areas and units of prefectural cities very often in the 1990s, the panel data is only meaningful when focused on statistics after 1999. Even if there is a change in the administration area from 2001-2015, it is controlled by the respective land area. Furthermore, there is a limitation in accessing official population census data of counties before 2000 and much data on economic development of the same period is missing. In order to reduce endogeneity between economic development and dialectal diversity, 2001 is chosen as the starting year of the sample. To avoid the influence of business cycles, typically 5-year average data is analyzed in the literature. Although shorter period average data can extend the time dimension, 5-year average data is also more appropriate for Chinese economic practices, which is consistent with the 5-year plan regarding social and economic development in China, both at the national level and local levels. Thus, 5-year average data performs better. When data in some year is missing, data of the corresponding period is also treated as missing.

Independent variables. We have five indices for dialectal diversity: dialectal fractionalization (ELF), adjusted dialectal fractionalization (GI), dialectal polarization (RQ), adjusted dialectal polarization (ER), and periphery heterogeneity (PH) (Desmet et al., 2009; Ginsburg and Weber, 2011). ELF is a Herfindahl-based metric measuring the probability that two randomly selected people come from different linguistic

[11] Department of urban social economic investigation, National Bureau of Statistics, China City Statistical Yearbook, 1996-2016, China Statistical Press.

[12] There are also cities at the county-level which are under the jurisdiction of prefecture-level cities and same as counties. In this study, we focus on prefecture-level cities.

groups without considering linguistic distances (Goeren, 2014). We use this in the computation of dialectal fractionalization. It increases with the number of dialect groups and the balance of population distribution among groups. We also consider the other four indices as in the study of linguistic diversity by Desmet et al. (2009). The index taking dialectal distances into consideration based on ELF is called GI, which was proposed by Greenberg (1956). Since dialectal distances are smaller than 1, GI has smaller values than ELF. RQ was proposed by Reynal-Querol (2002) and is determined by the population distribution between the two largest dialect groups. It is maximized when there are two equally sized groups and decreases with an increasing number of equally sized groups. Thus, fractionalization is positively associated with polarization at low levels, not associated with polarization at intermediate levels and negatively associated with polarization at high levels (Goeren, 2014; Ager and Bruekner, 2013). ER is the polarization measure adjusted by dialectal distances and was proposed by Esteban and Ray (1994). Thus, ER is affected most by the population shares of the two largest groups and the dialectal distance between them. The last index, PH, is proposed by Desmet et al. (2005) and takes dialectal distances into consideration. It reflects the alienation between peripheral groups and the largest group.

There are three steps to calculate dialectal diversity at the prefectural level. Firstly, since people in each county use one dialect, each county is matched with a dialect code referred to in the Coding Scheme of the Language Atlas of China. The code is designed at the dialect subgroup level, providing information on both low and high levels of dialect groups. For counties where more than one dialect is used, only the code of the dominant dialect is collected. The matching is conducted through the names of counties directly and 2625 counties are matched. Counties whose names have changed are also considered in the matching. Furthermore, 51 counties not covered in the coding scheme are added in the Chinese Dialects Dictionary, whose codes are added by matching with other counties using the same dialects.[13]

Secondly, dialectal distances are assigned to each pair of languages used in each city according to the method proposed by Fearon (2003). There are 6 levels in the tree

[13] Xu, Baohua; and Ichiro Miya, Chinese Dialects Dictionary (p. fl156-fl224), 1999, Zhong Hua Book Company.

of Chinese dialects, as shown in Figure 2.1. Levels 2 to 6 are made up of phylum, stock, supergroup, group and dialectal subgroup, respectively. Based on the data available, the analysis is focused on the diversity of Chinese dialects belonging to the Sino-Tibetan phylum. These dialects are divided into 8 supergroups – a Mandarin supergroup and 11 non-Mandarin supergroups. The Mandarin supergroup includes 8 groups while the non-Mandarin supergroups include more than 40 groups. The dialectal distances are assigned to each pair of dialects according to the codes of dialects (See details in Appendix B.1).

Thirdly, the population share of each dialectal subgroup in each city is calculated given the population data from the population census (2000, 2010) and the China Population Statistics Yearbook (2006), which provide population information at the county level.[14] Then given the population share of dialect groups and dialectal distances, the five indices are computed according to the method used by Desmet et al. (2009) (see details in Appendix B). Given the limited data on population at the county level, only data on the dialectal diversity of 274 cities in the year 2000 and 2010, and 275 cities in year 2005 is reserved in the sample. Since dialectal diversity does not change in a short period, values of dialectal diversity in the years 2000, 2005 and 2010 are assigned to observations over the period 2001-2005, the period 2006-2010 and the period 2011-2015, respectively, which is one way to reduce the potential problem of endogeneity. Table 4 shows the descriptive statistics of five diversity indices in years 2000, 2005 and 2010 separately.

[14] Tabulation on the 2000 Population Census Data of China and Tabulation on the 2010 Population Census Data of China, China Statistics Yearbook. Department of Population and Employment statistics, National Bureau of Statistics, the China Population Statistics Yearbook, 2006), China Statistics Yearbook.

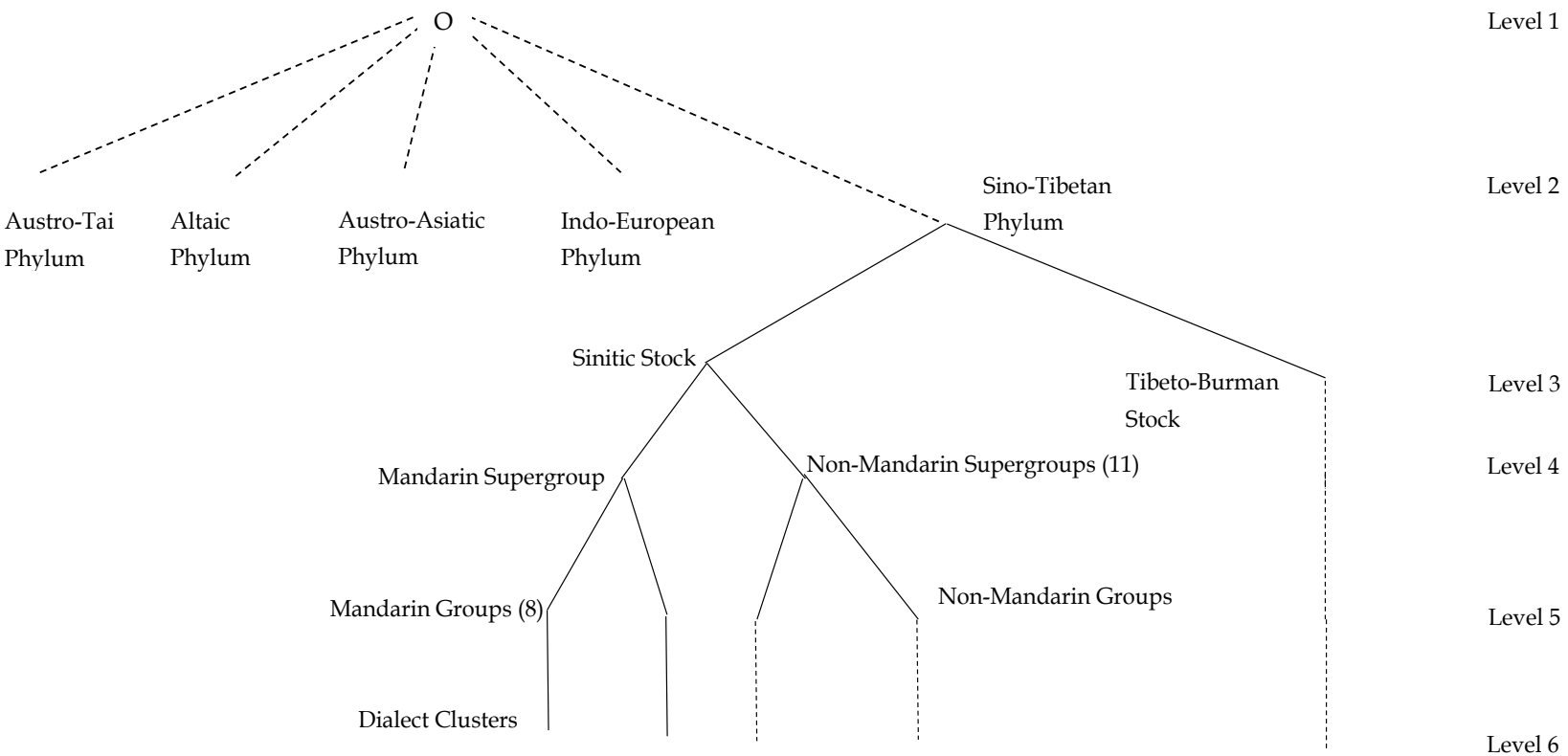

Figure 2.1. Language tree of Chinese dialects

Notes: As in Desmet et al. (2012), we assume there is an original language, O, of all language types that is at Level 1 of the game tree. Since Han dialects are in the Sino-Tibetan phylum, Sinitic stock more specifically, branches of other phyla and Tibeto-Burman are not drawn. For groups who have no subgroups, a dashed line is drawn and we assume that the subgroup is the same as its lower level group. From Level 4, due to limits of space, the specific name of each supergroup, group or cluster is not present.

Table 2.4. Descriptive statistics of dialectal diversity

			Year=2000		
Stats	ELF	GI	RQ	ER	PH
Obs	274	274	274	274	274
Mean	0.2208	0.0847	0.0974	0.0144	0.0760
Std. Dev.	0.2333	0.1050	0.0978	0.0324	0.0899
Min	0.0000	0.0000	0.0000	0.0000	0.0000
Max	0.7802	0.4275	0.2496	0.1334	0.2988
			Year=2005		
Stats	ELF	GI	RQ	ER	PH
Obs	275	275	275	275	275
Mean	0.2219	0.0850	0.0979	0.0369	0.0761
Std. Dev.	0.2339	0.1058	0.0981	0.0429	0.0901
Min	0.0000	0.0000	0.0000	0.0000	0.0000
Max	0.7915	0.4272	0.2498	0.1497	0.2993
			Year=2010		
Stats	ELF	GI	RQ	ER	PH
Obs	274	274	274	274	274
Mean	0.2340	0.1059	0.0981	0.0430	0.0901
Std. Dev.	0.0000	0.0000	0.0000	0.0000	0.0000
Min	0.7915	0.4272	0.2498	0.1497	0.2993
Max	0.2219	0.0853	0.0979	0.0369	0.0766

In the whole sample, there are 123 observations showing no dialectal diversity, accounting for 44.9% of 823 observed prefecture-level cities. Table 4 shows the descriptive statistics of five diversity indices in years 2000, 2005 and 2010 separately. Taking 0 as the minimum value for each index, ELF has the highest maximum value, close to 0.8, and ER has the lowest, which is less than 0.15. Comparing the mean of each index in each year, all the indices have higher values in 2005 than in 2000 and in 2010. For ELF, GI, RQ, and PH, the values in 2000 are higher than in 2010, while ER has a higher value in 2010 than in 2000. The distribution of dialectal diversity among all the observed prefecture-level cities in 2000 can be seen in the maps in Figure 2.2. For all the indices, all the prefectures are divided into five groups: homogeneous, low diversity, middle-low diversity, middle-high diversity, and high diversity. Firstly, there is no significant change in the distribution across all prefectures of all indices. Secondly, cities with a diversity level are not concentrated in one area. Thirdly, when

diversity is measured by GI and ER, the proportion of cities with high diversity increases, although there are a few cities that become less diverse compared to the case when diversity is measured by ELF and RQ. Fourthly, by comparing Figure 2.2a and Figure 2.2c, cities with middle-high and high ELF tend to be located in South China, while cities with a middle-high and a high RQ are more evenly distributed. Moreover, cities with a middle-high and a high GI, ER, and PH are more likely to be located in South China, which can be seen in Figures 2.2b, 2.2d, and 2.2e. Furthermore, the distributions of dialectal diversity across cities are similar in the other two periods, which are shown in Figures B.1-B.5 in Appendix B.3.

Dependent variable. The dependent variable is income per capita proxied by the gross regional product per capita. We have data on the gross regional product (GRP) per capita at current year's prices in the China City Statistical Yearbook (2001-2016), which is adjusted to the price level in 1995.[15] Due to missing data in the statistical yearbook, data on income per capita is only available for 801 observations in the 5-year average dataset. We report the distribution of ELF and income of each period in Figures 2.3. We also have more observations of average income for the period 2006-2010 and the period 2011-2015 and find that there is no explicit relationship between the distribution of ELF and the distribution of income in each period. High income can be observed in cities with low ELF as well as in cities with high ELF and the same holds for cities with relatively low income. Hence, there is no clear pattern regarding the relationship between dialectal diversity and economic development. In addition, we use the logarithm value of income per capita in the estimations.

Control variables. In the baseline regression, we have five groups of control variables. The first group includes the public expenditure per capita and the fixed asset investment per capita. The data on these two variables is mainly from the China City Statistical Yearbook (2001-2016), but the data on public expenditure per capita in the years 2001 and 2002 is from provincial statistical yearbooks for each year. Furthermore, public expenditure is adjusted at the price of the year 1995 by the GDP deflator and fixed asset investment is adjusted by the investment price index of the respective

[15] The data of GDP inflator and investment price index is obtained from the data in the China City Statistical Yearbook (1995-2015).

province. The logarithm values of these are put in the regression. The second group is the industry structure reflected by the ratio of the primary industry and the ratio of the second industry in the economy of prefecture-level cities. The third group reflects the financial development, including the ratio of loans in the GRP and the ratio of residential deposit in the GRP. The data of these two groups of controls is from the China City Statistical Yearbook (2001-2016). The fourth group is deals with labour and human capital, including the logarithm of population, employment rate, the average years of education per capita, the logarithm of enrolment of students in regular secondary schools and the number of key universities. The data on population, employment rate and enrolment of students is obtained from the China City Statistical Yearbook (2001-2016). The average years of education per capita is abstracted from the population census data in 2000 and 2010. The value in 2000 is matched with the periods 2001-2005 and 2006-2010 and the value in 2010 is matched with the period 2011-2015. To capture the capacity in promoting education development, the number of key universities in each city is obtained from the Ministry of Education.[16] Other control variables include the logarithm of highway freight traffic per capita, total land area, market institutions and intermediate organizations, the number of high technology zones to control the effect of transportation conditions, the constraint of land and related resources, market environment and development in technology. The data on highway freight traffic and total land area is from the China City Statistical Yearbook (2001-2016), with highway freight traffic divided by population to get its per capita level. The index of market institutions and intermediate organizations is from the Marketization Indexes Report of China Provinces (2011, 2016).[17] The number of high technology zones is gained from government policy documents and the number in each year is adjusted based on the policy of the year before. In addition to the control variables above, period dummies are also included to control for time trends. Furthermore, in order to identify the effect of dialectal diversity on economic growth, income per capita in lagging periods is also taken as a control variable. We also collect

[16]http://old.moe.gov.cn//publicfiles/business/htmlfiles/moe/moe_648/200506/10003.html

[17] Fan, Gang, Xiaolu Wang, Hengpeng Zhu, China's marketization index: the relative process of regional marketization, 2011, Economic Science Press. Wang, Xiaolu, Gang Fan, Jingwen Yu, China's provincial marketization index report, 2017, Social Sciences Academic Press (China).

data on gross regional product per capita over the period 1996-2000. Table 2.5 presents the basic information of all the variables apart from the diversity indices.

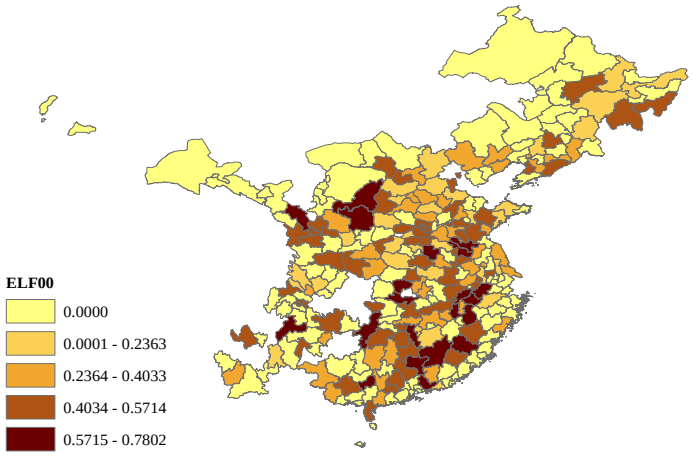

Figure 2.2a. ELF in the year 2000

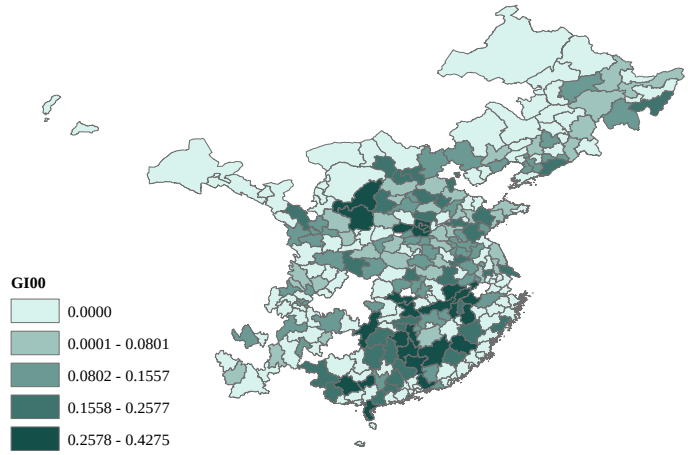

Figure 2.2b. GI in the year 2000

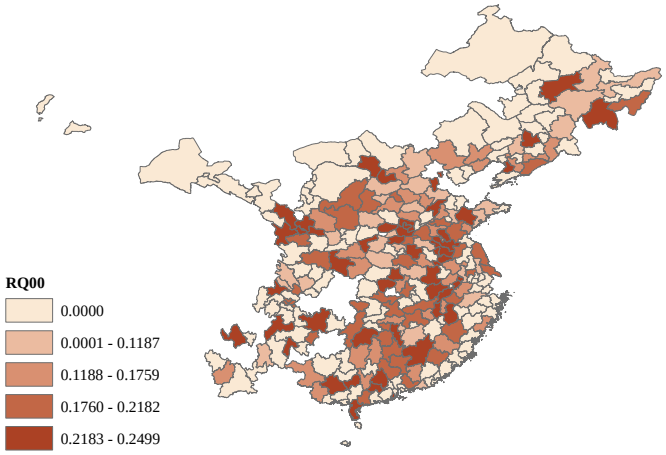

Figure 2.2c. RQ in the year 2000

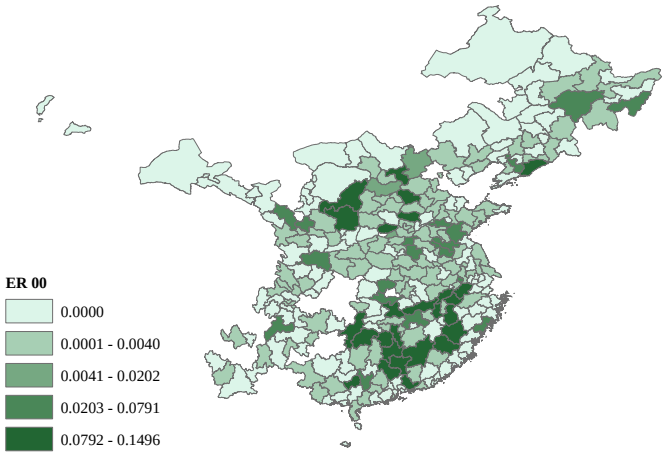

Figure 2.2d. ER in the year 2000

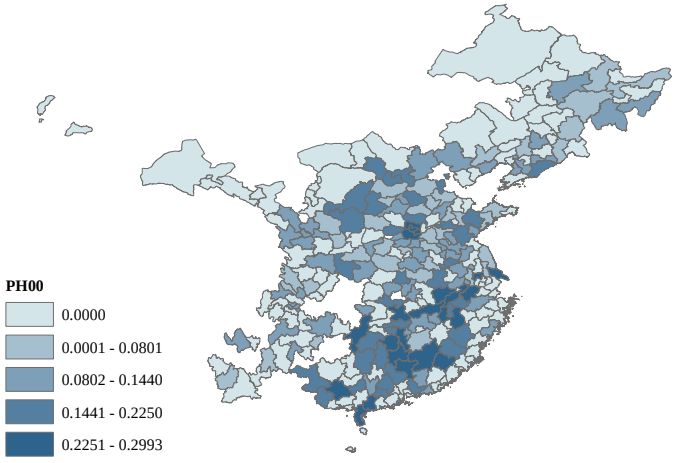

Figure 2.2e. PH in the year 2000

Figure 2.2. Distribution of dialect diversity in the year 2000 in the observed cities

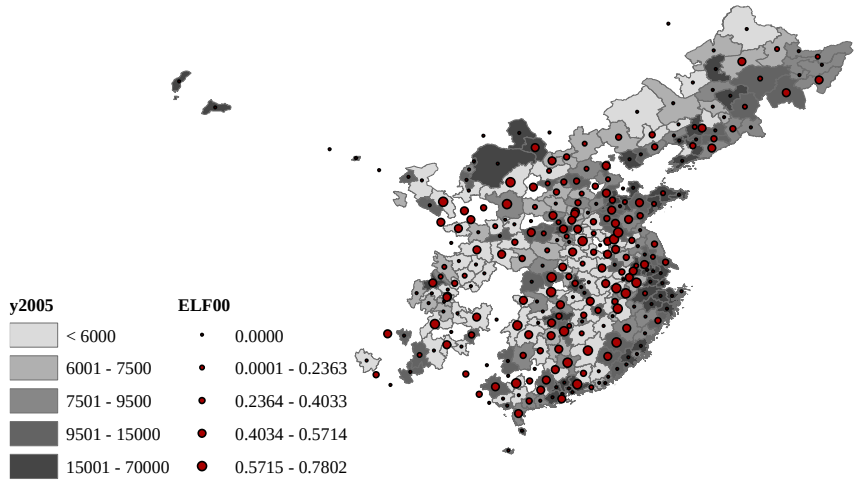

Figure 2.3a. Distribution of dialectal diversity and average income of 2001-2005

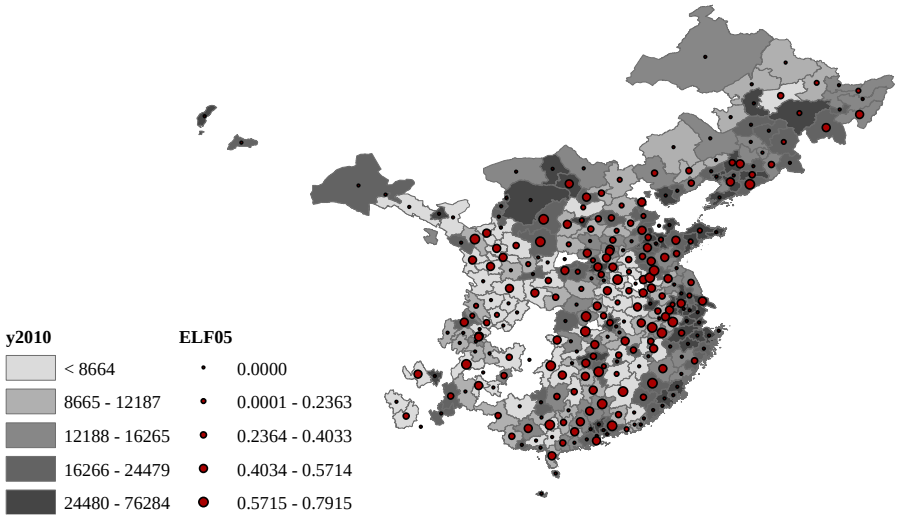

Figure 2.3b. Distribution of dialectal diversity and average income of 2006-2010

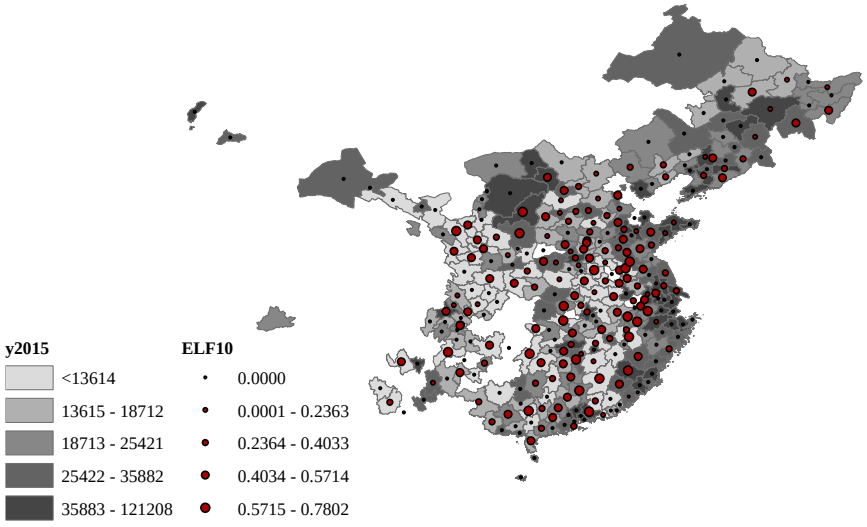

Figure 2.3c. Distribution of average income of 2011-2015

Figure 2.3. Distribution of dialectal diversity and average income in 2001-2015

Table 2.5. Variable description and sources

Variable	Notation	Unit	Source
Income	lny	Yuan	Calculation based on data of China City Statistical Yearbook (2001-2016)
Public expenditure	lnpe	Yuan	Calculation based on data of China City Statistical Yearbook (2001-2016)
Fixed asset investment	lnfai	Yuan	Calculation based on data of China City Statistical Yearbook (2001-2016)
Ratio of primary industry	ppg	%	Calculation based on data of China City Statistical Yearbook (2001-2016)
Ratio of secondary industry	spg	%	Calculation based on data of China City Statistical Yearbook (2001-2016)
Ratio of loans	rlnb	%	Calculation based on data of China City Statistical Yearbook (2001-2016)
Ratio of residential deposit	rdnb	%	Calculation based on data of China City Statistical Yearbook (2001-2016)
Population	lnapop		Calculation based on data of China City Statistical Yearbook (2001-2016)
Employment rate	empr	%	Calculation based on data of China City Statistical Yearbook (2001-2016)
Education level	hc	Year	Population Census Data (2000, 2010)
Enrolment of students	lnnrss		Population Census Data (2000, 2010)
Number of key universities	n29	Integral	Ministry of Education of the People's Republic China
Highway freight traffic	lnhft	Ton	Calculation based on data of China City Statistical Yearbook (2001-2016)
Total land area	lntlaar	km^2	Calculation based on data of China City Statistical Yearbook (2001-2016)
Market institutions and organization	mio	Index	Marketization Indexes Report of China Provinces (2011, 2016)
High technology zones	htdz	Integral	Government policy documents

Table 2.6 provides the basic descriptive statistics for all the main variables in addition to the dialectal diversity indices. There is no outlier for any variables. Although there are large differences between the minimum values and maximum values for the ratio of loans, ratio of resident deposits, and highway freight traffic, the standard deviation is smaller than the mean. The Pearson correlation coefficients between the independent variables and their significance level can be seen in Table B.2.

Firstly, there are no correlation coefficients between dialectal diversity indices and other variables larger than 0.8. Thus, we believe that there is no collinearity problem in the regression analysis. Secondly, although high correlation appears between public expenditure and fixed asset investment and between the ratio of loans and the ratio of resident deposits, the regression result shows that they are all significant and the correlation has no potential problem. Besides, they are also controlled simultaneously in the literature. Hence, controlling these variables will not cause a collinearity problem in the regression.

Table 2.6. Descriptive analysis of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Income	801	9.5627	0.7253	7.7098	11.7053
Public expenditure	802	7.5018	0.8069	5.6925	10.6270
Fixed asset investment	733	8.9635	1.0116	6.5705	11.3043
Ratio of the primary industry	800	15.2599	9.1648	0.0440	48.5700
Ratio of the secondary industry	800	48.6292	10.7448	16.3040	86.1200
Ratio of loans	816	80.8407	43.9151	15.0000	302.0000
Ratio of residential deposit	817	116.4468	51.3686	52.0000	576.0000
Population	818	5.8345	0.6621	2.7732	7.1001
Employment rate	818	0.9631	0.0228	0.7580	0.9930
Education level	823	8.0574	0.9984	5.0800	11.1200
Enrolment of students	818	2.9937	0.6881	-0.1625	4.4951
Number of key universities	823	0.3096	1.1739	0.0000	9.0000
Highway freight traffic	812	2.9505	0.7299	0.7326	5.5700
Total land area	819	9.2886	0.7469	6.9694	11.2132
Market institutions and organization	823	5.1957	2.9087	1.0800	14.5100
High technology zones	823	0.2423	0.4216	0.0000	2.0000

Note: Because of data missing for some prefecture-level cities, the number of observations for most variables is smaller than 823 in the sample of 5-year average data.

2.4.2 Empirical strategy

The analysis starts with the estimation of the basic specification of the two-way fixed-effects model with panel data:

$$Outcome_{it} = \beta_0 + \beta_1 Diversity_{it} + \left(control\ \ \text{var}iables\right)_{it}\gamma^T + \alpha_i + \eta_t + \varepsilon_{it}$$

The dependent variable is represented by the logarithm of income per capita, with the

coefficients of the independent variables reflecting their effect on economic growth. $Diversity_{it}$ represents the dialectal diversity of city i in period t and regressions regarding ELF, GI, RQ, ER, and PH will be run separately. The control variables include public expenditure, fixed asset investments, industrial structure, financial development and variables of labor and human capital, as well as other variables shown in Table 2. These variables will be included in the regression step by step; α and η are included to control individual and time effects. To avoid the impact of the persistence of economic development in lagging periods, we add income per capita in lagging period 1 as a control variable in the estimation. Furthermore, to identify the effect of dialectal diversity on changes in economic growth over periods, we also run regressions controlling income per capita in lagging period 2.

To solve the potential endogeneity problem between dialectal diversity and economic development, pooled-2SLS, FE-2SLS, and IV-GMM are applied after the baseline regression. We instrument dialectal diversity with historical migration, the average altitude, and the share of land area with an altitude under 500 meters. There are five large-scale migration waves within China at different periods in history – the Yong Jia Rebellion in the Western Jin dynasty, migration in the Sui, Tang, and Five dynasties, migration because of the shame of Jing Kang of the Song dynasty, migration at the beginning and middle of the Ming dynasty and "Hu-Guang people fill Sichuan" in the Ming and Qing dynasties. As in Shao et al. (2017), all five migration waves are considered in constructing the instrumental variable of historical migration. Firstly, five dummies of each migration wave are constructed. If a city received immigration in the given migration wave, the corresponding dummy takes the value 1, and 0 if otherwise. Based on the migration map and records for all cities in the area where immigrants were densely populated, the dummy takes the value 1.[18] If cities are in the area where immigrants are dispersed, only cities that accepted immigrants are specified. Secondly, we take the sum of these dummies.[19] Of all the dummies for each

[18] Migration maps and records can be found in Ge, Jianxiong (chief editor), Shuji Cao, Songdi Wu, 1997, Migration history of China, Vol. 1-Vol. 6, Fujian People's Publishing House.

[19] We sum the dummies of all migration waves, the latest four waves, the latest three waves and the latest two waves, respectively.

migration wave and summations of these dummies, we find that migration at the beginning and middle of the Ming dynasty works best as an instrumental variable, thus choosing the dummy for this as the proxy of historical migration. The data of the other two instrumental variables, the average altitude and the share of land area with an altitude under 500 meters, is abstracted from the DEM data by ArcGIS. If the altitude is above 500 meters, it is difficult for people historically to communicate and mobilize and languages are kept isolated from each other, thus resulting in higher dialectal distances. But it may also be positively related to dialectal diversity because regions with better geographical conditions are easier for population mobility and the formation of a higher number of dialect groups.

Since historical migration, the average altitude, and the share of land with an altitude below 500 meters are time-invariant, we first perform the IV regression with a pooled 2SLS model. Then we apply 2SLS and IV-GMM regressions in the fixed-effects model, in which instrumental variables are represented by interaction terms of each variable and period dummies according to the method proposed by Acemoglu et.al (2005). Furthermore, the influence of exposure to governance by the Chinese Communist Party (CCP) during the revolutionary war is obtained by estimating the effect of the experience of being in an area controlled by the CCP from the 1920s to the 1940s. A dummy variable, revolutionary area, is constructed indicating whether a city was governed by the CCP during the revolutionary area.[20] If more than 50% of the counties of a city have revolutionary towns accounting for over 59% of all towns, the variable takes a value of 1.[21] Otherwise, it takes 0. All the cities in the sample are divided into two groups, which are shown in Figure B.6 (see Appendix B.6). The regression is run through the fixed-effects model by including the interaction term between revolutionary area and dialectal diversity as well as control variables:[22]

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[20] Based on the Soviet area map as well as the map of revolutionary bases, http://dangshi.people.com.cn/GB/151935/164962/

[21] Other dummies, indicating more than 30% and 75% of counties of each prefecture-level city, are also constructed and used in the regression analysis. And we select the one performing the best.

[22] Interaction terms between control variables and revolutionary area are also regressed to control the potential effect on the effect of control variables of the experience governed by the CCP during the revolutionary war.

$$Outcome_{it} = \beta_0 + \beta_1 Diversity_{it} + \beta_2 Diversity_{it} * \text{Re}volutionary\ Area + \left(control\ \text{var}iables * \text{Re}volutionary\ Area\right)_{it} \gamma^T + \alpha_i + \eta_t + \varepsilon_{it} \quad .$$

2.5 Results

2.5.1 Baseline results

Taking economic growth as the outcome variable, the results of baseline estimations regressed on ELF, RQ, and PH are shown in Table 2.7A to Table 2.7C. In each table, column (1) is the result of the regression when only dialectal diversity is included in the model. Column (2) is the result of the regression when public expenditure and fixed asset investment are added as control variables and column (3) is the result when the industrial structure is also controlled. Based on the estimated model of column (3), financial development, population, and human capital, and other control variables are included in estimations of columns (4), (5) and (6). Column (7) and column (8) show the regression results when income in lagging period 1 and income in lagging period 2, respectively, are controlled.

In Table 2.7A where ELF is the independent variable, the coefficient of ELF is positive and significant at the level of 0.01 from column (1) to column (6) when income in lagging periods is not considered. In columns (7) and (8) when income in lagging periods is controlled, coefficients of ELF are not significant, but still positive. In addition, income in lagging period 1 shows a positive effect on current income and the coefficients are less than 1, which is consistent with the growth theory that economies with a higher initial income level have slower economic growth. We also notice that income levels in lagging periods 1 and 2 are not significant, but we find that this is the result of collinearity between them and other control variables. Table 2.7B shows the result of the estimation when RQ is taken as the independent variable. The coefficient is higher than the coefficient of ELF, but the significance level is the same as that in Table 2.7A. In both estimations, we find that there is a large decrease in the coefficients of ELF and RQ in column (2) compared to those in column (1). This may be because dialectal diversity has a significant impact on public expenditure and fixed asset investment, and the indirect effect of dialectal diversity is separated from the direct effect on economic growth. Furthermore, the magnitude and significance of the

coefficients of RQ become lower when income in the lagging periods is controlled, but they are still positive although they are not significant. In contrast, Table 2.7C shows that PH has no significant effect if economic development in the lagging periods is not controlled. The coefficients are positive and significant at the 1 percent level and 5-percent level when income in the lagging periods is controlled.

We also run an estimation when dialectal diversity is proxied by the adjusted dialectal fractionalization, GI, and adjusted dialectal polarization, ER, respectively. The results are shown in Table B.3 and Table B.4 (see Appendix B.1). When the dialectal distances between all the groups are equally considered, column (2)–column (6) of Table B.3 indicate that GI is not significant in explaining differences in economic growth. Moreover, it is significant only when income in both lagging periods 1 and 2 is included as a regressor. However, when income in lagging period 2 is considered, GI becomes significant at the level of 0.05. However, in Table B.4, we observe that coefficients are not significant whether income in lagging periods is considered or not.

Therefore, based on the baseline result, ELF and RQ have a significant and positive effect on economic growth. GI and PH show a significant and positive effect on economic growth when lagged economic development is controlled, while ER has no significant effect in any cases. Therefore, the effect of GI, ER, and PH on economic growth is related to dialectal distances and also the way in which indices are adjusted by dialectal distances. This may be because the potential benefits of the difference have not been exploited completely. Furthermore, the significant effect of PH on economic growth also suggests that the effect is determined by how indices are adjusted by dialectal distances, but the dialectal distance between polarized groups has no significant influence. But the result may also suffer from reverse causality between income and dialectal diversity.

In the literature, the endogeneity problem is that economic development tends to reduce linguistic diversity because people tend to be assimilated by mainstream culture and languages. But cultural evolution is a long-term process. On the other hand, economic development may promote population diversity by promoting population mobility. Along with economic development, the population of smaller dialect groups grows faster and thus the distribution of population among dialect groups becomes more balanced. Then, ELF and RQ increase. On the other hand, the positive effect on dialectal diversity may be smaller for indices adjusted by dialectal distances precisely

because they are also determined by dialectal distances. Since it is easier for dialect groups with less distant dialects to benefit from economic development, their population share may grow faster than others. For example, small dialect groups who have less dialectal distance from the central group may grow faster than other groups. In this case, GI, ER, and PH face a less positive effect from economic development and the effect might be negative if groups closer to each other in dialect become large enough. Therefore, when economic development has a positive effect on ELF as well as on RQ, ELF and RQ increase with increasing economic growth, with the result that the significant positive effect of ELF and RQ may be overestimated. When GI, ER, and PH are affected by income per capita negatively, they decline along with economic growth. If the true effect of these on economic growth is positive, the insignificance of their effect in the baseline estimation should be the result of underestimation. Therefore, to verify whether the true effect of dialectal diversity is identified, IV analysis will be conducted as well.

Table 2.7A. Baseline results of the relationship between ELF and economic performance

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ELF	1.571***	1.174***	1.068***	1.059***	1.128***	1.063***	0.537	0.523
	(0.335)	(0.338)	(0.320)	(0.322)	(0.344)	(0.352)	(0.379)	(0.406)
Public expenditure		0.209***	0.138**	0.138**	0.122**	0.130**	0.107	0.074
		(0.063)	(0.054)	(0.054)	(0.055)	(0.058)	(0.066)	(0.083)
Fixed asset		0.166***	0.083***	0.086***	0.082***	0.084**	0.114***	0.049
investment		(0.031)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.056)
Ratio of primary			-0.005*	-0.005*	-0.006**	-0.006*	-0.003	-0.007*
industry			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Ratio of secondary			0.009***	0.009***	0.009***	0.009***	0.009***	0.011***
industry			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ratio of loans				-0.000	-0.000	-0.000	0.000	0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of residents'				-0.000	-0.000	-0.000	-0.000	-0.000*
deposit				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population					-0.074	-0.077	-0.074	-0.434***
					(0.130)	(0.164)	(0.154)	(0.138)
Employment rate					0.503**	0.481*	0.115	-0.148
					(0.247)	(0.256)	(0.247)	(0.219)
Education level					0.014	0.010	-0.043	-0.009
					(0.041)	(0.042)	(0.027)	(0.029)
Number of key					-0.007	-0.006	0.004	-0.175
universities					(0.016)	(0.016)	(0.014)	(0.136)
Enrolment of					-0.054	-0.054	-0.005	-0.047
students					(0.039)	(0.039)	(0.039)	(0.049)
Market institutions						0.002	0.001	0.002
and organizations						(0.004)	(0.003)	(0.008)
Land area						0.023	-0.015	0.027
						(0.098)	(0.096)	(0.073)
High technology						0.001	-0.023	-0.015
zones						(0.029)	(0.019)	(0.022)
Highway freight						-0.027	-0.030	-0.066**
traffic						(0.024)	(0.025)	(0.027)
Income per capita in							0.286***	0.070
lagging period 1							(0.039)	(0.060)
Income per capita in								0.018
lagging period 2								(0.067)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.671***	6.387***	7.427***	7.394***	7.544***	7.403***	5.699***	10.463***
	(0.072)	(0.473)	(0.456)	(0.459)	(1.185)	(1.202)	(1.303)	(1.587)
Observations	801	729	728	723	723	712	656	412
R-squared	0.933	0.956	0.964	0.964	0.964	0.964	0.972	0.954
Number of cities	275	253	253	253	253	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2.7B. Baseline results of the relationship between RQ and economic performance

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RQ	3.779***	2.530***	2.275***	2.253***	2.370***	2.274***	1.117	0.998
	(0.758)	(0.736)	(0.716)	(0.720)	(0.788)	(0.802)	(0.837)	(0.898)
Public expenditure		0.208***	0.137**	0.137**	0.122**	0.129**	0.107	0.076
		(0.063)	(0.054)	(0.054)	(0.055)	(0.058)	(0.066)	(0.083)
Fixed asset		0.166***	0.083***	0.086***	0.082***	0.084**	0.114***	0.048
investment		(0.031)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.056)
Ratio of primary			-0.005*	-0.005*	-0.006*	-0.006*	-0.003	-0.006
industry			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Ratio of secondary			0.009***	0.009***	0.009***	0.009***	0.009***	0.012***
industry			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ratio of loans				-0.000	-0.000	-0.000	0.000	0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of residents'				-0.000	-0.000	-0.000	-0.000	-0.000*
deposit				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population					-0.075	-0.078	-0.074	-0.434***
					(0.130)	(0.164)	(0.154)	(0.138)
Employment rate					0.500**	0.480*	0.113	-0.152
					(0.247)	(0.256)	(0.247)	(0.222)
Education level					0.014	0.009	-0.043	-0.010
					(0.041)	(0.042)	(0.027)	(0.029)
Number of key					-0.007	-0.006	0.004	-0.172
universities					(0.016)	(0.016)	(0.014)	(0.136)
Enrolment of					-0.053	-0.052	-0.004	-0.047
students					(0.039)	(0.039)	(0.039)	(0.050)
Market institutions						0.002	0.001	0.002
and organizations						(0.004)	(0.003)	(0.008)
Land area						0.025	-0.014	0.028
						(0.098)	(0.096)	(0.074)
High technology						0.000	-0.024	-0.016
zones						(0.029)	(0.019)	(0.022)
Highway freight						-0.027	-0.030	-0.067**
traffic						(0.024)	(0.025)	(0.027)
Income per capita in							0.285***	0.070
lagging period 1							(0.039)	(0.061)
Income per capita in								0.019
lagging period 2								(0.067)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.650***	6.405***	7.443***	7.410***	7.568***	7.407***	5.710***	10.464***
	(0.072)	(0.476)	(0.459)	(0.462)	(1.191)	(1.209)	(1.303)	(1.587)
Observations	801	729	728	723	723	712	656	412
R-squared	0.934	0.956	0.964	0.964	0.964	0.964	0.972	0.954
Number of cities	275	253	253	253	253	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2.7C. Baseline results of the relationship between PH and economic performance

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PH	1.749	1.004	0.965	0.989	1.016	1.002	1.243***	1.269**
	(1.083)	(0.983)	(0.848)	(0.829)	(0.832)	(0.811)	(0.416)	(0.545)
Public expenditure		0.215***	0.143**	0.143**	0.128**	0.134**	0.107	0.075
		(0.065)	(0.056)	(0.056)	(0.057)	(0.059)	(0.066)	(0.083)
Fixed asset investment		0.169***	0.085***	0.088***	0.085***	0.088***	0.118***	0.053
		(0.031)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.055)
Ratio of primary industry			-0.005*	-0.005*	-0.006**	-0.006*	-0.003	-0.006
			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Ratio of secondary			0.009***	0.009***	0.009***	0.009***	0.009***	0.011***
industry			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ratio of loans				-0.000	-0.000	-0.000	0.000	0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of residents' deposit				-0.000	-0.000	-0.000	-0.000	-0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population					-0.070	-0.073	-0.063	-0.405***
					(0.129)	(0.164)	(0.153)	(0.143)
Employment rate					0.461*	0.438*	0.143	-0.128
					(0.250)	(0.257)	(0.249)	(0.210)
Education level					0.003	-0.000	-0.048*	-0.011
					(0.038)	(0.038)	(0.026)	(0.028)
Number of key					-0.011	-0.010	0.003	-0.182
universities					(0.017)	(0.017)	(0.014)	(0.135)
Enrolment of students					-0.055	-0.053	-0.005	-0.053
					(0.039)	(0.039)	(0.039)	(0.049)
Market institutions and						0.002	0.001	0.003
organizations						(0.004)	(0.003)	(0.008)
Land area						0.026	-0.011	0.028
						(0.099)	(0.096)	(0.075)
High technology zones						0.001	-0.024	-0.013
						(0.028)	(0.019)	(0.022)
Highway freight traffic						-0.030	-0.032	-0.066**
						(0.025)	(0.025)	(0.027)
Income per capita in							0.281***	0.064
lagging period 1							(0.039)	(0.061)
Income per capita in								0.022
lagging period 2								(0.068)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.880***	6.491***	7.526***	7.487***	7.762***	7.582***	5.667***	10.299***
	(0.083)	(0.470)	(0.454)	(0.457)	(1.111)	(1.159)	(1.308)	(1.613)
Observations	801	729	728	723	723	712	656	412
R-squared	0.932	0.956	0.963	0.963	0.964	0.964	0.972	0.954
Number of cities	275	253	253	253	253	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

2.5.2 Results of IV estimation

All three potential instrumental variables are examined for dialectal diversity separately and the F-statistic of the exclusion test and the values of Prob>F in the first-stage regression are reported in Tables B.5-B.14 (see Appendix B.1). On the basis of pooled 2SLS regression results, we observe that taking historical migration or the average altitude as instruments leads to higher F-statistics in first stage regressions when ELF, GI, ER, and PH are used as independent variables (the F-statistics of the instruments in the first stage are higher than 10 in most cases). When RQ is the independent variable, regressions with historical migration and the share of land with the average altitude below 500m have higher F-statistics in the first stage. Thus, we include historical migration and one geographical factor of the above as instruments in IV regressions through pooled 2SLS. In regressions using FE-2SLS and IV-GMM, we can see that all F-statistics in the first stage are smaller than 10, but the coefficients of the average altitude or the share of land with the average altitude below 500m are significant for all dialectal indices. In regressions using FE-2SLS and IV-GMM, we select one geographical factor with a higher F-statistic in the first stage as the instrument. Thus, we use the average altitude as the instrument for ELF, GI, RQ, and PH and the share of land with an altitude below 500m as an instrument for ER. We estimate robust standard errors in all the regressions.

The results of IV regressions on ELF, RQ, and PH with selected instrumental variables are reported in Tables 2.8A-2.8C, with each table containing one index of diversity as the independent variable. Columns (1)-(3) display the results of the pooled 2SLS regression. Columns (4)-(6) display the results of the FE 2SLS regression and columns (7)-(8) show the results of IV-GMM regression. Table 2.8A shows that ELF has a positive and significant effect on economic growth no matter whether the economic development in the lagging period 1 is controlled or not. But the effect does not persist when income per capita in lagging period 2 is controlled. Thus, ELF has an effect on the level of economic growth, but no effect on the increase in growth over periods. We can see the result of regressions on RQ in Table 2.8B, which shows that RQ has a positive and robust effect on economic growth, but no significant effect on the change in economic growth when income in lagging period 2 is included as a control variable. Furthermore, we can see a similar significant, positive, and robust

effect of PH on economic growth in Table 2.8C in all regressions. The results of the regression on GI are reported in Table B.15 (see Appendix B.1), where we find no robust effect of GI on economic growth, but it may affect change in economic growth positively. However, as the polarization index adjusted by dialectal distances, ER only shows a positive effect on economic growth and an increase over periods in the pooled 2SLS estimation, but the effect is not robust (see Table B.16 in Appendix B.1). Furthermore, in the first stage of pooled 2SLS regressions, most of the F-statistics are higher than 10, with others close to 10, and the coefficients of the instrumental variables are significant. In the first stage of FE-2SLS and IV-GMM regressions, the coefficients of instrumental variables are significant although the F-statistics are small. As the average altitude and the share of land with the average altitude below 500m are indeed exogenous and the results of the second stage regressions through FE-2SLS are very different from that of the baseline regression, we think the two geographical factors are effective instruments which tackle the endogeneity problem efficiently.

Through IV analysis, we find ELF, RQ, and PH each have a robust and positive effect on economic growth across all regressions**.** However, GI and ER have no robust effect on economic growth. Compared with the significant effect of PH, we can conclude that dialectal distance between the central group and other groups plays a greater role than dialectal distances between other groups in explaining differences in economic development. In addition, compared with baseline results, the increase in the magnitudes of the effects of ELF and RQ on economic growth indicates that the positive effects of ELF and RQ in the baseline results are overestimated, while the fact that the effect of PH on economic growth becomes significant provides evidence that peripheral heterogeneity is negatively associated with economic development. Thus, economic development contributes more to the balance of population distribution across dialect groups, but average dialectal distances between the central group and other groups become smaller.

Table 2.8A. Results of IV regression on ELF

	Pooled 2SLS			FE 2SLS			IV-GMM	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ELF	0.949***	0.290***	0.040	12.762**	11.878**	5.809	12.793**	11.996**
	(0.244)	(0.101)	(0.105)	(5.674)	(6.023)	(4.026)	(5.670)	(5.968)
Income in lagging		0.691***	0.787***		0.169**	-0.022		0.167**
period 1		(0.027)	(0.052)		(0.084)	(0.110)		(0.083)
Income in lagging			-0.078*			-0.091		
period 2			(0.045)			(0.100)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	656	412	704	631	366	704	631
R-squared	0.833	0.964	0.966	0.902	0.906	0.903	0.901	0.905
Number of cities				245	225	183	245	225
F-statistic of the 1st stage	14.55	17.18	11.36	4.38	3.27	3.8	4.38	3.27
Historical migration	0.081***	0.090***	0.10***					
	(0.020)	(0.021)	(0.026)					
Altitude*t1	-0.032***	-0.037***	-0.036**	-0.003***	-0.003**		-0.003***	-0.003**
	(0.011)	(0.011)	(0.016)	(0.001)	(0.001)		(0.001)	(0.001)
Altitude*t2				-0.002*	-0.002	-0.004*	-0.002*	-0.002
				(0.001)	(0.001)	-0.002	(0.001)	(0.001)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Additional control variables include all those in column (7) of Table 2.7A. In the regression on instrumental variables, t1 means the period 2001-2005 and t2 means the period 2006-2010. However, in the first stage of the pooled 2SLS regression, instrumental variables are regressed without interacting with period dummies.

Table 2.8B. Results of IV regression on RQ

	Pooled 2SLS			FE 2SLS			IV-GMM	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RQ	1.328***	0.248	-0.244	27.088**	24.388**	12.784	27.187**	24.618**
	(0.477)	(0.230)	(0.290)	(12.206)	(12.321)	(9.119)	(12.179)	(12.197)
Income in lagging		0.686***	0.794***		0.168**	-0.038		0.166**
period 1		(0.026)	(0.053)		(0.084)	(0.124)		(0.083)
Income in lagging			-0.093**			-0.100		
period 2			(0.046)			(0.110)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	656	412	704	631	366	704	631
R-squared	0.885	0.971	0.965	0.902	0.911	0.899	0.901	0.910
Number of cities				245	225	183	245	225
F-statistic of the 1st stage	13.51	14.48	8.83	4.01	3.32	3.37	4.01	3.32
Historical migration	0.031***	0.035***	0.036***					
	(0.008)	(0.009)	(0.010)					
Altitude	0.033***	-0.032***	0.032**					
	(0.010)	(0.011)	(0.014)					
Altitude*t1				-0.001***	-0.001***		-0.001***	-0.001***
				(0.000)	(0.001)		(0.000)	(0.001)
Altitude*t2				-0.001*	-0.001	-0.002*	-0.001*	-0.001
				(0.000)	-0.001	(0.001)	(0.000)	-0.001

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Additional control variables include all those in column (7) of Table 2.7A. In the regression on instrumental variables, t1 means the period 2001-2005 and t2 means the period 2006-2010. However, in the first stage of the pooled 2SLS regression, instrumental variables are regressed without interacting with period dummies.

Table 2.8C. Results of IV regression on PH

	Pooled 2SLS			FE 2SLS			IV-GMM	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PH	2.218***	0.716***	0.170	16.738**	14.568**	9.712	16.028**	14.403**
	(0.505)	(0.226)	(0.241)	(7.075)	(6.806)	(6.084)	(7.056)	(6.805)
Income in lagging period 1		0.689***	0.790***		0.174**	-0.034		0.170**
		(0.026)	(0.053)		(0.072)	(0.096)		(0.072)
Income in lagging period 2			-0.079*			-0.021		
			(0.045)			(0.063)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	656	412	704	631	366	704	631
R-squared	0.846	0.964	0.966	0.926	0.943	0.916	0.929	0.944
Number of cities				245	225	183	245	225
F-statistic of the 1st stage	21.01	23.13	14.51	4.5	4.74	5.87	4.5	4.74
Historical migration	0.034***	0.037***	0.041***					
	(0.008)	(0.008)	(0.010)					
Altitude*t1	-0.018***	-0.019***	-0.020***	-0.001*	-0.002***		-0.001*	-0.002***
	(0.004)	(0.004)	(0.006)	(0.001)	(0.001)		(0.001)	(0.001)
Altitude*t2				-0.001***	-0.002***	-0.002**	-0.001***	-0.002***
				-0.001	(0.001)	(0.001)	-0.001	(0.001)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Additional control variables include all those in column (7) of Table 2.7A. In the regression on instrumental variables, t1 means the period 2001-2005 and t2 means the period 2006-2010. However, in the first stage of the pooled 2SLS regression, instrumental variables are regressed without interacting with period dummies.

Furthermore, to affirm the positive effect of dialectal diversity, we introduce a random-effects model using the dialectal diversity in the year 2000 and single-year data of economic development from 2011 to 2015. Compared with the dialectal diversity and income of the same periods, the dialectal diversity in the lagging period is less likely to influence the economic development of the current period. Thus, in the following analysis, the dialectal diversity in 2000 is regressed and the indices are represented by ELF00, GI00, RQ00, ER00, and PH00. The results of this analysis are displayed in Table B.17 (see Appendix B.1). We can observe that the coefficients of ELF00, GI00, RQ00, and PH00 are positive and significant. Therefore, dialectal fractionalization and polarization as well as periphery heterogeneity each show a robust and positive effect on income and economic growth, as shown in the IV analysis. The positive effect of dialectal fractionalization adjusted by dialectal distances also gains more supportive evidence. But we still have no evidence for the significant effect

of ER.

According to our analysis above, ELF, GI, RQ, and PH each have a positive effect on local economic growth in China, which is different from the conclusion in the literature. In the literature, on the one hand, diversity should have a positive effect on the innovation capacity. Pan et al. (2017) suggest that private high-tech firms have more innovative output in more diverse cities. On the other hand, dialectal diversity has a negative impact because of the difficulty in communication between different dialect groups, which results in less economic interaction. Nevertheless, we suggest that this kind of negative effect does not exist in China. For one thing, the coexistence of dialects has a long history and people speaking different dialects can understand each other to some extent. In addition, Putonghua has been the official language for more than 50 years and most people are able to communicate with each other using Putonghua.[23] For another thing, the same writing system is common to all Chinese dialects and thus speaking different dialects does not affect the ability to communicate in writing. We also find empirical evidence showing that larger dialectal distance has no influence on the effect of dialectal diversity on economic growth (see Appendix B.4). Furthermore, there are also studies showing that cultural diversity has a negative impact on the level of public spending due to heterogeneous preferences and interest conflicts. But this does not affect our result because we include both public expenditure and fixed asset investments as controls in the regression. However, the study of Liu et al. (2017) states that dialectal diversity is detrimental to the efficiency of resource allocation. We conjecture that the efficiency loss is not common across all cities and it is also affected by the capacity of local government and the economic environment. We will discuss this more in the next section.

2.6 The effect of CCP governance during the revolutionary war

During the period of the Agrarian Revolutionary War and the anti-Japanese national revolutionary war, some districts functioned as revolutionary bases controlled by the

[23] Melitz and Toubal (2014) show that common official language have significant effect on the ease of communication in bilateral trade when controlling the common native language and the latter has no robust effect while controlling the former.

CCP. The governance of these districts was primarily through congress and democratic government composed of local people. In the process of war, government members as well as the government itself formed a close relationship with local residents. After the war ended, these people continued to be government members, and this has had a lasting effect on the contemporary government structure that the government of this area has a higher proportion of cadres selected from local residents. The closer relationship between the local government and citizens has resulted in higher government capacity in the coordination and efficiency of resource allocation. But the effect of the government capacity may also be affected by the economic environment and resource support in developing the economy. Conflicts and deficient allocation of resources may only appear when resources are sufficient such that the governments of counties have choices concerning the availability of resources.

Since the beginning of economic reforms starting in 1978 when the unbalanced development strategy was first implemented, the eastern part of China has been the pioneer in economic development, receiving more support and resources through preferential policies in relation to investments, fiscal decentralization, tax, credit, investment and the introduction of new technologies by establishing special economic zones and economic-technological development zones.[24] Facing relatively high amounts of resources and policy support for economic development, it is more difficult for dialect groups to reach an agreement regarding resource allocation among local county governments. Thus, the government at the prefecture-level with a higher proportion of local cadres can allocate resources more efficiently by coordinating the conflicts between counties arising from different dialect groups. Hence, in the East of China, dialect diversity may have a negative effect because of conflicts in resource

[24] There are, in total, four economic regions in mainland China, the eastern part, the central part, the north-eastern part and the western part. The Western Development Strategy started in year 2000 and then the central government has been providing support to develop economy in the western part. There is also a western development office in the central government making related policies and decisions. Thus, the local government in the western part plays a smaller role in developing economy than other parts of China. Hence, as we want to examine the effect from different roles of local government, we focus on the eastern, central and north-eastern regions in China.

allocation, but the experience of being governed by the CCP during the revolutionary war should contribute to the reduction in the negative role of diversity.

At the same time, local governments in the central and northeastern part of China have received less motivation from the central government to promote economic development. Although the situation has improved since the beginning of the 21st century, the advantage in the East of China has persisted. For example, the ratio of special economic zones and high technology development zones to cities in the East is 0.869, while the ratio in the other two regions is 0.21. Hence, in these regions, there are only limited resources to be allocated to sectors and departments which have a critical need for local economic development. Thus, dialectal diversity may not result in conflicts in resource allocation. But local cadres may play a negative role in the efficiency of resource allocation because of their preference for counties having close relations with native cadres in the upper level government. Therefore, dialectal diversity should have a less positive effect in cities in central and northeastern regions of China that experienced governance by the CCP during the revolutionary war. Taking the dummy revolutionary area as the proxy for governance by the CCP during the revolutionary war, our hypothesis is verified by empirical estimation.

We firstly run the regression by propensity score matching on the dummy of the revolutionary area while controlling different indices of dialectal diversity. We find that there is no difference in economic growth between the revolutionary area and the non-revolutionary area (see Table B.18 in Appendix B.1). Therefore, the effect of dialectal diversity on economic growth will not be disturbed by the experience of being governed by the CCP during the revolutionary war. Furthermore, by introducing the interaction terms of dialectal diversity and the dummy for the experience in the fixed-effect model, we observe that the experience of being governed by the CCP during the revolutionary war might contribute to the positive effect of dialect diversity (See Table B.19 in Appendix B.1). Hence, there is no difference in the effect of dialectal diversity between the revolutionary area and the non-revolutionary area.

Tables 2.9A-2.9D report the results of regressions in the subsample of the East and other regions regarding the effect on economic growth. Firstly, we observe that, in the East, the coefficients of the interaction term between ELF and the revolutionary area are positive and significant and have higher absolute values than the negative coefficients of ELF (Table 2.9A). In other regions, in contrast, ELF shows a positive and

significant effect on economic growth in the non-revolutionary area. Moreover, the coefficient of interaction terms in columns (5) is significant and negative. Therefore, consistent with our hypothesis, the negative role of the conflicts over resource allocation is reduced by the experience of being governed by the CCP during the revolutionary war in the East, but such experience in central and north-eastern regions leads to more negative impacts. Similarly, regarding the effect of GI (Table 2.9B), we find that GI also shows a negative effect on economic growth in the revolutionary area of the East. Thus, the conflicts over resource allocation are common among different dialect groups and deeper as dialectal distance increases. Furthermore, in the East, RQ has a negative effect on income and economic growth in cities of the revolutionary area and a positive effect in cities that were not in the revolutionary area. In other regions, RQ may also induce a stronger negative effect on economic growth in the revolutionary area. We also observe similar results regarding the influence of the experience of being governed by the CCP during the revolutionary war on the effect of PH in the East and other regions (Tables 2.9D). We additionally run regressions in which ER is included as the independent variable and the results are shown in Table B.20 (See Appendix B.1). However, we observe that ER has no significant effect in most cases, as was the case in the results of the analysis in the sections above.

In brief, the experience of being governed by the CCP during the revolutionary war inhibits the negative impact of dialectal diversity and contributes to its positive effect in the eastern part of China. In central and north-eastern regions, the experience tends to promote the negative influence of dialectal diversity. Furthermore, the results regarding the effect of GI suggest that dialectal distances also play some role in determining economic development. But the difference in the significance of ER and PH predicts that different distance has different roles. The effect of ER is only significant in the East when income in lagging periods 1 and 2 is controlled, while the effect of PH is significant and robust. Hence, dialectal distances between the central group and other dialect groups has a larger role in influencing economic outcomes.

Table 2.9A. The effect of ELF: revolutionary area vs. non-revolutionary area

	The East			Other regions		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ELF	-1.961*	-1.892*	-2.726***	1.262**	0.865	0.693
	(1.027)	(0.991)	(0.864)	(0.637)	(0.653)	(0.757)
ELF*Revolutionary area	2.301*	2.261**	3.489***	-1.447	-2.157**	-0.279
	(1.198)	(1.111)	(0.939)	(0.896)	(1.003)	(0.980)
Income in lagging period 1		0.347***	0.208*		0.279***	0.186*
		(0.066)	(0.115)		(0.071)	(0.102)
Income in lagging period 2			0.052			-0.024
			(0.154)			(0.072)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	13.922***	8.147*	4.663	13.057**	8.635**	9.994**
	(4.430)	(4.223)	(7.231)	(5.351)	(4.245)	(4.202)
Observations	177	172	112	330	310	201
R-squared	0.986	0.989	0.989	0.979	0.982	0.980
Number of cities	60	60	59	115	115	113

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Time variant control variables shown in column (7) of Table 2.7A are also included in the regression.

Table 2.9B. The effect of GI: revolutionary area vs. non-revolutionary area

	The East			Other regions		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
GI	-0.650	-3.271*	-4.611***	1.954	1.175	1.156
	(0.525)	(1.682)	(1.544)	(2.292)	(1.910)	(1.546)
GI*Revolutionary area	1.744	4.252**	6.287***	-2.569	-1.671	0.350
	(1.489)	(1.942)	(1.568)	(2.345)	(2.259)	(2.052)
Income in lagging period 1		0.345***	0.199*		0.277***	0.181*
		(0.065)	(0.115)		(0.073)	(0.104)
Income in lagging period 2			0.042			-0.011
			(0.153)			(0.075)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	14.660***	8.096*	4.577	13.030**	7.144	9.663**
	(4.625)	(4.306)	(6.985)	(5.250)	(4.465)	(4.153)
Observations	177	172	112	330	310	201
R-squared	0.986	0.990	0.990	0.979	0.982	0.980
Number of cities	60	60	59	115	115	113

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Time variant control variables shown in column (7) of Table 2.7A are also included in the regression.

Table 2.9C. The effect of RQ: revolutionary area vs. non-revolutionary area

	The East			Other regions		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
RQ	-4.027*	-3.866*	-5.826***	2.805**	2.060	1.839
	(2.037)	(1.961)	(1.709)	(1.301)	(1.393)	(1.788)
RQ*Revolutionary area	4.129	4.370*	7.276***	-3.221	-3.945*	-1.135
	(2.716)	(2.534)	(2.228)	(2.010)	(2.099)	(2.150)
Income in lagging period 1		0.349***	0.196*		0.280***	0.187*
		(0.068)	(0.117)		(0.071)	(0.102)
Income in lagging period 2			0.088			-0.028
			(0.159)			(0.071)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	14.242***	8.275*	4.466	13.086**	8.155*	10.084**
	(4.368)	(4.260)	(7.298)	(5.398)	(4.399)	(4.221)
Observations	177	172	112	330	310	201
R-squared	0.986	0.989	0.989	0.979	0.982	0.980
Number of cities	60	60	59	115	115	113

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Time variant control variables shown in column (7) of Table 2.7A are also included in the regression.

Table 2.9D. The effect of PH: revolutionary area vs. non-revolutionary area

	The East			Other regions		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
PH	-3.431*	-3.343*	-5.096***	1.871	1.176	0.929
	(1.721)	(1.672)	(1.512)	(1.578)	(1.364)	(1.102)
PH*Revolutionary area	4.684**	4.586**	6.775***	-1.375	-0.160	0.355
	(1.994)	(1.943)	(1.724)	(1.950)	(2.222)	(1.593)
Income in lagging period 1		0.344***	0.152		0.277***	0.180*
		(0.064)	(0.116)		(0.073)	(0.106)
Income in lagging period 2			0.103			-0.012
			(0.154)			(0.075)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	13.782***	8.048*	2.939	12.485**	6.362	9.768**
	(4.587)	(4.313)	(7.011)	(5.354)	(4.425)	(4.216)
Observations	177	172	112	330	310	201
R-squared	0.987	0.990	0.990	0.979	0.982	0.980
Number of cities	60	60	59	115	115	113

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Time variant control variables shown in column (7) of Table 2.7A are also included in the regression.

2.7 Conclusions

In this chapter, the effect of dialectal diversity on economic performance at the prefectural level in China is re-examined. Firstly, five indices of dialectal diversity are analyzed to identify the effect of diversity resulting from a variety of languages and diversity resulting from both the variety and differences of languages. Of these five indices, ELF and RQ are determined only by the population distribution among the dialect groups. GI and ER also consider the dialectal distances of each pair of dialects. PH is determined by the population distribution and dialectal distance between the central group other groups. Secondly, dialectal diversity in the years 2000, 2005 and 2010 are calculated and a fixed-effects model is implemented. Thirdly, a panel sample of 5-year average data covering the period 2001-2015 is used in the estimation. There are 274 prefecture-level cities in the sample. To solve the problem of endogeneity, instrumental variable analysis is applied using the approaches pooled 2SLS, FE-2SLS and IV-GMM. Furthermore, differences in the effect between cities that were governed by the CCP during the revolutionary war and those that were not are also explored.

We find that ELF and RQ each have a significant and robust effect on economic growth. Of the indices considering dialectal distances, only PH has a robust and positive effect on economic growth. GI, however, shows a significant effect on the change in economic growth over time, whereas ER does not show a robust effect in any cases. Hence, the effect of GI and PH imply that dialectal distances also play a role in explaining variation in income, but the insignificant effect of ER indicates that dialectal distances between the central group and other groups, instead of that between the two largest groups, are more relevant. Furthermore, the significant effect of GI also suggests that dialectal diversity may be related to the variation in economic growth over time. In addition, the influence of the experience of being governed by the CCP during the revolutionary war on the effect of dialectal diversity is different between the East and other parts (including the central and north-eastern regions) of China. In the East, exposure to communist governance tends to inhibit the economic loss from dialectal diversity and promotes its positive effect, while it is the opposite in the Center and Northeast other regions. The discussion of the experience of being in the revolutionary base also shows that the actual effect of dialectal diversity is related to the relative scale of benefits compared to economic loss caused by diversity.

On the basis of this research, there is still much potential for further study. Firstly, due to the limitation of data access, a longer period panel will be better for the analysis. It is necessary to do further research in the future to identify the long-run effect of dialectal diversity on economic development, especially on the time trend of economic growth. Secondly, more potential channels need to be investigated. But this requires better data on efficiency in resource allocation, productivity, and technological improvement at the prefecture-level. Thirdly, conclusions of this study are limited to the sample we have, and it is still meaningful to conduct this research in the future when more data is available. Above all, this study contributes to a better understanding of the effect of dialectal diversity on economic development in China under the same cultural and institutional environment.

Chapter 3

Antiquity and Capitalism: The Finance-growth Perspective*

3.1 Introduction

This chapter explores the impact of state antiquity on capitalism through the finance-growth nexus. We define antiquity as the length of established statehood within the present-day territory of a country. In the tradition of the deep-roots of economic development (henceforth DRD) literature, we conjecture that historical legacies are important in understanding the contemporary differences in socio-economic outcomes (Spolaore and Wacziarg, 2013). However, in contrast to a large part of this literature, we focus on how capitalism functions rather than on what long-run results it brings about in terms of economic development under state antiquity. The two approaches are intimately connected: the former enables a deeper understanding of the latter.

The chapter takes into account the result of Borcan et al. (2018) according to which a much too long history of statehood might be detrimental to economic development because of the probable emergence of extractive institutions and deeper entrenchment of interest groups in the society. Our main contribution to the literature is that we elaborate a particular channel proposed in the seminal paper of Dombi and Grigoriadis (2020), the finance-growth nexus, through which extractive institutions may manifest themselves in societies with ancient roots. We present convincing evidence that in countries with a long-established statehood, the financial sector tends to allocate society's savings in an inefficient way because of its likely capture by the

* This chapter is a result of joint work with Theocharis Grigoriadis (Freie Universität Berlin) and Akos Dombi (Eötvös Loránd University). To honor their contribution, "we" will be used throughout this chapter.

economic and political elites. The impaired functioning of the financial sector is a devastating example of the heavy legacy of antiquity on capitalism. The paper is motivated by the finance-growth literature, the corruption in lending literature and two sub-strands of the DRD literature: the state history and the historical development literature.

The empirical *finance-growth literature* dates back to the early 1990s (King and Levine, 1993). In its first wave, the general conclusion was that financial development was beneficial for growth (Levine, 2005). However, from the early 2000s a growing number of papers have challenged the linearity proposed in previous studies (Rosseau and Wachtel, 2002; Deidda and Fattouh, 2002). This second generation of the finance-growth literature has switched the focus to the nonlinear effect of financial development on growth. A group of papers suggests that the effect of financial development on growth may depend on the level of economic development in a positive way (e.g., Rioja and Valev, 2004). Their argument is that higher development is paired with better institutions and the Schumpeterian role of banks in selecting promising investments might be more important in the intensive phase of economic development than in the extensive one. The second source of nonlinearity relates to the size of the financial sector by assuming that too much finance is bad for growth. Indeed, the inverted U-shaped relationship of financial development with growth is well established (e.g., Law and Singh, 2014; Arcand et al., 2015). The third strand of the nonlinear finance-growth literature emphasizes the role of institutions and argues that better institutions result in better finance (e.g., Law et al., 2013; Law et.al, 2018). Finally, Dombi and Grigoriadis (2020) initiate a new channel of nonlinear finance by demonstrating that longer state history over the last two millennia is paired with a less beneficial growth effect of financial development in post-socialist transition economies.

The literature on *corruption in lending* investigates the mechanisms and conditions of the capture of the financial sector and surveillance authorities by interest groups. Its main insight is that if this capture occurs the allocation of savings becomes suboptimal, resulting in slower growth. In their seminal paper, Beck et al. (2006) study how bank supervisory policies are connected to corruption in lending. According to their results, powerful centralized bank supervision tends to increase corruption in lending. They conjecture the state/regulatory capture of the banking sector in the latter case. In contrast to Beck et al. (ibid.), Barth et al. (2009) focus on the effect of competition and

information sharing among lenders on corruption in lending. They find that the more concentrated the banking sector is, the more widespread corruption in lending is. They argue that a low level of banking sector competition enhances the bargaining power of banks against firms and makes the latter resort to bribery. Barry et al. (2016) considers how banks' ownership structure influences corruption in lending. According to their empirical results, family and state ownership tends to increase lending corruption in both developed and developing countries. The authors explain this outcome with the importance of relatedness in bank lending. Morck et al. (2011) also corroborate the tendency toward the elite-capture of a country's financial system when banks are controlled by tycoons. According to their results, in the case of the latter , not only is capital allocation less efficient, but financial instability is also more prevalent.

The *state history* literature was initiated by the seminal paper of Bockstette et al. (2002). These authors construct the state history index of the last two millennia, measuring the length of established statehood in the present-day territories of countries. Based on this index, they conclude that state history is positively associated with economic development. Bockstette et al. (ibid.) argue that countries with a longer state history tend to have better institutions and state capacity. Furthermore, Ang (2013) demonstrates that early starter countries are also financially more developed, at least according to the experience of the last two millennia. Borcan et.al. (2018) extend the original state history index over the last six millennia. They find that if the ages before the Common Era are also taken into account, and ancient societies (e.g., Egypt, Greece) can really be differentiated from younger ones, the relationship of state history with contemporary economic development follows an inverted U-shape. They continue to recognize the positive effect of established statehood proposed by Bockstette et al. (2002), but argue that with a longer state history, societies tend to have more centralized institutions and more powerful interest groups, resulting in more pervasive rent-seeking. In the *state history-economic development* nexus, this implies a tipping point above which the negative consequences of longer state history outweigh the positive ones, leading to a lower level of economic development. Indeed, there is some evidence that older societies tend to have more centralized and autocratic political and social systems. Hariri (2012) finds that countries with a longer state history in the pre-Columbian era were more effective in being able to resist European

colonization and settlements and preserve their own regime, resulting in more autocratic establishments today. Hariri also demonstrates that older societies pursue more collectivist values. Lagerlöf (2016) suggests that countries with an early statehood have become stuck in autocracy because of the higher extractive capacities of the incumbent rulers and thus their lower willingness to bestow power in the form of a democratic transition.

The literature on *historical development* aims to reveal the persistent effect of historical events on present socio-economic outcomes and the underlying transmission channels, mainly focusing on culture and formal institutions (Nunn, 2014).[25] Nunn (2008) finds that the number of slaves exported from a country in Africa negatively affects its current level of economic development. He argues that the slave trade reduced interpersonal trust, thereby impeding both the establishment of strong states and the emergence of ethnically homogenous large communities. Lowes et al. (2017) examine the impact of historical institutions on contemporary cultural norms. They take the example of the Kuba Kingdom, established in Central Africa in the 17th century with one of the most developed centralized statehoods of that time in the region. They conclude that those individuals whose ancestors lived in the Kuba Kingdom are more likely to be associated with weaker forms of rule-following and are more prone to cheating for material gain than those whose ancestors lived outside the Kingdom. The authors argue that this might be the legacy of more developed formal institutions that enabled Kuba citizens to place less importance on the intergenerational transmission of the right norms and values. Guiso et al. (2016) also emphasize the importance of cultural persistence in establishing a link between historical shocks and contemporary socio-economic outcomes. They find that Italian cities that achieved self-governance in the Middle Ages have a higher level of civic capital today. Gusio et al. (2016) argue that this might be the result of the conducive attitudes (such as self-efficacy beliefs) that emerged in independent Medieval cities being transmitted across generations. Becker et al. (2016) take the Habsburg rule as a positive historical shock in terms of public sector quality. They find that corruption in

[25] This literature has been exploding recently, with a massively growing number of papers. For a thorough review see Nunn (2014).

courts and police is significantly lower, while public trust in these institutions is significantly higher, in those regions of the successor state that were previously under Habsburg rule than in those that were not. The authors argue that this can be attributed to the long-run cultural effect of highly developed centralized institutions in the former Habsburg Empire. The long-run cultural legacy of empires is also corroborated in the case of Poland by Grosfeld and Zhuravskaya (2015).

The main hypothesis of this study builds on the following conclusions of the literature considered: 1. antiquity (i.e. the remote past) still shapes our present, 2. an extensive history of statehood tends to result in deeply entrenched interest groups, 3. powerful economic and political elites are prone to capture the financial sector, and 4. the effect of financial development on economic growth is conditional. The intuitive theoretical framework building on the seminal results of Dombi and Grigoriadis (2020) is presented in Figure 3.1. We start off with the hypothesis of Borcan et al. (2018), according to which interest groups are more deeply entrenched in societies with a long-established statehood. As a result, rent-seeking and extractive institutions are more prevalent. One important way of extracting rents is the access to easy credits provided under generous conditions. This permanent striving for corrupt lending leads companies to capture the financial sector through their political and private connections – provided that they have the power needed. Corruption in lending results in the inefficient allocation of society's savings and an impaired finance-growth relationship. Figure 1 depicts the sequence of our arguments.

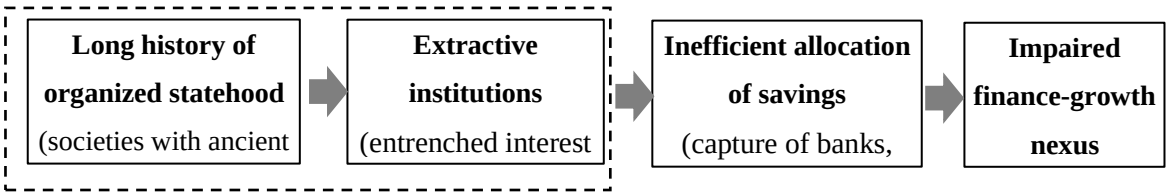

Figure 3.1. The theoretical framework

Note: The Borcan-Olsson-Putterman (2018) hypothesis

We follow a two-step strategy to provide evidence supporting our arguments. First, we develop a theoretical model on the interaction of banks and enterprises to show how antiquity may impair the finance-growth nexus by supporting soft-budget constraints in lending. In this model, there are two equilibrium regimes: younger

countries with an economic elite too weak to corrupt banks in their lending activity and older countries with an economic elite strong enough to capture the financial sector. In the second step, we examine empirically whether financial development, measured by the amount of credit, is less favorable in more ancient societies. The regression results are supportive, indicating that the finance-growth nexus is indeed impaired in countries with a long statehood.

Our paper builds on Dombi and Grigoriadis (2020) and extends their results in several respects. First, we follow a general approach by focusing on antiquity. Whilst Dombi and Grigoriadis (ibid.) use the state history index of the last two millennia constructed by Bockstette et al. (2002), we resort to the extended index of Borcan et al. (2018) also including the ancient ages before the Common Era. Moreover, as an alternative measure of antiquity, the number of agricultural years since the Neolithic Revolution is also considered in our analysis (see below). The second improvement is that our paper provides a profound theoretical foundation for the impaired financed-growth nexus in societies with ancient roots. Finally, our empirical results embrace the last half-century and the whole globe. With these improvements, our paper contributes to the thorough establishment of the legacy perspective – proposed by Dombi and Grigoriadis (2020) – in the nonlinear finance-growth literature.

Our paper also contributes to the other strands of the literature discussed previously. First, instead of focusing on the contemporary structural characteristics of the financial sector, we augment the literature on *corruption in lending* by revealing the deep historical root of the underlying phenomenon. Second, our paper also contributes to the *DRD* literature by elaborating the finance-growth channel in terms of the suboptimal work of capitalism under the conditions of antiquity.

The chapter is structured as follows: Section 3.2 presents the tales of two countries with ancient statehood and analyzes the capture of the financial sector by powerful elites. Section 3.3 discusses the theoretical model, while Section 3.4 introduces the measures of state antiquity. Section 3.5 presents the data and the empirical methodology and Section 3.6 the results, with Section 3.7 offering a general discussion of the results. Section 3.8 performs the sensitivity analyses and Section 3.9 concludes.

3.2 The tales of two countries

We start with the experiences of two ancient and, at the same time, developed countries, Italy and South Korea. The two countries have very different cultural and institutional backgrounds, but one point is common: their banking sectors have frequently suffered from the collusion of political and economic elites, both in times of massive state centralization and liberalized financial markets.

Italy

After the Italian Banking Act of 1936, the government gained considerable control over banks in Italy and strongly influenced credit allocation (Rota, 2013). During the Golden Age (1950-1970), the banking system heavily promoted domestic capital accumulation by providing preferential credits for state-owned enterprises, in close accordance with the industrialization strategy of the government. Although this policy was conducive for growth until the 1970s, the negative side effects of inefficient resource allocation started to proliferate in the ensuing two decades (Del Monte and Papagni, 2007). During the half-century of state centralization, the collusion between politicians and industrialists intensified significantly and political connections became an invaluable currency for access to bank credits.[26]

Even after the financial deregulation and nationwide investigation into political corruption in the 1990s, banks continued to be exposed to considerable political influence (Stefancic, 2017). Italy also has a higher ratio of politically connected firms

[26] There are several documented instances of elite collusion and corruption in lending. We cite three notable cases. The first case is the financial scandal involving Milan's Banco Ambeosiano which collapsed in 1982 after unsecured loans were endorsed by the Vatican. As early as 1978, the bank was being investigated by the Bank of Italy. However, the investigation countered heavy political opposition (Lewis, P.: "Italy's Mysterious, Deepening Bank Scandal". The New York Times, 28. July 1982). The second case is the spectacular and rapid rise of Silvio Berlusconi's financial empire, the Fininvest, owing to some extent to the advocacy of Bettino Craxi, socialist party leader and later prime minister (Semler, P.K.: "Italy's Corrupt Industrial Elite". The Journal of Commerce, 15. November 1993). The third case is the bumpy escape of Corriere della Sera, the foremost newspaper in Italy. The company fell into financial trouble in 1977, but was unable to obtain bank credit because of the editor's opposition to the ruling party. Finally, the newspaper managed to acquire financial support from P2 (Masonic Lodge) by serving its political interests. (Gumbel, A.: "Obituary: Franco Di Bella". Independent, 23. December 1997).

than most other countries (Faccio 2006). Infante and Piazza (2014) find that these firms enjoy loans with lower interest rates than the market average and the preferential treatment is stronger when firms and banks are linked with the same politician. Carretta et al. (2012) focus on politicians on the boards of directors of banks and come to the conclusion that their presence exerts a negative effect on loan quality. Even in banks where politicians have no position, the appointment of CEOs and members of the board of directors have frequently been constrained by political power (Rota, 2013). To sum up, there is ample evidence that there is great interference in the governance of Italian banks by political interests. Biased developmental banking has certainly contributed to the weak efficiency of Italian banks and, thereby, the significant share of non-performing loans (Stefancic, 2017).[27]

South Korea (Korea hereafter)

The financial sector in Korea also experienced massive state intervention, but suffered more from the collusive elite networks. A highly institutionalized system of kickbacks was first set up under the Park regime (1963-1979). The regime nationalized the banking sector and, as a major tool of industrial policy, exerted a tight control on credit allocation. This allowed the evolvement of a quasi-institutionalized system of bribery: senior party officials collected fixed payments from business conglomerates (chaebol) and provided access to bank credit (Hellmann, 2017). In 1974, there were 50 chaebols enjoying preferential access to both foreign and domestic loans thanks to governmental backing (Kyong-Dong, 1976). The corruption in lending continued to prevail under the Chun regime (1980-1988) (Schopf, 2011).[28] Surprisingly, the rise of

[27] In 2016, non-performing loans in Italian banks amounted to roughly 22 percent of GDP. Recent examples of easy lending are the preferential credits to two highly indebted companies, Stefanel (the third largest clothing manufacturer in Italy) and the Feltrinelli publishing group (the Italian publishing giant) (Stefancic, 2017). These companies were facing severe financial problems, even bankruptcy, when applying for bank credit. Although there is no direct evidence of political inference, lending to such financially stressed companies under extraordinarily favorable conditions seems to be indicative in our respect.

[28] Schopf (2011) reveals that Chun Doo-hwan's regime allocated private property and loans at no cost to firms which paid the largest bribe and were connected with members of his ruling elite, allowing him to amass at least 1.24 billion USD from the corporate sector illegally.

democracy in the late 1980s did not dismantle the collusive elite network (Wad, 2002)[29]. Indeed, Park (2008) finds that the number of collusive networks multiplied after the introduction of free elections, and chaebols continued providing financial support to politicians and probable political candidates.[30]

Owing to elite collusion, the chaebols' economic and political power grew continuously and the financial sector became even more captured after democratization, leading to increasingly clientelistic and biased financial policies (Lukauskas, 2002; Kalinowski and Cho, 2009). The chaebols' leverage in the financial sector evolved as follows. In the 1970s, the control over credit policy was already practiced by the chaebols and the government in a mixed way (Choi, 1993; Woo, 1991). In the late 1980s, the deregulation of interest rates became bogged down due to the opposition of chaebols who feared the growing interest burden and loss of their preferential access to credit (Choi, 1993). In the 1990s, however, much progress was achieved in financial deregulation because the chaebols faced fewer constraints to ownership of non-bank financial institutions and thus freer access to credit (Lee, 2005). In the 2000s, the government aimed to weaken the chaebols' power by admitting foreign investors to the financial sector. However, the endeavor failed due to the sluggish stabilization and restructuring of the financial industry (Kalinowski and Hyekyung, 2009). In recent years, the scandal of Samsung, the largest conglomerate in Korea, has revealed that the collusive elite network still might play a crucial role in the financial sector.[31]

The experiences of these two countries illustrate the point that financial development in societies with ancient statehood may suffer from state intervention and collusive intra-elite relationships. As a counter-example, we may consider briefly the case of Canada, a relatively young state. In Canada, the banking sector faces only minor state and political interventions and is more or less politically independent

[29] The government retained control over privatized banks, resulting in a higher ratio of bad loans than in the case of originally privately-owned banks without any state-ownership in the past (An et.al, 2007).

[30] One of the most salient scandals concerns the Hanbo Steel corporation, which went bankrupt in 1997 after accumulating a large number of preferential credits by bribing ruling party officials (Nakarmi, L.: "The fall of Hanbo Steel". Asiaweek CNN, 7. February 1997). The scandal touched the inner-circle of the president too. ("Officials close to Kim charged in South Korea loan scandal" CNN, 11. February 1997)

[31] "Samsung scandal: Who is Lee Jae-yong?" (www.bbc.com, 5. February 2018)

(Breydo, 2015). Although the banking market is highly concentrated, there are no symptoms of elite collusion in terms of lending (Calomiris and Haber, 2014; Breydo, 2015) and firms face no significant obstacles in access to credit (Beck et.al, 2004; Hendry and King, 2004). Competition among banks is intensive (Shaffer, 1993; Allen and Engert, 2007), which can be effective in curbing corruption in lending (Barth et.al, 2007). Indeed, based on the investigation of Beck et.al (2006), the level of banking corruption in Canada is one of the lowest worldwide. The possible reasons for the contrast between Korea and Italy, on the one hand, and Canada, on the other hand, may be manifold. We conjecture that antiquity and its social legacy might play a crucial role in this respect.

3.3 Measures of antiquity

In this paper, the antiquity of societies is defined as the length of established statehood beyond the tribal level in the present-day territory of countries. Mature statehood is a necessary – and most of the time also a sufficient – condition for the settlement of socio-political frameworks and hierarchical power structures. We resort to two commonly used measures of established statehood: the state history index, first introduced by Bockstette et al. (2002) and extended by Borcan et al. (2018), and the agricultural years since the Neolithic revolution collected by Putterman and Trainor (2018).

Our baseline measure of antiquity is the extended state history index of Borcan et al. (2018), which embraces the last six millennia (3500 BCE - 2000 AD).[32] This state history index measures the cumulative experience of societies with established statehood in the underlying period. It is computed on the basis of the state history scores of the constitutive half-centuries. The state history score (s) is a composite measure of the type and territorial extent of statehood in the given 50-year period. Three dimensions are considered: 1. the level of governance (z^1), 2. the independence of government (z^2), and 3. territorial coverage (z^3). To each *half-century-country* unit and dimension, a value between 0 and 1 is assigned based on historical records and archeological data. Thereafter, the state history scores are calculated as follows: $s_{it} = z_{it}^1 \cdot z_{it}^2 \cdot z_{it}^3 \cdot 50$, where i and t represent the country and the given half-century,

[32] Originally, Bockstette et al. (2002) constructed the state history index only for the last two millennia.

respectively.[33] Based on these scores, the cumulative, normalized index is calculated as follows:

(1) $$SH_i = \frac{\sum_{t=0}^{\tau}(1+\delta)^{t-\tau} \cdot s_{it}}{\sum_{t=0}^{\tau}(1+\delta)^{t-\tau} \cdot 50}$$, where $t = 0$ is the half-century of 3500-3451 BCE.

The last half-century (τ) can be set according to the focus of the analysis. In the baseline case (SH1950), we equate it to 108, which corresponds to the period from 1901 to 1950 CE. We omit the second half of the 20th century in order to avoid any endogeneity concern related to the state history index in our estimations. Another crucial point is the δ depreciation rate in equation (1). It is reasonable to assume that whatever the impacts of established statehood on culture, norms, and social structures are, they must partly fade away with time. The rate of this depreciation is a matter of arbitrary choice. However, if the cumulated state history index is to proxy for antiquity, a low level of δ is needed. Otherwise, the difference between societies with ancient roots (e.g., Egypt) and relatively younger societies (e.g., France) decreases noticeably owing to the overwhelming dominance of the more recent centuries in the calculation. Figure 2 demonstrates this by contrasting the SH1950 indexes based on two alternative depreciation rates, 1 percent, and 5 percent.

The rationale for antiquity having an effect on present socio-economic outcomes is that societies with ancient roots are characterized by norms and values different from those of relatively younger societies. Hariri (2012) demonstrates that countries with a longer state history tend to be more centralized and autocratic and pursue more collectivist values. Lagerlöf (2016) also proposes that countries with an early statehood might be more autocratic. Olsson and Paik (2016) find that more ancient societies, with an earlier date of the Neolithic Revolution, tend to be more collectivist today.

It is generally believed that values and norms relate more to people and less to the geographic area they inhabit. However, the institutions of a country can considerably influence the culture of its inhabitants. Indeed, the mutual impact of

[33] The state history score is maximized at 50, which occurs when the greater part of the current territory of the country was ruled by a domestic government in the given 50 years.

institutions and culture on each other is well-known (Alesina and Giuliano, 2015). Consequently, it is uncertain whether the experience of the geographic area or the experience of its inhabitants – and their ancestors – counts more when it comes to the contemporary effect of antiquity. This issue is crucial since massive population flows occurred in the post-Columbian era leading to mixed societies, in terms of ancestral history and culture, in several countries.

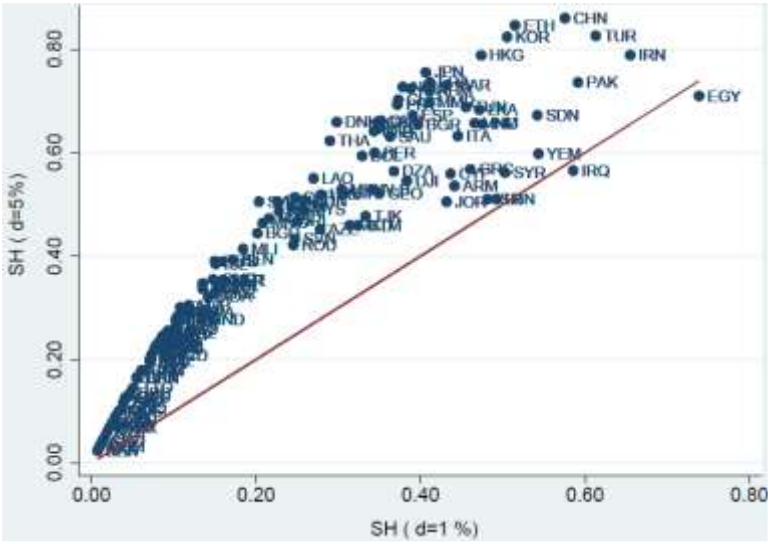

Figure 3.2. Evaporating antiquity: The effect of the applied depreciation rate

Source: Own graph. For the data source, see Table C.2.
Notes: SH=SH1950 in the figure.

Our baseline measure of antiquity considers the experience of the geographic area with established statehood. However, as an alternative measure, we also use the ancestry-adjusted state history index to see how the results change when the respective experience of the inhabitants is in focus. We compute the ancestry-adjusted state history index as the (normalized) sum of the weighted average of the pre-Columbian (i.e. 3500 BCE-1500 CE) state histories and the unadjusted post-Columbian (i.e. 1501-1950 CE) state history of the particular country:

$$SH1950adj_i = \frac{\sum_{t=100}^{108}(1+\delta)^{t-108}\cdot s_{it} + \sum_j w_{ij}\left(\sum_{t=0}^{99}(1+\delta)^{t-108}\cdot s_{it}\right)}{\sum_{t=0}^{108}(1+\delta)^{t-108}\cdot 50}, \quad (2)$$

where w_{ij} is the share of country j in country i's year-1500AD ancestors as retrieved from the World Migration Matrix of Putterman and Weil (2010). As can be observed in Figure 3, the adjustment for the ancestral composition of the population considerably increases the state history index in those, mainly New World, countries which experienced massive post-Columbian population flows.

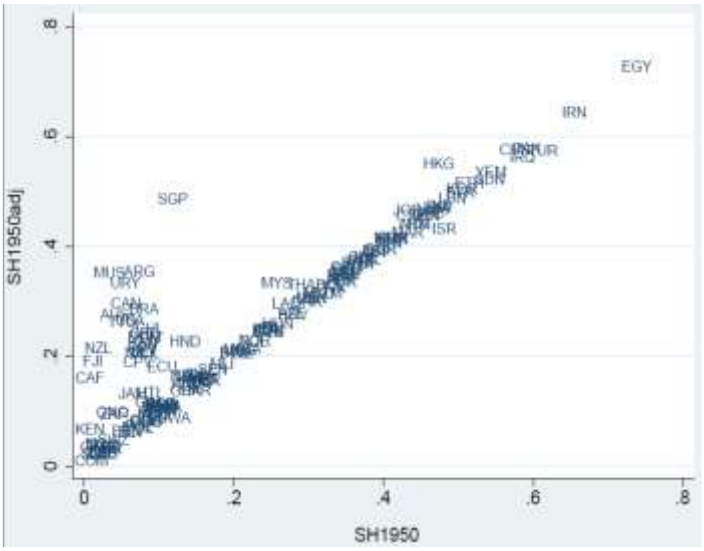

Figure 3.3. Ancestry: unadjusted vs adjusted state history

Source: Own figure. For the data source, see Table C.2.

Another crucial point is whether pre-Columbian state history is preferable over total state history (i.e. including the post-Columbian ages). On the one hand, it is true that the long-lasting effect of early development on contemporary socio-economic outcomes has solid foundations. On the other hand, it is hard to argue against the importance of post-Columbian experience concerning contemporary economic development. In any case, we use the pre-Columbian state history, both unadjusted (SH1500) and adjusted (SH1500adj) for ancestry, as an alternative measure of antiquity.[34]

As a final alternative measure of antiquity, we consider the years elapsed since

[34] SH1500 is calculated according to equation (1) with $\tau = 99$ representing the half-century of 1450-1500AD. SH1500adj is calculated as follows: $SH1500adj_i = \left(\sum_j w_{ij}\left(\sum_{t=0}^{99}(1+\delta)^{t-99}\cdot s_{it}\right)\right)\Big/\left(\sum_{t=0}^{99}(1+\delta)^{t-99}\cdot 50\right)$.

the Neolithic Revolution (AgrY) as compiled by Putterman and Trainor (2018) and used, inter alia, in Putterman and Weil (2010). This indicator appraises the number of years before 2000AD that have passed since a considerable share of the population in any area within the present border of countries started to meet their food needs largely from cultivation. The timing of agricultural transition is a common measure of early development in the DRD literature (e.g., Olsson and Hibbs, 2005). It is deemed as an approximation for the antiquity of societies due to the fact that the sedentary mode of agricultural production necessitated a much more well-organized society than hunting and gathering. Indeed, the first states were established in the Fertile Crescent, along with the spread of irrigation-based farming (Diamond, 1997). Figure 4 corroborates the strong co-movement of state history with agricultural years.

Finally, we briefly discuss the cross-country relationship between state history and financial and economic development. Figure 5 is a scatterplot of state history and average domestic credit in the first decade of the 2000s. In accordance with Ang (2013), we find a moderately positive relationship between antiquity and financial development. In Figure 6, the seminal result of Borcan et al. (2018) on the inverted U-shaped relationship between antiquity and contemporary economic development is reflected.

Figure 3.4. State history vs. Agricultural years

Source: Own figure. For the data source, see Table C.2.

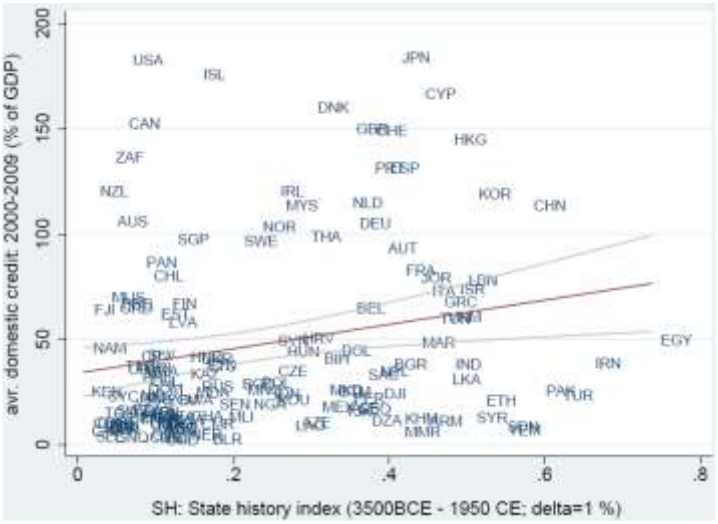

Figure 3.5. Financial development and antiquity

Source: Own figure. For the data source, see Table C.2.

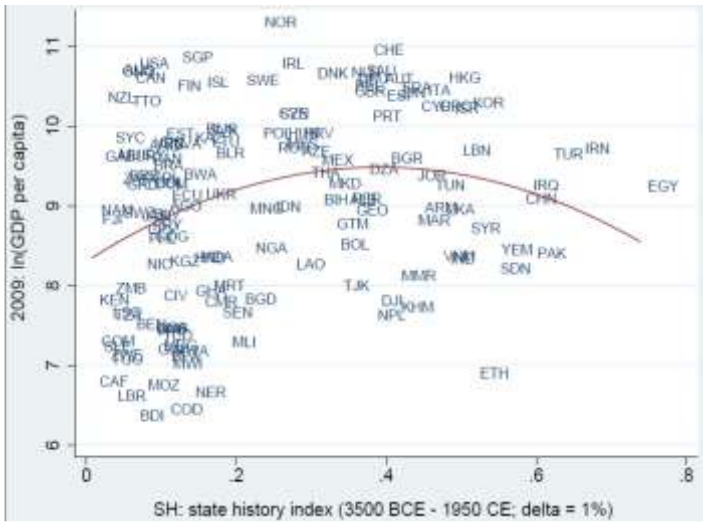

Figure 3.6. Economic development and antiquity

Source: Own figure. For the data source, see Table C.2.

3.4 A model of antiquity and finance

The emergence of powerful interest groups that capture the financial system and generate the provision of soft budget constraints in their favor provides an explanatory

mechanism for the negative effect of antiquity on the finance-growth nexus. In our proposed model, we complement Borcan et al. (2018) by establishing the financial development channel in order to elaborate on the inverted U-shaped relationship between state history and economic growth. High levels of state history correspond to economic systems with a long exposure to organized statehood and a culture of centralization. In contrast, low levels of state history reflect a more decentralized set of financial institutions and a recent exposure to organized statehood.

To analyze the effect of antiquity on the finance-growth nexus and show in particular why very ancient societies exhibit soft budget constraints, which in return impair their growth, we consider a static game between a bank *B* and an entrepreneur *E* as per Dewatripont and Maskin (1995). State history is denoted by a stochastic variable α^S such that $\alpha^S \in \left\{\alpha^L = 1, \alpha^H = \alpha\right\}$ and $\alpha > 1,$ where α^H corresponds to a high level of state history and α^L to a low level of state history. In the case of the soft budget constraint, the bank's utility function is $u^B_{SBC} = r_2 - d^j,$ where r_2 denotes the bank's return from refinancing the provided credit, d^j is the size of the provided credit such that $r_2 < d^j \leq r_1$ and $d^j = \frac{\alpha^S}{1-\lambda^j};$ $\lambda^j \in (0,1)$ denotes the bank's monitoring of the credit provided to the entrepreneur. The higher the degree of monitoring imposed by the bank, the higher the overall amount of credit provided. Similarly, in the case of the soft budget constraint, the entrepreneur's payoff is provided by $u^E_{SBC} = v_2 + d^j,$ where v_2 is exogenous and denotes profit. When defining the status-quo and hard budget constraint payoffs for the bank and the entrepreneur, we assume that there is an opportunity cost for the bank if it decides not to provide credit to the entrepreneur. Furthermore, $i \geq 0$ is the bank's initial endowment and θ indicates the opportunity cost of the credit provision s.t. $\theta \in (0,1)$.

Hence, the static antiquity-capitalism game is defined as follows:

1. Players: a bank *B* and an entrepreneur *E* such that $N = \{B, E\}$.
2. States: $\alpha^i_t \in \{\alpha^L_t = 1, \alpha^H_t = \alpha\},$ where $\alpha > 1.$

3. Strategies: $\Phi^S = \{\lambda^H, \lambda^L\}$ is the strategy set of the bank, where *H* refers to a high level of credit monitoring and *L* refers to a low level of credit monitoring such that $\lambda^L < \lambda^H \in (0,1)$.
4. Payoffs for the bank and the entrepreneur:

   The status-quo: $u^B_{SQ} = i - \theta d^L$ and $u^E_{SQ} = v_1$
   Good entreprenur: $u^B_G = r_1 - d^L$ and $u^E_G = v_1 + d^L$
   Soft budget constraint: $u^B_{SBC} = r_2 - d^H$ and $u^E_{SBC} = v_2 + d^H$
   Hard budget constraint: $u^B_{HBC} = -\theta\alpha^2$ and $u^E_{HBC} = 0$

where $v_1 > v_2$. Under conditions of long state history (high state), a bad project entails a high monitoring cost on the part of the bank, both in the case of a soft and a hard budget constraint. State history measures antiquity of institutions and implies that an entrepreneur in the high state is more likely to capture the financial system and receive a soft budget constraint from the bank.

The timing of the antiquity-capitalism game, therefore, has the following structure as per Acemoglu and Robinson (2006):

1. $\alpha^i_t \in \{\alpha^L_t, \alpha^H_t\}$ is revealed.
2. The bank decides whether to provide credit to the entrepreneur with monitoring λ^L or revert to the status quo: $\zeta \in \{0,1\}$.
3. The entrepreneur completes the project directly with probability μ or requests refinancing with a probability $1-\mu$ such that $\mu \in (0,1) : \xi \in \{0,1\}$.[35] If she completes the project, then the stage game is over.
4. If the entrepreneur requests refinancing, then the bank decides whether to refinance the project (soft budget constraint) with probability η or to terminate (hard budget constraint) with probability $1-\eta$ such that $\eta \in (0,1) : \chi \in \{0,1\}$.[36] In either case, the stage game is over.

[35] $P(\xi = 1) = \mu$ and $P(\xi = 0) = 1 - \mu$.

[36] $P(\chi = 1) = \eta$ and $P(\chi = 0) = 1 - \eta$.

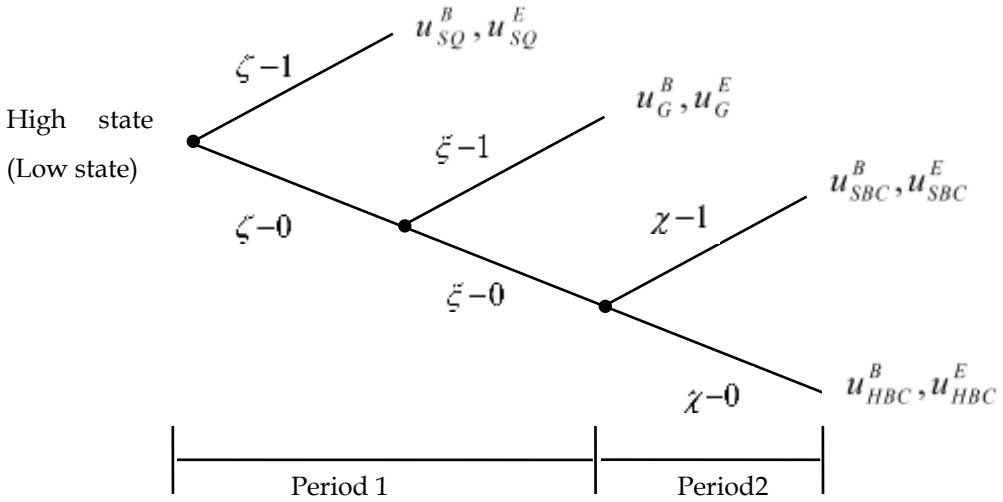

Figure 3.7. The model tree

Definition 1

The entrepreneur receives credit from the bank under conditions of long state history if $\mu > \theta,$ and $r_1 > i.$

Proof

The bank is indifferent between providing credit to the entrepreneur and remaining in the status quo under the following condition:

$$u^B_{SQ} = \mu u^B_G + (1-\mu)\left[\eta u^B_{SBC} + (1-\eta)u^B_{HBC}\right] \Rightarrow i - \theta d^L = \mu(r_1 - d^L) + (1-\mu)\left[\eta(r_2 - d^H) - (1-\eta)\theta\alpha^2\right] \Rightarrow$$
$$i = \mu(r_1 - d^L) + \theta d^L + (1-\mu)\left[\eta r_2 - \eta d^H - (1-\eta)\theta\alpha^2\right] \Rightarrow$$
$$i = \mu r_1 - d^L(\mu - \theta) + (1-\mu)\left[\eta r_2 - \eta d^H - (1-\eta)\theta\alpha^2\right] \Rightarrow$$
$$i = \mu r_1 - \frac{\alpha}{1-\lambda^L}(\mu - \theta) + (1-\mu)\left[\eta r_2 - \eta\frac{\alpha}{1-\lambda^H} - (1-\eta)\theta\alpha^2\right]$$

Hence, the bank will prefer to provide credit to the entrepreneur if and only if:

$$i < \mu r_1 - \frac{\alpha}{1-\lambda^L}(\mu - \theta) + (1-\mu)\left[\eta r_2 - \eta\frac{\alpha}{1-\lambda^H} - (1-\eta)\theta\alpha^2\right].$$

Now, we turn to the state history threshold and identify the antiquity condition under which the bank is captured by the entrepreneur and therefore provides a soft budget constraint. It is the case that the bank provides a soft budget constraint rather than a hard budget constraint to the entrepreneur under conditions of long state history if and only if:

$$u_{SBC}^{B} > u_{HBC}^{B} \Rightarrow r_2 - d^H > -\theta\alpha^2 \Rightarrow \theta\alpha^2 - \frac{\alpha}{1-\lambda^H} + r_2 > 0 \Rightarrow$$

$$\alpha_1 < \frac{\frac{1}{1-\lambda^H} - \sqrt{\left(\frac{1}{1-\lambda^H}\right)^2 - 4r_2\theta}}{2\theta}, \text{ or } \alpha_2 > \frac{\frac{1}{1-\lambda^H} + \sqrt{\left(\frac{1}{1-\lambda^H}\right)^2 - 4r_2\theta}}{2\theta}$$

Since $\frac{\frac{1}{1-\lambda^H} - \sqrt{\left(\frac{1}{1-\lambda^H}\right)^2 - 4r_2\theta}}{2\theta} < 1$ and $\alpha^L = 1$ is the lowest value of state antiquity, the solution that makes $u_{SBC}^{B} > u_{HBC}^{B}$ should be α_2. Hence, the threshold of state history that makes the bank indifferent between the provision of a soft and a hard budget constraint is the following:

$$\alpha^* = \frac{\frac{1}{1-\lambda^H} + \sqrt{\left(\frac{1}{1-\lambda^H}\right)^2 - 4r_2\theta}}{2\theta}.$$

Thus, α^* increases with λ^H and decreases with θ.

Proposition 1

There is a unique subgame perfect equilibrium of the *antiquity-capitalism* game that has the following form:

If $\eta < \frac{v_1 + d^L}{v_2 + d^H}$, then the entrepreneur submits a good project to the bank.

If $\eta \geq \frac{v_1 + d^L}{v_2 + d^H}$, then the entrepreneur submits a bad project to the bank and the following equilibria come into play:

If $\alpha \leq \alpha^*$, then in either state the bank terminates an insolvent entrepreneur (hard

budget constraint).

If $\alpha > \alpha^*$, then the bank refinances an insolvent entrepreneur under conditions of high credit monitoring λ^H (soft budget constraint), while in the low state the bank terminates an insolvent entrepreneur (hard budget constraint).

In our model, we observe that for higher levels of state history, the financial system is more inclined toward the provision of soft budget constraints to inefficient entrepreneurs, and therefore it reinforces the emergence of entrenched interest groups that perpetuate its capture. In contrast, for lower levels of state history, the financial system is less inclined toward refinancing. Hardening the budget constraint of inefficient entrepreneurs allows the entry of new market players that may be more efficient and less dependent on credit. In the low state, the bank does not provide a soft budget constraint to the entrepreneur, but always terminates an inefficient entrepreneur by hardening her soft budget constraint with a low opportunity cost of lending. We suggest that antiquity in the form of state history may pose institutional barriers to financial development and entrepreneurship.

Our model treats the opportunity cost of lending as an exogenous parameter. However, θ may in reality increase with state history. As we propose, in more ancient societies, interest groups are more powerful and capable of capturing the government and the financial sector. Under such conditions, the rejection of lending – either at the initial or at the refinancing stage – can cause larger costs for banks due to the larger scale of counteractions by the government and business elite in the form of economic punishment. In our model, the threshold for soft budget constraint (α*) decreases with θ and the probability of exceeding that threshold increases. This implies that the probability of a soft budget constraint is higher in societies with a longer state history and the finance-growth nexus might, therefore, be impaired.

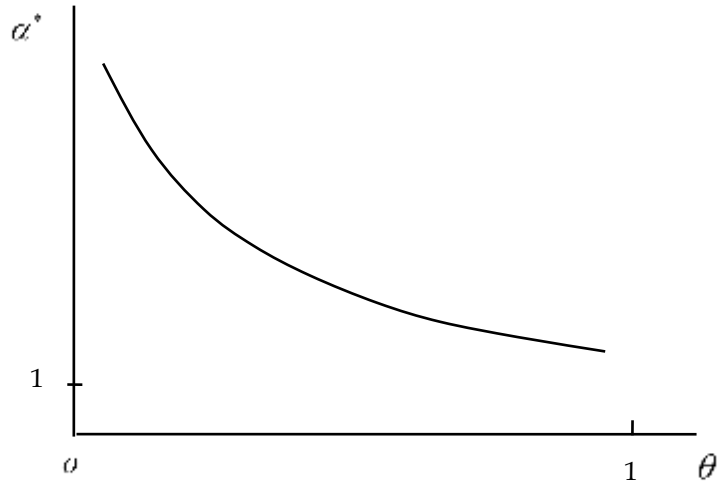

Figure 3.8. Comparative statics $\alpha^*(\theta)$

3.5 Data and methodology

Our panel data covers the period from 1970 to 2014. We work with 5-year panels in order to average-out business cycles, and are thus left with nine periods (1970-74, 1975-79, etc.). As a rule, the only countries included in the sample are those possessing the required minimum number of time periods with complete observations in terms of the model variables. In the baseline case, this number is set at four, thus leaving us with a sample of 95 countries. The list of these countries is presented in Table C.1 in Appendix C. When this condition is relaxed by reducing the minimum number of time periods with complete observations to 3, the number of included countries jumps to 118.

Most of the variables are averaged over the 5-year intervals. As a rule, a minimum of three available observations is required within a 5-year period in order to calculate the period-average instead of reporting a missing value. The panel is unbalanced. Table C.2 introduces the data and their sources. Table C.3 and C.4 present the descriptive statistics and the correlation matrix, respectively. Based on our previous arguments in Figure 3.1, we pose the following hypotheses:

H1: Antiquity transforms the finance-growth nexus.

H2: The increase in outstanding credit impacts economic growth negatively in states with an ancient tradition of statehood.

To test these hypotheses, we specify the following dynamic model:

(3)

$$\ln y_{i,t} = \beta \ln y_{i,t-1} + \alpha_1 I(AQ_i \le \gamma) \ln FD_{i,t} + \alpha_2 I(AQ_i > \gamma) \ln FD_{i,t} + \phi^T (\mathbf{Controls_{i,t}}) + \mu_i + p_t + \varepsilon_{i,t},$$

where $\ln y$ is log GDP per capita, *AQ* is the measure of antiquity, *FD* is the measure of financial development, Controls represents the control variables, μ is the country-fixed effect, p is the time-fixed effect, i and t are country- and time-indexes, respectively, and $\varepsilon \sim N(0, \sigma^2)$. In the baseline model, antiquity is measured by the extended state history index of Borcan et al. (2018) calculated according to a 1-percent depreciation rate and terminated in 1950 (SH1950).

We use two size-based measures of financial development: domestic credit and private credit by banks. The control variables include classic growth determinants such as human capital, physical capital investments, inflation, government consumption, social conflicts, and level of democracy. These variables are meant to control for the production capacities of the economy, soundness of the economic policy, provision of public goods, social stability, and institutional quality. The initial GDP per capita of the underlying period is included in the explanatory variables to control for conditional convergence.

In equation (3), the *I(.)* indicator function takes the value 1 if the condition in the parenthesis is met, and 0 otherwise. We postulate two regimes in terms of antiquity, a bottom regime where the *AQ* is below the γ threshold level, and an upper regime where *AQ* exceeds γ. We are primarily interested in the alpha and gamma parameters. A difference in the sign and/or the significance of α_1 and α_2 would be proof of our *Hypothesis 1* that antiquity matters for the growth impact of financial development. Moreover, if $\alpha_1 > \alpha_2$ were to hold, *Hypothesis 2*, arguing that antiquity is bad for the finance-growth nexus, would also be corroborated.

We estimate equation (1) using the method of dynamic panel threshold regressions (DPTR). DPTR originates in panel threshold regressions (PTR) introduced by Hansen (1999, 2000). The concept of PTR is to estimate threshold models – like equation (3) – by picking the γ threshold which optimizes the underlying objective function. PTR was, however, originally developed for static models with exogenous explanatory variables. Caner and Hansen (2004) develop an instrumental variable approach to threshold models, but they assume cross-sectional data. Kremer at al.

(2013) are the first to consider dynamic panel threshold models with endogenous explanatory variables. They adapt the method of Caner and Hansen (ibid.) on dynamic panel models and use forward orthogonal deviation to remove unobserved unit fixed effects. However, their procedure is of an applied nature lacking any theoretical proof. The theoretical foundations of endogenous dynamic panel threshold regressions are laid down by Seo and Shin (2016).

Seo and Shin (ibid.) propose the estimation of equation (3) by GMM on first-differenced data. However, first-differencing has two major drawbacks. First, it artificially induces first-order residual autocorrelation. Second, it aggravates the missing data problem in unbalanced panels due to its inability to perform data transformation in the immediate neighborhood of missing observations. To avoid these pitfalls of data transformation, we apply forward orthogonal deviation (henceforth FOD) as suggested in Kremer et al. (ibid.).[37] In other respects, however, we closely follow the suggestions of Seo and Shin (ibid.): first, we locate the optimal value of the threshold variable by minimizing the 2-step GMM objective function for equation (3), and thereafter, in the second step, we rerun the 2-step GMM on equation (3), already substituting the estimated threshold for γ. Concerning the above, our approach is a hybrid of that of Kremer et al. (2013) and that of Seo and Shin (2016).

In each step of the estimation, we use the same GMM settings. Our internal instruments are the first- and second-order lags of endogenous explanatory variables in their original, i.e. not FOD-transformed, form. With the exception of the social conflict measure (Violence) which is considered to be strictly exogenous, all right-hand side variables are deemed to be endogenous after FOD-transformation. Beyond internal instruments, we also include external instruments such as legal origin, continent dummies, and latitude (see Table C.2). Legal origin is a commonly accepted highly relevant instrument for financial development (Levine, 1999; La Porta et al., 2008), while geographic variables are intended to control for the unobserved unit

[37] Forward orthogonal deviation, originally proposed by Arellano and Bover (1995), performs the following data transformation: $x_{it}^{*} = \sqrt{\frac{T-t}{T-t+1}}\left[x_{it} - \frac{1}{T-t}\left(x_{i(t+1)} + \ldots + x_{iT}\right) \right]$, where T is the number of time units in the panel.

specific variation in the explanatory variables.[38] Concerning the weighting matrix, we assume clustered errors in our baseline estimations.

3.6 Results

The results of the two baseline models (models 1A & 1B), differing from each other only in terms of the financial development indicator, are presented in Tables 3.1A and 3.1B. As can be observed, the two models lead to similar conclusions. The control variables are mostly significant and have the expected sign. According to the overidentification test (J-test), the instruments are valid at standard levels in model 1A and at the 5-percent level in model 1B. In both models, the sign of the financial development coefficient differs across the two regimes: it is positive and significant at the 5-percent level in the bottom regime, while it is negative and significant at the 1-percent level in the upper regime. According to the respective Wald test, this difference between the effect of financial development on growth in the two regimes seems to be significant.

These results corroborate our hypotheses. First, the Wald test rejects the H0 of there being the same effect of financial development on growth in old and young societies. Second, the sign and the significance of the financial development coefficient in the two regimes support our second hypothesis that the increase in outstanding credit is detrimental to growth in societies with ancient roots, while it is conducive to growth in younger ones.

In order to fix any concern on the sensitivity of our results to the underlying antiquity measure, we also run the estimation of equation (3) for the other antiquity measures discussed in Section 3. In models 2# to 4#, we use the state history index of the last 6 millennia calculated according to different depreciation rates. Although the dispersion of the index is very much impacted by the applied depreciation rate, the estimation results are fairly stable. The underlying reason is that although a higher depreciation rate squeezes the index values to some extent, it leaves the relative ranking of countries – the important aspect of the distribution from the viewpoint of

[38] Note, that it would be impossible to include these external IVs in the control variables because FOD-transformation eliminates observed fixed effects too.

Table 3.1A. Results on private credit

Models	1A	2A	3A	4A	5A	6A	7A	8A	9A
Treshold variable	SH1950	SH1950	SH1950	SH1950	SH1950adj	SH1500	SH1500adj	AgrY	AgrYadj
depr. rate of SH	1 %	0 %	2 %	5 %	1 %	1%	1%	Ø	Ø
lag(lny)	0.8786	0.8786	0.8786	0.8269	0.8598	0.8786	0.8437	0.8935	0.835
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(GFCF)	-0.0049	-0.0049	-0.0049	-0.0133	0.0047	-0.0049	-0.0054	-0.0481	-0.0264
	(0.912)	(0.912)	(0.912)	(0.771)	(0.91)	(0.912)	(0.921)	(0.354)	(0.614)
lag(ln(HC))	0.3563	0.3563	0.3563	0.3327	0.3833	0.3563	0.1804	0.3676	0.2137
	(0.016)	(0.016)	(0.016)	(0.016)	(0.01)	(0.016)	(0.107)	(0.02)	(0.076)
ln(INFL)	-0.0669	-0.0669	-0.0669	-0.078	-0.0725	-0.0669	-0.0815	-0.0522	-0.0772
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.01)	(0.000)
ln(GovCons)	0.035	0.035	0.035	0.0548	0.0225	0.035	-0.021	0.0057	-0.033
	(0.408)	(0.408)	(0.408)	(0.229)	(0.578)	(0.408)	(0.601)	(0.901)	(0.434)
Violence	-0.003	-0.003	-0.003	-0.0028	-0.0035	-0.003	-0.0037	-0.0021	-0.0036
	(0.001)	(0.001)	(0.001)	(0.007)	(0.000)	(0.001)	(0.000)	(0.069)	(0.000)
Polity2	0.0059	0.0059	0.0059	0.0073	0.0045	0.0059	0.004	0.006	0.0047
	(0.007)	(0.007)	(0.007)	(0.001)	(0.033)	(0.007)	(0.116)	(0.006)	(0.054)
ln(PCB_bottom)	0.0826	0.0826	0.0826	0.0757	0.0695	0.0826	0.1461	0.085	0.1161
	(0.018)	(0.018)	(0.018)	(0.03)	(0.046)	(0.018)	(0.014)	(0.029)	(0.021)
ln(PCB_upper)	-0.1008	-0.1008	-0.1008	-0.0959	-0.1237	-0.1008	-0.0804	-0.0865	-0.0653
	(0.002)	(0.002)	(0.002)	(0.001)	(0.000)	(0.002)	(0.008)	(0.009)	(0.04)
Wald test (pv)	0.157	0.153	0.073	0.020					
γ	0.216	0.147	0.289	0.510	0.276	0.144	0.037	4000	3549
SH quartile	Q3	Q3	Q3	Q3	Q3	Q3	Q1	Q3	Q2
N	536	536	536	536	536	536	536	536	536
no. of countries	93	93	93	93	93	93	93	93	93
J-test (pv)	0.291	0.291	0.291	0.172	0.201	0.291	0.112	0.128	0.070
no. of IVs	32	32	32	32	32	32	32	32	32

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Table 3.1B. Results on domestic credit

Models	1B	2B	3B	4B	5B	6B	7B	8B	9B
Treshold variable	SH1950	SH1950	SH1950	SH1950	SH1950adj	SH1500	SH1500adj	AgrY	AgrYadj
depr. rate of SH	1 %	0 %	2 %	5 %	1 %	1%	1%	Ø	Ø
lag(lny)	0.8681	0.8681	0.8681	0.8475	0.8612	0.8681	0.8265	0.8649	0.8175
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(GFCF)	0.0083	0.0083	0.0083	0.0188	0.0242	0.0083	0.0021	-0.0366	-0.0053
	(0.862)	(0.862)	(0.862)	(0.688)	(0.603)	(0.862)	(0.967)	(0.491)	(0.919)
lag(ln(HC))	0.3326	0.3326	0.3326	0.2724	0.3275	0.3326	0.1896	0.3475	0.1998
	(0.018)	(0.018)	(0.018)	(0.036)	(0.021)	(0.018)	(0.1)	(0.018)	(0.104)
ln(INFL)	-0.0886	-0.0886	-0.0886	-0.0976	-0.0718	-0.0886	-0.073	-0.0759	-0.0715
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(GovCons)	0.0552	0.0552	0.0552	0.0657	0.0407	0.0552	-0.0208	0.0225	-0.0273
	(0.203)	(0.203)	(0.203)	(0.159)	(0.303)	(0.203)	(0.622)	(0.634)	(0.529)
Violence	-0.0029	-0.0029	-0.0029	-0.003	-0.0034	-0.0029	-0.0034	-0.0022	-0.0033
	(0.003)	(0.003)	(0.003)	(0.004)	(0.000)	(0.003)	(0.001)	(0.066)	(0.003)
Polity2	0.0059	0.0059	0.0059	0.007	0.0049	0.0059	0.0048	0.0059	0.0056
	(0.003)	(0.003)	(0.003)	(0.000)	(0.008)	(0.003)	(0.035)	(0.003)	(0.009)
ln(DC_bottom)	0.0709	0.0709	0.0709	0.0532	0.0534	0.0709	0.168	0.0696	0.1193
	(0.014)	(0.014)	(0.014)	(0.051)	(0.067)	(0.014)	(0.005)	(0.026)	(0.024)
ln(DC_upper)	-0.0864	-0.0864	-0.0864	-0.1012	-0.1092	-0.0864	-0.0398	-0.0663	-0.0258
	(0.01)	(0.01)	(0.01)	(0.001)	(0.000)	(0.01)	(0.165)	(0.042)	(0.389)
Wald test (pv)	0.097	0.200	0.097	0.017	0.035	0.130	0.275	0.105	0.165
γ	0.216	0.147	0.289	0.5101	0.276	0.144	0.037	4000	3549
SH quartile	Q3	Q3	Q3	Q3	Q3	Q3	Q1	Q3	Q2
N	544	544	544	544	544	544	544	544	544
no. of countries	95	95	95	95	95	95	95	95	95
J-test (pv)	0.076	0.076	0.076	0.052	0.067	0.076	0.021	0.024	0.015
no. of IVs	32	32	32	32	32	32	32	32	32

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

DPTR – mostly untouched (see Figure 3.2). Note, however, that the estimated thresholds differ considerably from each other even if they represent similar quantile of the distribution of state history. This is the result of the complete rescaling of accumulated state history triggered by the change in the depreciation rate.

In model 5#, we use the ancestry-adjusted state history index calculated according to equation (2) as the threshold variable. With this threshold variable, we account for the post-Columbian population flows and relate antiquity more to the people than to the geographic area. As already discussed, this adjustment changes the relative position of several New World countries in the distribution of state history (see Figure 3.3). Despite this, the results are remarkably similar to the baseline case.[39]

In models 6# and 7#, the threshold variable is the pre-Columbian state history either in original or in ancestry-adjusted form. The results are in line with the baseline ones owing to the fact that the order of pre-Columbian state histories coincides largely with that of overall state histories. To put it differently, the experience with established statehood in the post-Columbian era does not add much to the ranking of countries in terms of state history.

Finally, in models 8# and 9#, agricultural years are used as the threshold variable either in original or in ancestry-adjusted form. The high positive correlation of agricultural years with state history produces similar results to the baseline ones. Identically to the case with the threshold effect, the estimated coefficients also show considerable consistency over the different threshold and financial development variables. The underlying reason is that the individual estimates group the countries into the two regimes in a similar way owing to the strong positive correlation of the antiquity measures. In both regimes, the effect of financial development is important economically. Considering the baseline results, a 10-percent increase in private credit tends to accelerate the (cumulated) growth rate over the underlying 5-year period by 0.8 percentage points in the bottom regime (young societies) and decelerate it by 1 percentage point in the upper regime (ancient societies). In the case of domestic credit and the other antiquity measures, similar magnitudes characterize the growth impact

[39] Note that the estimated threshold value is again not comparable to the baseline one due to its different scale.

of financial development.

To conclude, in accordance with the theoretical model, the empirical analysis proves our two initial hypotheses. Antiquity impacts the finance-growth nexus by rendering the increase in the amount of outstanding credit detrimental to growth in societies with ancient roots. On the other hand, in younger societies, the marginal effect of financial development on growth is positive – as the traditional finance-growth literature would suggest. This result holds irrespective of the measure of antiquity.

One point is worth emphasizing: our results are not a simple reincarnation of the literature on institutional quality, economic development, and finance. Although some of the world's oldest societies are located in the underdeveloped Middle East, there are also leading examples of antiquity in developed countries such as Greece, Italy or South Korea. Indeed, in our baseline estimations, both the bottom and the upper regimes of state history include a mix of developed and developing countries (see Table C.1 in Appendix C). Therefore, the general argument of the literature that financial development is more conducive to growth in countries with better institutions or with a higher level of economic development is clearly irrelevant in our case. In contrast to the conventional institutional quality literature, the economic story behind our results is more about informal institutions rather than formal ones. Its about the latent rent-seekers who may render institutional systems extractive – even those systems with a relatively high score of institutional quality according to standard measures – provided that they are powerful enough to do so.

3.7 Discussion

Our results establish a robust relationship between antiquity, in the form of accumulated exposure to state and centralized institutions, and one of the main pillars of capitalism: the banking sector. We provide overwhelming evidence that the lending activity of banks is less conducive to economic growth in countries with a long state history. The malfunctioning of the finance-growth nexus can be attributed to the enhanced power of the business and political elites to capture the financial sector and corrupt lending under the condition of antiquity. In line with the literature, we conjecture that interest groups are entrenched deeper and have increased bargaining

power at their disposal in economies with a long state history (Borcan et al., 2018; Lagerlöf, 2016). In our model, we present the dependence of banks' lending activity on antiquity. The case studies of Italy and South Korea also provide some underpinning of our argument. However, the deep entrenchment and the persistent survival of interest groups in older societies is still rather a supposition than a thoroughly explored stylized fact in the literature. This section provides some evidence on the rationale for this assumption. In doing so, we focus on the distinguishing features of societies with an ancient statehood in terms of social dynamics, culture, and institutions.

Early starters in a state organization were able to dominate territories and extract resources for the benefit of their elites and the consolidation of their military power. These ancient autocratic regimes were characterized by advanced political and economic hierarchies. A long tradition of centralization resulted in social norms which are conformable with elite rule and vested political interests are deeply settled at the same time. Owing to this, these societies were more effectively able to resist the changing strategic and economic environment resulting from the appearance of competing states, the replacement of old empires, the monetization of economic activities, and the rise of novel types of political-economic organizations on their territories (e.g., democracy in ancient Athens, imperial mercantilism in medieval Venice). This resistance also means that the elite-based social structure of countries with ancient roots has been less influenced by the emergence of modern capitalist markets and democratic regimes. The persistence of social norms enable the survival of elite-rule in the form of informal networks, cronyism, and state capture in the modern era too. Hence, antiquity in economic terms becomes equivalent to a set of institutional and inter-generationally transmitted constraints that may undermine the primacy of competitive markets and result in impaired functioning of some crucial aspects of capitalism, such as the finance-growth nexus.

The probable survival of oligarchic social structures and accommodating social norms has also been supported by the collectivist culture of societies with ancient statehood. Olsson and Paik (2016) explore a robust positive correlation between agricultural years since the Neolithic Revolution and cultural collectivism. They argue that the sequential spread of sedentary agriculture was transmitted by the step-by-step outmigration of the most individualist people from the Middle East toward Northern

Europe and other regions. Moreover, since climatic conditions were rather favorable for individualist agriculture in the temperate zone, collectivist social norms were not needed compared to the Fertile Crescent where agriculture was based on irrigation (Diamond, 1997). Sedentary agriculture was a major trigger for the formation of states. The above therefore also explains why countries with a longer state history tend to be more collectivist (Hariri, 2012).

As opposed to personal freedom and horizontal relationships in individualist societies, collectivism is characterized by the embeddedness of the individual in the community, hierarchical structures, and loyalty toward the group (Gorodnichenko and Roland, 2017). Individualist societies are driven more by general morality and legal rules, while collectivist societies operate more on the basis of reciprocal moral obligations and personal connections. As a consequence, in collectivist societies informal personalized enforcement mechanisms may dominate the formal rules. All these characteristics are conducive to the survival and perpetuation of elite networks.

Another argument in favor of the perpetuation of elite-based social structures in older countries is the growing empirical evidence of their long-run survival. Oto-Peralías and Romero-Ávila (2016) investigate how the speed of the Reconquest of the Iberian Peninsula affected the political and social structures established in the newly regained territories. They argue that in regions which were reconquered relatively fast, 'colonization' remained incomplete and resulted in the concentration of power in the hands of the political elite, the nobles. They demonstrate that this oligarchic centralized social structure survived until the industrial revolution in the late 19th century and is one of the main reasons behind the current underdevelopment of the respective Spanish regions. In another recent study, Greif and Tabellini (2017) demonstrate that social organization was historically characterized by patrilineal kin-based clans in China. These clans were abolished when the communist regime gained power in 1949. However, after the regime stopped persecuting them in 1979, clans re-emerged and proliferated. The authors see the latter as evidence of cultural persistence actively shaping the organization of societies.

The survival of social structures is further underpinned by the adaptive formation of formal institutions. Indeed, it has already been pointed out that social norms and values (culture) and institutions mutually influence each other (Alesina and Giuliano, 2015; Nunn, 2014). In his seminal paper, Greif (1994) demonstrates how

the difference in cultural beliefs between medieval Genoese and Maghribi traders shaped their respective societies. Acemoglu et al. (2001) emphasize the importance of European settlers in terms of the type of institutions that were established in the new colonies. As regards the opposite causation – running from institutions toward social norms and values – the empirical evidence is also abundant. Becker et al. (2016) explore the long-term positive legacy of the Habsburg Empire on the general trust toward bureaucracy and police in the successor states. Lowes et al. (2017) investigate the long-term effect of early centralized institutions on contemporary cultural norms through the evidence of the Kuba Kingdom and find that developed institutions in the past result in weaker norms of rule- following and a greater propensity to cheat for material gain in the present. Tabellini (2008) builds a model in which institutions and culture both evolve endogenously, mutually shaping each other.

To sum up, there is strong evidence in the literature that countries with ancient roots are more collectivist and thereby the dominance of powerful elites is more likely to survive. Moreover, the establishing oligarchic economic and political conditions are further reinforced by the dynamic interplay of institutions and culture: a collectivist society captured by some major interest groups can easily find itself in a bad equilibrium where formal rules based on general morality are dominated by personalized informal rules and hierarchical within-group structures.

Finally, we want to point out that antiquity is not necessarily a subordinated system. The logic of antiquity appears to be similar to the logic of the soft budget constraint, whose efficiency is rejected *ex-ante*, but confirmed *ex-post*. While antiquity generates conditions for the inefficient provision of credit due to elite capture and entrenched interest groups, it is essential to keep in mind that it also may provide an alternative path to economic efficiency, as it is not possible to undo or disregard the ancient roots of societies. In societies with a longer horizon of state history, it is costlier to replace hierarchical institutions with horizontal ones than to have an impaired financial system captured by established elites**.** This observation is also in line with the collectivism-individualism dichotomy. Individualist societies are more likely to be richer than collectivist societies. However, this may not always be the case. Antiquity prevents a capitalist development based on market-based finance, but this does not preclude the existence of alternative developmental paths that can be relatively successful in capitalism. The latter question goes beyond the scope of our paper and

may be the topic of future research.

3.8 Sensitivity analysis

This section conducts the sensitivity analyses of the results. We are primarily interested in the sensitivity to the estimation method, the sample, the threshold effect, and the control variables. In advance, the sensitivity analyses show that the results are robust to these issues. In order to save space, we present only the sensitivity analyses in the case of private credit. The results of domestic credit are very similar and are available in Appendix C.1 (Tables C.5-C.8.).

As regards the estimation methodology, we investigate the sensitivity to the defining characteristics of the GMM estimation such as the set of IVs and the assumption on the weighting matrix. The results are presented in Table 3.2. In sensitivity checks S1A and S2A, we change the set of external IVs first by dropping geography-related variables (S1A), and then by discarding legal origin dummies too (S2A). As can be observed, the impact of private credit in the two regimes is not sensitive to the inclusion of external instruments. In sensitivity check S3A, we keep the external instruments unchanged but restrict the internal IVs to the first order lag of untransformed right-hand side variables. The results concerning the coefficient of private credit in the two regimes are similar to the baseline case. Finally, we switch from clustered errors to heteroskedastic errors and adjust the weighting matrix used for the second step of GMM accordingly (S4A). The conclusion concerning the threshold effect of antiquity holds in this case too.

Three issues can be raised concerning the sensitivity to the sample: the sensitivity to the time span, the country set, and the inclusion of countries according to the required minimum number of complete observations. In the baseline case, the only countries we keep in the sample are those with at least four time periods containing complete observations in terms of the baseline variables. In sensitivity check S5A, we increase this threshold to six periods of complete observation. The results are unchanged despite the fact that the number of included countries decreased considerably (Table 3). When we loosen the condition of inclusion to three complete observations, the number of countries increases noticeably – to 117 (S6A). However, the results remain similar to the baseline case. Another sign of robustness to the

inclusion threshold is that, in both sensitivity checks, the estimated threshold value of state history is the same as in the baseline model.

Table 3.2. Sensitivity to the GMM settings

Sens. check	S1A	S2A	S3A	S4A
Weighting matrix	default	default	default	cross-country & -time heteroskedasticity
Internal IV	default	default	1st order lags	default
External IV	legal origin	none	default	defaut
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2				
ln(PCB_bottom)	0.0989	0.115	0.143	0.0746
	(0.015)	(0.018)	(0.002)	(0.054)
ln(PCB_upper)	-0.0859	-0.088	-0.0738	-0.1041
	(0.009)	(0.035)	(0.08)	(0.000)
Wald test (pv)	0.103	0.080	0.073	0.097
γ	0.216	0.108	0.204	0.216
SH quartile	Q3	Q2	Q3	Q3
N	536	536	604	536
no. of countries	93	93	93	93
Jstat (pv)	0.186	0.136	0.842	0.048
no. of IVs	26	23	25	32

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

We perform two sensitivity checks in relation to the time span. First, we drop the last 5-year period (2005-09) to avoid any distortions related to the global financial crisis (S7A). The significant threshold effect in the finance-growth nexus remains, but the estimated threshold value of the state history index is considerably lower than in the baseline case, falling this time into the second quartile of the underlying sample distribution. Second, we drop the 1970s to exclude the turbulent decade of oil crises and to focus on the post-Keynesian period of liberalization, deregulation, and privatization (S8A). This is important because one might be concerned about the distorting effect of state-owned banks, which actually dominated the financial landscape before the turnaround in mainstream economics at the beginning of the 1980s. Namely, one might argue that antiquity counts only when market forces are constrained by state ownership. As the results show, this is not the case, with the main conclusions being valid for this limited time span too. Moreover, the estimated

threshold value of state history is also unchanged.

Finally, we investigate the sensitivity to the country sample. One might argue that the effect of antiquity on the finance-growth nexus might be driven by developing countries or some other groups of countries. In sensitivity checks S9A and S10A, model (1) is estimated separately for developed and developing countries. Although, in each case, private credit continues to weigh positively for growth in the bottom regime, it loses significance.[40] However, in both cases, the significant negative effect of private credit is preserved in the upper regime. These results corroborate our previous reasoning that the antiquity-capitalism nexus is not another representation of the well-known institutional approach suggesting that the finance-growth nexus is impaired in antique societies due to their lower level of economic and institutional development. As a second round of the sensitivity check to the country sample, we also drop groups of countries according to their territorial affiliation. Five scenarios are considered (S11A-S15A): estimation without Latin American & Caribbean, Asian, Sub-Saharan, Middle East & North African, and Western countries. As the results in Table 3.3 show, for each constrained country sample the impact of antiquity follows the same pattern as in the baseline case.

In the third type of sensitivity check, we investigate whether the impaired finance-growth nexus holds when a threshold effect is allowed for other explanatory variables too. In order to avoid an adverse increase in the number of regression parameters, beyond financial development, a threshold effect is introduced for other control variables one-by-one:

$$\begin{aligned}(4)\qquad \ln y_{i,t} = {} & \beta \ln y_{i,t-1} + \alpha_1 I(SH_i \le \gamma) \ln FD_{i,t} + \alpha_2 I(SH_i > \gamma) \ln FD_{i,t} + \\ & + \eta_1 I(SH_i \le \gamma) X_{i,t} + \eta_2 I(SH_i > \gamma) X_{i,t} + \phi^T (\mathbf{Controls}^*_{\mathbf{i,t}}) + \mu_i + p_t + \varepsilon_{i,t}\end{aligned},$$

where $\mathbf{Controls} - \mathbf{Controls}^* = \left\{ X : X \in \mathbf{Controls}\ ,\ X \notin \mathbf{Controls}^* \right\}$. Equation (4) differs from equation (3) in also allowing for a threshold effect in control variable X. The rationale is that the baseline results on the threshold effect in the finance-growth nexus might be driven by the omitted possible threshold effects in terms of the other

[40] However, notice that the number of countries in the two groups is much lower than in the baseline case, leading to less precise estimations.

control variables. The results are presented in Table 3.4.

In the case of the lagged GDP per capita, the lagged human capital, and Polity2, there does not seem to be any threshold effect (S16A, S18A, S21A). In the case of the other control variables, antiquity seems to matter in a contradictory way. In antique societies, inflation is more costly and government consumption retards growth – instead of enhancing it (S19A & S20A). So, from the perspective of the effect of these two policy variables, antiquity is detrimental just as in the case of financial development. On the other hand, as far as the effect of investments is concerned, antiquity is conducive (S17A). These additional threshold effects suggest that beyond the finance-growth nexus, antiquity potentially impacts the contemporary functioning of capitalism through other channels as well. The underlying mechanisms are a subject for future research.[41] Nevertheless, at the moment, the most important result is that the revealed threshold effect in the finance-growth nexus is not sensitive to the inclusion of other channels. In each extension, private credit continues to be positive in the bottom regime, although not always in a significant way, and significantly negative at the 10-percent level in the upper regime.

The final sensitivity check considers the control variables. We add the total volume of trade (lnTrade), the balance of trade (BoT), and a banking crisis measure to the baseline model one-by-one.[42] The banking crisis measure is of particular interest since the finance-growth nexus might be impaired by financial crises in the short run, and so it is important to control for such events (Loayza and Rancière, 2006). Despite this, we decided not to include the banking crisis measure in the baseline model since it is a simple sum of the dummy of crisis events, compiled by Laeven and Valencia (2018), in the underlying five-year period and can therefore be only considered as a fairly crude proxy for the economic consequences of financial collapse. As can be observed in Table 3.5, although the volume of trade and banking crisis are significant control variables, the results concerning the effect of antiquity on the finance-growth nexus are unchanged in each case (S22A-S24A).

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[41] In the case of government consumption, the adverse effect of antiquity might be explained by similar arguments as in the case of the finance-growth nexus: in more ancient societies rent-seeking is more prevalent, the state tends to be captured by interest groups leading to corruption in government spending, and an impaired growth effect of the latter.

[42] For the sources of these data, see Table C.1.

Table 3.3. Sensitivity to the sample

Table Sens. check	S5A	S6A	S7A	S8A	S9A	S10A	S11A	S12A	S13A	S14A	S15A
Complete obs. (min.)	6	3	default	default	default	default	default	default	default	default	default
Period	default	default	1970-2004	1980-2009	default	default	default	default	default	default	default
Countries	default	default	default	default	Developed	Developing	w/o LAC	w/o Asia	w/o MENA	w/o SSA	w/o West
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2											
ln(PCB_bottom)	0.0836	0.0685	0.1147	0.079	0.0214	0.0346	0.1108	0.0763	0.0709	0.0114	0.0731
	(0.017)	(0.047)	(0.007)	(0.066)	(0.421)	(0.417)	(0.004)	(0.025)	(0.032)	(0.722)	(0.047)
ln(PCB_upper)	-0.0805	-0.1113	-0.0614	-0.1073	-0.062	-0.0908	-0.0501	-0.1256	-0.1335	-0.08	-0.0775
	(0.009)	(0)	(0.034)	(0.003)	(0.008)	(0.003)	(0.138)	(0)	(0)	(0.001)	(0.072)
Wald test (pv)	0.225	0.087	0.090	0.103	0.193	0.037	0.040	0.075	0.165	0.055	0.080
γ	0.216	0.216	0.112	0.216	0.104	0.216	0.108	0.228	0.216	0.251	0.481
SH quartile	Q3	Q3	Q2	Q3	Q2	Q3	Q2	Q3	Q3	Q2	Q4
N	510	562	440	466	333	203	399	459	481	407	416
no. of countries	81	117	84	93	54	39	73	81	83	66	72
Jstat (pv)	0.225	0.290	0.179	0.188	0.119	0.786	0.199	0.486	0.299	0.013	0.377
no. of IVs	32	32	31	30	32	28	31	31	31	31	30

Notes: Robust p-values are in brackets. Developed countries: high income & upper-middle income countries, Developing countries: low income & lower-middle income countries. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Notations: LAC – Latin America & the Caribbean, MENA – Middle East & North Africa, SSA – Sub-Saharan Africa, West – Europe & North America

Table 3.4. Sensitivity to the threshold effect

Sens. check	S16A	S17A	S18A	S19A	S20A	S21A
X with.threshold effect	lag(lny)	lnGFCF	lag(lnHC)	ln(INFL)	ln(GovCons)	Polity2
control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2						
ln(PCB_bottom)	0.0230	0.0322	0.0606	0.0666	0.0446	0.0773
	(0.421)	(0.199)	(0.017)	(0.019)	(0.142)	(0.026)
ln(PCB_upper)	-0.0518	-0.0819	-0.0714	-0.0952	-0.0461	-0.0713
	(0.099)	(0.015)	(0.044)	(0.006)	(0.098)	(0.022)
ln(X_bottom)	0.8976	-0.0097	0.2802	-0.0269	0.2456	0.0079
	(0.000)	(0.866)	(0.035)	(0.292)	(0.001)	(0.002)
ln(X_upper)	0.8027	0.3260	0.2746	-0.1878	-0.2115	0.0037
	(0.000)	(0.001)	(0.019)	(0.003)	(0.008)	(0.264)
γ	0.216	0.216	0.204	0.226	0.216	0.216
SH quartile	Q3	Q3	Q3	Q3	Q3	Q3
Jstat (pv)	0.084	0.072	0.159	0.166	0.175	0.244

Notes: Robust p-values are in brackets. In each case, N=536, no. of countries = 93, no. of IVs = 32. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls.

Table 3.5. Sensitivity to the control variables

Sens. scenario	S22A	S23A	S24A	S25A
Add. control	*lnTrade*	*BoT*	*Banking crisis*	*lnPCB*Polity2*
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2				
Add. control	-0.1352	0.0014	-0.0237	-0.001
	(0.014)	(0.629)	(0.000)	(0.674)
ln(PCB_bottom)	0.069	0.0788	0.0555	0.0849
	(0.078)	(0.044)	(0.100)	(0.016)
ln(PCB_upper)	-0.0997	-0.1141	-0.0362	-0.1056
	(0.002)	(0)	(0.087)	(0.000)
Wald test (pv)	0.093	0.060	0.053	0.157
γ	0.216	0.216	0.135	0.216
SH quartile	Q3	Q3	Q3	Q3
N	536	536	431	536
no. of countries	93	93	82	93
Jstat (pv)	0.534	0.331	0.210	0.264
no. of IVs	34	34	32	34

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

As a final check, we also add the interaction of private credit with Polity2 in order to condition the effect of the former on the latter. Polity2 is a proxy for institutional quality, and so sensitivity check S25A addresses the concern whether our results are driven by the conditionality of the effect of financial development on institutional quality. It turns out not to be the case: the threshold effect in the finance-growth nexus is unchanged, while the introduced interaction proves to be highly insignificant.

3.9 Conclusions

This paper investigated the long-run persistent effect of antiquity on the working of capitalism. It did so by exploring the conditioning effect of antiquity, i.e. the length of established statehood and centralized institutions, on the *finance-growth* nexus. The effect of financial development on economic growth has long been in the focus of economists since the efficient operation of financial markets is decisive in terms of the performance of capitalism. An efficient financial sector allocates the savings of the society to the most promising investment projects. In this paper, we argue that the latter is harmed in countries with ancient roots, leading to an impaired finance-growth nexus at the macroeconomic level. In older societies, interest groups might be more entrenched and political and economic elites might be more powerful due to the persistence of hierarchical social structures enhanced by antiquity. This leads to extractive (informal) institutions and the continuous endeavor of the elite for access to easy credit. As a result, corruption in lending tends to be more widespread, thus maintaining a modern form of the soft budget constraint.

To prove our theory, we followed a two-step strategy. First, we model the conditionality of the firm-bank relationship on antiquity and introduced the mechanism through which a soft budget constraint might characterize older societies to a larger extent. Thereafter, we examined empirically whether the growth impact of the amount of outstanding credit does indeed differ in older and younger societies, and if so, in what way. To do this, we resorted to the method of dynamic panel threshold regressions. We applied different variants of the state history index of the last six millennia, constructed by Borcan et al. (2018), and the agricultural years since the Neolithic Revolution, constructed by Putterman and Trainor (2018), as the threshold variable in the estimations. The sample embraced 118 countries and 45 years

(1970-2014). The results corroborate our hypothesis robustly: the finance-growth nexus is considerably impaired in older societies. We found that while the traditionally assumed positive growth effect of financial development holds in younger societies, this effect becomes outright negative in societies with a long history of established statehood. Based on our theoretical model and empirical results, we deliver robust evidence on the negative effect of antiquity on the finance-growth nexus and thereby on capitalism too.

Our paper contributes to the literature in several respects. First, we provide a profound establishment of the legacy perspective in the non-linear finance-growth literature. Second, we unveil the deep historical roots of corruption in lending. Third, we contribute to the opening of the black-box of the DRD literature by elaborating on a channel through which history might exert its persistent effect on current socio-economic outcomes. To date, most of the studies in the DRD literature have focused on the determining effect of historical shocks on the contemporary level of development. Much less effort has been devoted to understanding the mechanisms underlying this. A popular explanation is the persistence of culture and social norms. This approach appears in the background of our argumentation as well. However, our study tried to be more operative by unveiling a concrete economic mechanism related to the malfunctioning of capitalism under the condition of antiquity, the finance-growth nexus. As our empirical results demonstrated, there are other promising alternative channels as well that might help to open up the black-box of the deep roots of economic development further, such as the investment-growth nexus or the government expenditures-growth nexus. The exploration of these is a subject for future research.

Chapter 4

Chinese Diaspora and the Making of Southeast Asia*

4.1 Introduction

Southeast Asia is the area with the highest concentration of overseas Chinese in the world. The earliest immigration from China can be traced back to thousands of years ago and large scales of immigration started with colonial development in Southeast Asia. In academic studies on migration, scholars usually describe the group of Chinese immigrants as overseas Chinese, Chinese diaspora, or ethnic Chinese. For clarity, when we use the term Chinese diaspora, we refer to Chinese immigrants to Southeast Asia and their descendants. By 2007, the population of the Chinese diaspora in Southeast Asia had reached about 33 million, accounting for more than 7% of the total population (Zhuang, 2010). Except in Singapore, ethnic Chinese constitute a minority of the whole population in all the countries in Southeast Asia. However, they have achieved great economic success and become known as one of the highly entrepreneurial, most technically sophisticated, and wealthiest groups in the world (Kotkin 1992). According to the latest estimation of Zhuang and Wang (2015), the proportion of assets in Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam controlled by the Chinese diaspora is between 20% and 50%. In Singapore and Laos, the ratio is also higher than the population share of the Chinese diaspora, although the gap is not significant. Based on existing research, three factors contribute to the economic miracle of the Chinese diaspora in Southeast Asia.

The first driving force of their economic success is their cultural tradition, Confucianism. Confucian values have positive effects on work ethic, labor

* This chapter is based on the single work of Junbing Zhu (Freie Universität Berlin), and "I" will be used throughout this chapter.

productivity, and entrepreneurial ability. Khan (1979) firstly points out that neo-Confucian societies, including Japan, South Korea, Taiwan, Hongkong, Singapore, and ethnic Chinese minorities in Thailand and Malaysia, are more adept at industrialization and this results in higher growth rates than in Western countries. Based on the analysis of interviews with Chinese entrepreneurs in Singapore, Chen and Zhang (1994) conclude that entrepreneurship is profoundly affected by Confucian ethics. Self-discipline, thrift, and diligence are in parallel with the work ethic.[43] Values of integrity, trust, and morality help maintain long-term business cooperation. In addition, the importance attached to education enhances labor productivity (Chan, 1991) and human capital accumulation (Li et al., 2014). Furthermore, under the influence of Confucian familism, the Chinese diaspora prefers family-run enterprises. For one thing, the family organization provides flexibility in the deployment of human resources and the accumulation of financial resources (K.Sundaram, 2003). For another, the kinship relation has a positive role in smoothing the cooperation between management and labor and maintaining labor loyalty (Chan, 1991; Chen and Zhang, 1994; Kim and Park, 2003). Being fond of learning, Confucian society is open to knowledge and innovations from practice and from others and also learns from modern enterprises how to improve business management (Chen and Zhang, 1994; Whyte, 1996; Ornatowski, 1996). Empirical research also shows that Confucian ethics lead to higher efficiency in learning general knowledge about economic and government policies, social relationships, and sensitivity to market and industry (Yeh and Xu, 2010). Therefore, Confucian ethics do not deny the advantage of modern business ethics but provide more choices for better management.

The second factor is the cooperative business network based on the mutual trust within the Chinese diaspora in Southeast Asia. The business network provides mutual support in terms of capital, information, markets, labor, and security within a nation as well as across borders (Redding, 1990; Kotkin, 1992; Weidenbaum and Hughes, 1996; Koon, 1997; Guo, 1998; K.Sundaram, 2003 Chuah et al., 2016), for example, the credit-commerce nexus between Malay peasants and Chinese merchants in the Kelantanese

[43] The emigration experience of the Chinese diaspora may also contribute to the more conducive work ethic (Guo, 1998; Chuah et al., 2016). With the hopes of their families, they sought to make a fortune in a new country. Therefore, they were prepared to work hard and overcome hardships.

interior (Chia, 1987). Moreover, the network is more effective in taking advantage of diversity in business integration across national boundaries (Peng, 2000) and international trade of differentiated products (Rauch and Trindade, 2002). Thus, the business network is responsible for the economic success of the Chinese diaspora.

The third factor is that the economy of the Chinese diaspora is a critical part of the private economy in Southeast Asia. During colonial development in Southeast Asia, large numbers of Chinese merchants and workers were attracted and recruited to Southeast Asia. While keeping the indigenous people in traditional sectors of agriculture and fisheries, the colonists preferred to employ Chinese merchants for trading and Chinese workers in mines and plantations (Skinner, 1957; Wyatt, 1984; Guo, 1998). Therefore, indigenous groups had fewer opportunities to accumulate capital during the colonial period. In the aftermath of the reduction in investment by Western colonists at the beginning of the twentieth century, the Chinese diaspora was allowed to expand its business, and capital was a primary source of private investment. The outcome is that the Chinese diaspora controls a disproportionate amount of private domestic capital in countries where they are minorities, except in Singapore (Bardsley, 2003; Chuah et al., 2016). The critical issue, however, is who deploys the capital rather than the amount of capital as such (K.Sundaram, 2003). With the advantages of entrepreneurial abilities, work ethic, and business networks, the Chinese diaspora can organize business with higher efficiency. Although the Chinese diaspora economy also experienced loss during the war, its role in the private economy did not change and its superiority in cultural and business networks persisted.

Therefore, the Chinese diaspora has strengths in business expertise inherited from its cultural traditions and the mobilization of economic resources. Moreover, while the colonists brought capitalism to Southeast Asia, the economic role of the Chinese diaspora during colonial development makes its members an essential part of the local private economy. Studies on entrepreneurship suggest that it has a generally positive effect on economic growth (Stoica et al., 2020). Besides, according to the theory of Spolaore and Wacziarg (2013) that a higher share of the population with superiority in technologies results in a higher growth rate, ethnic Chinese diaspora should be helpful for the economic growth of their residing country. Hence, they should help promote the economic development of their residing country in the process of industrialization after independence. Although only a fraction of ethnic Chinese

nowadays is descendants of earlier immigrants, the legacy of human traits is still important in accounting for economic development (Spolaore and Wacziarg, 2013).[44] There has been research attributing the economic performance in Thailand, Malaysia, and Indonesia to their Chinese minorities (Yoshihara, 1988). But there is no empirical analysis on the effect of the Chinese diaspora on economic growth. Thus, the focus of this paper is the empirical analysis of the relationship between the Chinese diaspora and economic growth in Southeast Asia.

Following the arguments for the advantages of the Chinese diaspora conducting business activities, we hypothesize that, in Southeast Asia, countries with a higher population share of the Chinese diaspora are associated with higher economic growth over the period from their independence to the present. However, the relationship between the Chinese diaspora and economic growth may be influenced by the economic environment in which the Chinese diaspora do business. In the second half of the twentieth century, economic nationalism and economic nationalization were implemented in most Southeast Asian countries to transfer the economic role of the Chinese diaspora to indigenous groups or the state. Economic policies discriminated against the Chinese diaspora business. The economic gap between the Chinese diaspora and the indigenous people also invoked significant anti-Chinese sentiment. As a result, members of the Chinese diaspora experienced a substantial increase in business uncertainty and risk in the economic environment. Their investment was limited and marked by capital outflows. Hence, the advantages and abilities of the Chinese diaspora in economic activities were not utilized effectively. Furthermore, no substitute assumed the economic role of Chinese entrepreneurs, which also caused problems in economic development in most Southeast Asian countries. The discriminatory policies focused on ethnic redistribution and undermined the ability of states in leading industrialization and growth (Jesudason, 1989; Bowie, 1991; Yoshihara, 1995). However, there was also no sufficiently strong bourgeoisie to advance industrialization (K.Sundaram, 2003). Therefore, the deprivation the Chinese diaspora suffered, and its weakened economic role distorted the existing economic

[44] The human traits include human capital, scientific and technological knowledge, general education, access to international markets, ideologies, cultural values, social norms, and so on (Easterly and Levine, 2012)

order, which resulted in efficiency loss in the allocation of economic resources. The higher the population share of the Chinese diaspora, the greater the loss was. In this case, we conjecture that a higher population share of the Chinese diaspora is associated with lower economic growth when the economic environment of doing business is adverse for the Chinese diaspora.

In addition, Confucianism may be an obstacle to economic growth in Singapore nowadays because it has been a developed country for a few decades. Liang (2010) proposes that Confucian traits contribute to "follower" mode growth but may become an impediment to "leading" mode growth. Supporting evidence can be found in the study of Feng et al. (2017), which shows a robust and negative relationship between Confucianism and innovative activities in China. Empirical evidence also shows that Confucian ethics result in higher residential saving rates and more risk-averse behavior (Huang and Sun, 2005; Wan and Xiao, 2013; Chen, 2017; Ye et al., 2018; Du and Zhan, 2019). Therefore, I expect lower economic growth in Singapore compared to developing countries in Southeast Asia. However, Confucianism also has a significant influence on social governance in Singapore because the majority population is ethnic Chinese. Liu (2000) states that South Korea's growth benefits from Confucianism through the state capacity in keeping social stability, effective regulation of the economy, and communitarianism. The tradition of stressing the cooperation between good officials and the people is also helpful in settling social and economic issues (Frederickson, 2002; Liu, 2017). As a result, the Chinese diaspora may contribute to economic development through social governance, and, thus, may still have a positive effect on economic growth in Singapore, but it is smaller compared to the effect in developing countries.

Therefore, in this paper, I will test the following three hypotheses regarding the relationship between the population share of the Chinese diaspora and economic growth in Southeast Asia:

Hypothesis 1. *Countries with a higher population share of the Chinese diaspora are associated with higher economic growth over the period from their independence to 2014;*

Hypothesis 2. *A higher population share of the Chinese diaspora is associated with lower economic growth when the economic environment for doing business is adverse for the Chinese diaspora;*

Hypothesis 3. *An increase in the population share of the Chinese diaspora results in a greater increase in economic growth in developing countries in Southeast Asia.*

To test the first hypothesis, I run regressions with pooled OLS and 2SLS using a dataset covering the period 1959-2014. The sample includes Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippine, Singapore, Thailand, and Vietnam. As the distribution of the Chinese diaspora is mainly determined by migration during the colonial period and the Chinese were major participants in colonial development, the population share of the Chinese diaspora is instrumented by two variables related to colonial history. The first one is the number of product categories per unit area in the 1930s, reflecting the level of exploitation of economic resources. A higher level of exploitation indicates a higher share of the Chinese diaspora. The second one is the dummy of the massacre, showing whether there was any massacre by colonists in a country that discourages immigrants from China. Furthermore, since I focus on the effect of the Chinese diaspora through their superiority in entrepreneurial abilities and work ethic, economic variables are also controlled, including fixed capital formation, financial development, trade, and natural resources rents. The second hypothesis will be tested using regressions in subsamples distinguished by the quality of the economic environment. I will test the third hypothesis by running regressions on the sample without Singapore. Due to the limitation of the available data, it is not possible to examine the effect of the Chinese diaspora in Singapore directly.

I find that the Chinese diaspora has had a positive effect on economic growth over the last few decades. However, countries with higher shares of the Chinese diaspora population are inclined to have lower economic growth when the economic environment discriminates against ethnic Chinese. I also observe a more substantial effect in developing countries. The paper is structured as follows. Section 2 is a review of the historical background of ethnic Chinese and Southeast Asia. The data and empirical strategy are in Section 3. In Section 4, the main results are analyzed. Section 5 contains the robustness check, and Section 6 concludes.

4.2 Historical background: Chinese diaspora in Southeast Asia

The earliest migration of Chinese to Southeast Asia can be traced back to two thousand years ago. Beginning in the Song dynasty, Chinese merchants started playing a leading

role in the sea trade of East Asia. Because of incentive policies for sea trade during the Yuan dynasty, many Chinese merchants migrated to Cambodia, Malacca, Thailand, and Vietnam (Guo, 1998). During the Ming dynasty, Zheng He undertook seven voyages to the western seas from 1405 to 1433, following which there were also merchants who emigrated to Southeast Asia. In the fifteenth century, the network of ethnic Chinese merchants was formed and provided support for subsequent immigrants from China. Until the middle of the twentieth century, migration took place mainly along the sea route between southeast China's coastal area and Southeast Asia.

The first large scale migration began with colonization around the beginning of the seventeenth century. Malacca was conquered by Portugal in 1511 and later by Britain. The Spanish captured Manila in 1570 and the Chinese, mainly from Fujian, started a migration to the present-day Philippines. At the end of the nineteenth century, Myanmar became a British colony, while Cambodia, Laos, and Vietnam came under the control of France. Emigrants to Southeast Asia can be divided into two groups: merchants and workers called "coolies". Before the eighteenth century, most emigrants were merchants who were attracted by opportunities for trading. Along with the further development of Southeast Asia, there was a larger demand for workers in the mines and plantations. A large number of Chinese workers were recruited, and the population of the Chinese diaspora increased considerably in many regions. From the middle of the nineteenth century on, the deterioration of the domestic economy in China pushed more Chinese to seek opportunities outside China. What is more, the Qing dynasty opened several port cities, making emigration to Southeast Asia more convenient. More Chinese then went to Southeast Asia as contracted workers or free immigrants, including peddlers, craftsmen, and peasants. Contracted workers could regain their freedom once their contract ended. From the beginning of the twentieth century on, the colonists were preoccupied with matters elsewhere and had little time to engage in business in Southeast Asia, which left a vacuum for the expansion of the Chinese diaspora economy. The new industrial development in Southeast Asia increased the demand for skilled workers, while the influx of traditional workers continued (Zhuang, 2008). The new trend of migration lasted until the middle of the 20th century.

In the process of Chinese migration to Southeast Asia, the pull factor was the

emerging opportunities because of the development in Southeast Asian countries and the push factor was mainly the bad economic situation in China and personal reasons (Guo, 1998). The main goal of the immigrants was to earn a better life in a new environment by themselves and they had the incentive to work hard. During the colonial period, they were employed as workers or the middlemen of the capitalist economy. Although they faced many limitations in life and business under the governance of the colonists, they were still capable of conducting small business activities, with this breaking the isolation by means of the network across regions and promoting the development of the local economy (Guo, 1998). Because of their more robust work ethic, high entrepreneurial ability, and value for credit, they achieved great economic success and capital accumulation. By 1921 in Indonesia, for instance, enterprises of ethnic Chinese accounted for 36.1% of about 9000 factories (Liu and Shu, 1934).

However, the economic success did not earn the Chinese diaspora political power in making policy (Chen, 2001). After the Second World War and fighting for independence in Southeast Asian countries, instead of utilizing the superiority of the Chinese diaspora to support the recovery of the national economy, some states, including Indonesia, the Philippines, Thailand, and Malaysia, implemented discriminatory economic policies against the Chinese diaspora while promoting economic nationalism. Indonesian independence in 1949 saw a subsequent rise in nationalist sentiment and an increase in the influence of indigenous businessmen, both of which had a significant impact on economic policies. Indigenous business people had priority access to credit, licenses, and foreign exchange. Enterprises with more than 70% of indigenous capital also had privileges. However, owing to the lack of capital, entrepreneurial ability, and experience, these indigenous businessmen chose to sell import licenses to Chinese merchants. Furthermore, the Indonesian government asked the Chinese merchants to pay a large deposit, with the consequence that 1000 out of 1004 Chinese enterprises stopped their business activities (Wen et al. 2000). Many more enterprises closed because they were not allowed to do business in such areas as the production of rice and wood products. Moreover, in November 1959, the Presidential Decree No.10 was implemented, and the Chinese diaspora was required to transfer retail businesses in rural areas to Indonesian citizens before the new year of 1960. In the same year, the government devalued cash with a nominal value of 500 and

1000 Rupiah by 90%, and deposits exceeding 25000 Rupiah were frozen. These policies imposed huge damage and increased uncertainty and risk on ethnic Chinese businesses (Wen et al. 2000). The consequence was decreases in domestic investment and increases in capital outflows. Although some policies were not implemented strictly and the economic power of ethnic Chinese persisted in some areas, significant changes in policies did not occur until 1986. There were also frequent anti-Chinese movements in the 1990s, which caused a persistent loss of life and property of the Chinese diaspora. Therefore, it is clear the economic environment was hard for the development of the Chinese diaspora economy before the 21st century.

From the independence of the Philippines in 1946 1975, the government there imposed strict restrictions on the naturalization of the Chinese diaspora, while simultaneously endeavoring to Filipinize various economic sectors, including the public market, banking, import, retailing, and manufactures of rice and millet. As a consequence, there was a severe decline in the scale and scope of business of those members of the Chinese diaspora who were non-Filipino, and the Chinese business network was broken. Doing business was also tough for ethnic Chinese with Filipino citizenship because their loyalty was questioned. Subsequently, the national economy was trapped in a state of high unemployment and low growth (Wen et al. 2000). To utilize the advantages of the Chinese diaspora in business, the state relaxed restrictions on naturalization from 1975 on. About 99% of the Chinese diaspora had become became Filipino citizens in the middle of the 1990s., with the Chinese diaspora in the Philippines then obtaining legal rights in business.

The situation in Thailand was similar to that in the Philippines. From the end of the 1940s to the 1960s, the government adopted policies promoting a nationalist economy and expanded the proportion of national capital. Although the restrictions mainly targeted Chinese who had no Thai citizenship, the economy of Thai Chinese was also affected as a considerable fraction of the private economy was under their control (Wen et al., 2000). From the 1960s, the development of the private economy was encouraged, and the economy of ethnic Chinese started to recover and develop. But the loyalty of Chinese capital to the state was still called into question (K.Sundaram, 2003). In 1975, the situation for ethnic Chinese changed comprehensively. China and Thailand established diplomatic relations and reopened bilateral trade. Naturalization restrictions were relaxed further and Thai Chinese started participating in political life

in the 1980s, providing more freedom for the economic activities of the Chinese diaspora.

Malaysia gained independence in 1957 and there were no specific restrictions on the business of ethnic Chinese, but indigenous Malaysians had privileges over other ethnic groups. Furthermore, the New Economic Policy (NEP), the intention of which was to increase the proportion of indigenous capital and employment, was implemented in 1970 and made the economic environment worse for the Chinese diaspora, especially for medium-sized and small enterprises. As a consequence, the size of the Chinese diaspora economy decreased significantly and a large amount of capital outflowed to Hong Kong and Singapore (Wen et.al, 2000). The implementation of the NEP was not relaxed until the beginning of the 1990s.

In Vietnam, Cambodia, Laos, and Myanmar, the Chinese diaspora economy suffered more from the nationalization of the economy, in addition to the impact of economic nationalism. From 1958 to 1974, the government of northern Vietnam conducted the socialist transformation of the private economic sector and the Chinese diaspora became the organizer of production and labor in state and collective enterprises. Thus, private investments on the part of the ethnic Chinese were impossible. At the same time, the development of the Chinese diaspora in Southern Vietnam also encountered difficulties. Beginning in 1956, restrictions on the occupations of Chinese who had no Vietnamese citizenship disrupted the local economy and caused capital outflows. Although most ethnic Chinese had Vietnamese nationality by 1961 (Zhao, 1993), they only expanded their business to the protected manufacturing of the government. They still had difficulty in raising the scale of business because of limited access to credit. In addition, the Vietnamese government also attributed shortages and inflation during the unification war to faults of the Chinese diaspora. After the unification of Vietnam in 1975, the full nationalization of the private economy started. Since the Chinese diaspora owned the bulk of private capital, their business was almost completely destroyed. The bad relationship between China and Vietnam that began in 1979 made the situation worse. Economic reform that started in 1986 improved the social situation for the ethnic Chinese, and consequently their business grew fast. However, due to the suffering before the unification they recovered only slowly and only gradually gained confidence in the policies of the government. In 1999, the general secretaries of the communist parties of China and

Vietnam laid down the principles of their relationship: long-term stability, future-orientation, good-neighborly friendship, and comprehensive cooperation. This led to a comprehensive improvement in the economic environment of the ethnic Chinese in Vietnam.

The policies towards the Chinese diaspora in Cambodia and Laos were broadly similar to those in Vietnam. The Chinese diaspora in Cambodia also suffered greatly during the governance of the Khmer Kraham from 1975 to 1979, and they were not allowed to do business freely until 1987. Their influence became significant in Cambodia in 1991 when political stability returned. In Laos, the economic environment for the Chinese diaspora has been improving since 1984. The Chinese diaspora economy has recovered its essential position in the national economy again thanks to the economic reform of 1988. Myanmar gained its independence in 1948, and the Chinese diaspora first experienced the period of economic nationalism and then the nationalization of the economy. Myanmar's economic reform started in 1988 and the Chinese diaspora's economic environment has been improving since then.

It is clear then that in most of the years in the second half of the twentieth century, the economic environment for the Chinese diaspora in Southeast Asia, except in Singapore, was full of risk and uncertainty. The consequence was that ethnic Chinese would not expand the scope and scale of investment and lost confidence and trust in the government as the economy developed. Hence, their entrepreneurial ability and work ethic could not be utilized to promote economic development. Although the investment of the Chinese diaspora in the private sector was replaced by indigenous capital in some countries, their role in business operations had no substitutes. Therefore, the attempt to transfer the economic role of the Chinese diaspora to indigenous groups or the state came at a great loss to the national economic development. Because the private economy was mainly controlled by the Chinese diaspora, I conjecture in general that a higher population share of the Chinese diaspora means more severe damage to the national economy when the economic environment for doing business is adverse for the Chinese diaspora, as stated in Hypothesis 2. Nevertheless, once the economic environment becomes benign to the ethnic Chinese and they are allowed to do business without excessive restrictions, their positive role in promoting economic development emerges. The new migration from China started in the 1980s, and nowadays, the Chinese diaspora is very active in Southeast Asia. The

latest estimation of their distribution across countries is shown in Figure 4.1. The share of ethnic Chinese is the highest in Singapore, at 74.7%. The shares in Vietnam and the Philippines, however, are under 2%. Comparing that with the case around the year 1970, shown in Figure 2, we observe an increase in the share of Chinese in countries where the Chinese diaspora accounts for less than 5% of the whole population and a significant decrease in Malaysia. However, the share of Chinese in Malaysia is still higher than in other countries, with the exception of Singapore.

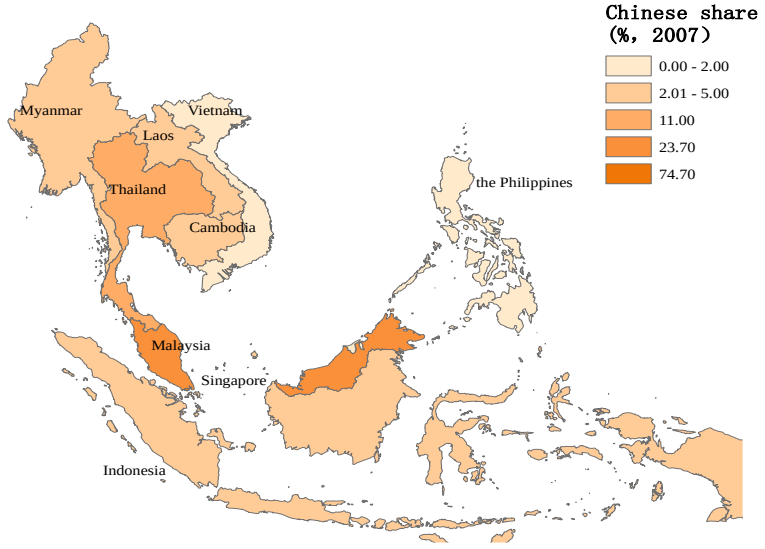

Figure 4.1. The population share of ethnic Chinese in each country around 2007
Source: Own map. The year of data on the population shares in the Philippines is 2006.

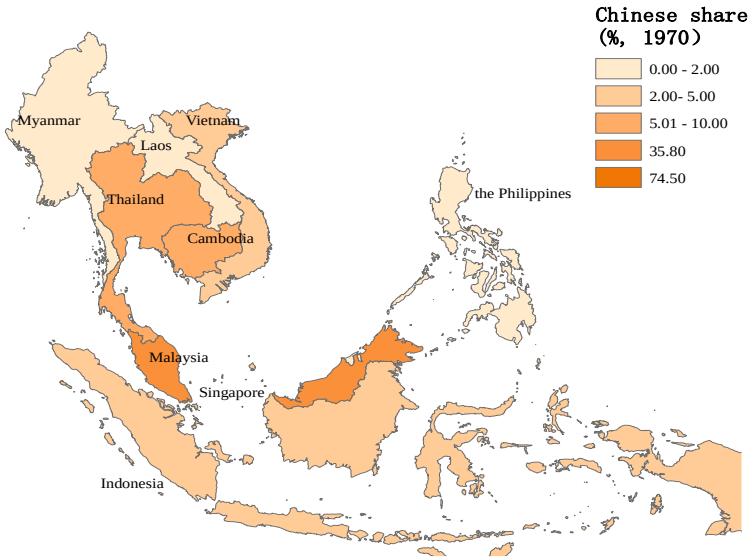

Figure 4.1. The population share of ethnic Chinese in each country around 1970.
Source: Own map.

4.3 Data and empirical strategy

4.3.1 Data

The dataset covers the period from 1959 to 2014 and the 5-year average of data is used for estimation. The countries involved in the analysis are Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. Three primary data sources are used to collect data: research outcomes of scholars, census data, and databases of research institutions. Due to the limited access and accuracy of the data in the population census, data on the population share of the Chinese diaspora in each country is primarily from estimations of researchers and institutes. Table 4.1 reports details of the years with available data and data sources. Since data on the population share in some years is not available, the available data is matched with periods after the year of data acquisition.

Table 4.1. The years with available data and data sources for each country.

Country	The years with available data and data sources
Cambodia	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1975 (Demographics expert report, 2009), 2007 (Zhuang, 2009)
Indonesia	1965 (Fitzgerald, 1972), 1970 & 2000 (Suryadinata, et al., 2003), 1983 (Zhang, 2015), 2007 (Zhuang, 2009)
Laos	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1973 and the beginning of 1980s (Zhuang, 2004), 2001 (Qiu, 2001), 2007 (Zhuang, 2009)
Malaysia	1965 (Fitzgerald, 1972), 1970 &1975 (Hirschman, 1980), 1980 (Zhang, 2015), 1991 & 2000 (Population census), 2006 (Zhuang, 2009)
Myanmar	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1978 (Zhang, 2015), 2001 (Qiu, 2001), 2007 (Zhuang, 2009)
The Philippines	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1983 (Zhang, 2015), 2000, 2006 (Zhuang, 2009)
Singapore	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1990, 2000 & 2009 (Population census)
Thailand	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 2001 (Qiu, 2001), 2007 (Zhuang, 2009)
Vietnam	1965 (Fitzgerald, 1972), 1970 (Lee, 2003), 1978 (Liu and Yu, 1993), 2007 (Zhuang, 2009)

In the original dataset, GDP, population, and human capital are from the Penn World Table 9.1 (PWT 9.1). GDP per capita is obtained by dividing the national GDP by population, and human capital is constructed using the average years of schooling (see Table 3). Data on the gross fixed capital formation, the total amount of foreign trade, and total natural resources rents are from the World Development Indicators (WDI) and they are measured as the fraction of GDP at the end of each year. Financial development is reflected by the ratio of domestic credit to the private sector in GDP extracted from the Global Financial Development Database. A fraction of the data on ethnic fractionalization is calculated using the estimates of population shares of each ethnicity by Esman (1975) and other data are from the research of Alesina et al. (2003). The database of Polity IV provides the index of democratic quality. I also use a dummy variable, island, showing whether a country is an island/on an island or not. Data on the total area, which is the sum of total land area and water area, is abstracted from the research of Spolaore and Wacziarg (2013).

Furthermore, in order to reflect the economic environment of the Chinese diaspora in different periods, a dummy variable, economic environment, is constructed. This takes a value of 0 if the environment is hostile and 1 if the situation is friendly. On the one hand, the dummy is assigned 1 in all periods for Singapore. On the other hand, the dummy takes 1 in the periods after 1999 and 0 in the rest of the periods for the other countries. Although the policy environment improved before 1999 in some countries, it took time for the Chinese to regain trust and confidence in the government and market. The description of the variables and the corresponding data sources are displayed in Table 4.2. The descriptive statistics of the variables and the Pearson correlation matrix are in Table 4.3 and Table 4.4.

Table 4.2. Details of variables and data sources.

Description	Unit	Data source	Notes
GDP per capita	2011 USD at PPP	PWT 9.1	"rgdpna" series / "pop"
Chinese share	% of Pop	Shown in Table 2	The population share of the Chinese diaspora
Gross fixed capital formation	% of GDP	WDI	
Trade	% of GDP	WDI	Export + import
Financial development	% of GDP	GFDD	Domestic credit to the private sector
Natural resources rents	% of GDP	WDI	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.
Ethnic diversity	[0,1]	Esman (1975), Alesina et al. (2003)	$Ethfr = 1 - \sum_{k=1}^{n} s_k^2$, where s_k is the population share of each ethnic group
Population		PWT 9.1	
Human capital	--	PWT9.1 (Barro-Lee)	$HC = e^{\beta \cdot (years\ of\ schooling)}$, where beta is calibrated according to empirical estimations
Polity	(-10 , 10)	Polity IV	Democracy measure
Island	{0,1}		1 if the country is an island or on an island
Total area	km2	Spolaore and Wacziarg (2013)	Sum of land area and water area
Economic environment	{0,1}	Own calculation	The social status of ethnic Chinese

Table 4.3. Descriptive statistics of 5-year average observations

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per capita	91	7118.884	10888.610	633.779	63312.080
Chinese share	95	14.800	23.043	0.150	77.800
Gross fixed capital formation	69	10.494	3.105	5.000	19.400
Trade	75	111.352	99.711	0.200	410.900
Financial development	73	45.589	40.363	2.000	146.500
Natural resources rents	65	6.691	6.993	0.000	30.100
Population	91	49.002	54.944	1.969	248.856
Ethnic diversity	95	0.508	0.199	0.211	0.860
Human capital	91	1.837	0.482	1.158	3.280
Polity	92	-1.492	5.659	-9.000	10.000
Island	95	0.453	0.500	0.000	1.000
Total area	95	509450.400	544537.000	648.000	1919440.000
Economic environment	95	0.358	0.482	0.000	1.000

Table 4.4. Pearson correlation matrix of 5-year average observations

Variable	GDP per capita	Chinese share	Gross fixed capital	Trade	Financial development	Ethnic diversity
Chinese share	0.768***	1				
Gross fixed capital formation	0.132	0.247**	1			
Trade	0.836***	0.897***	0.008	1		
Financial development	0.628***	0.471***	0.319**	0.592***	1	
Ethnic diversity	-0.081	-0.065	0.243**	-0.303***	-0.044	1
Natural resources rents	-0.266**	-0.118	0.405***	-0.286**	-0.093	0.345***
Population	-0.168	-0.373***	-0.242**	-0.409***	-0.078	0.283***
Human capital	0.676***	0.336***	0.104	0.497***	0.745***	-0.174*
Polity	0.158	0.169	0.273**	0.102	0.330***	0.07
Island	0.415***	0.492***	0.148	0.334***	0.251**	0.259**
Total area	-0.248**	-0.357***	-0.171	-0.449***	-0.226*	0.542***
Economic environment	0.479***	0.402***	-0.238**	0.526***	0.323***	-0.253**

Variable	Natural resources rents	Population	Human capital	Polity	Island	Total area
Natural resources rents	1					
Population	0.04	1				
Human capital	-0.219*	0.212**	1			
Polity	-0.067	0.094	0.466***	1		
Island	0.154	0.267**	0.432***	0.396***	1	
Total area	0.227*	0.856***	-0.124	-0.084	0.240**	1
Economic environment	-0.283**	0.032	0.576***	0.208**	0.159	-0.156

4.3.2 Empirical Strategy

The primary objective of this study is to identify the effect of ethnic Chinese on national economic growth in Southeast Asia. The basic specification is as follows:

$$\ln y_{it} = \alpha_0 + \alpha_1 ChineseShare_{it} + \beta X_{it} + \gamma \ln y_{i,t-1} + \gamma^T \mathrm{P} + \varepsilon,$$

where, (i) $\ln y_{it}$ is the logarithm of GDP per capita for country i in period t; (ii) $ChineseShare_{it}$ is the independent variable measured by the share of ethnic Chinese population in country i and period t; (iii) X_{it} are control variables including economic factors, social characteristics, and geographical factors. The economic variables are gross fixed capital formation, financial development, trade, and natural resources rents. The social characteristics are reflected by ethnic diversity, population, human capital, and polity. The geographical factors show whether the country is on

an island and its total area. Furthermore, I include logarithms of the economic variables, human capital, and total area in the regression; (iv) $\ln y_{i,t-1}$ is the logarithm of GDP per capita in the lagged period; (v) P is a vector of period dummies to control the time trend. As I argue that the Chinese diaspora is helpful for economic growth because of its superiority in cultural traditions and business networks, the economic factors are all controlled, although some data concerning the economic factors is missing, as shown in Table 4.3.

The baseline regression is carried out with pooled OLS and pooled 2SLS on the whole sample to test Hypothesis 1. The share of the Chinese diaspora is instrumented by two variables. The first instrument is the number of product categories per unit area in the 1930s. The products originated mainly from the production of mines and plantations, and particularly the port service in Singapore. For one thing, the number of product categories reflects the level of exploitation of economic resources during the colonial period. For another, the level of exploitation of economic resources is positively associated with the number of Chinese immigrants because they were the major participants in colonial development, especially in the 1930s when the colonists had little time to engage in Southeast Asian affairs. Therefore, the number of product categories is related to the scale of the Chinese diaspora in the 1930s. Furthermore, the current distribution of the Chinese diaspora is mainly determined by earlier Chinese immigration to Southeast Asia because the scale of new immigration is much smaller than that of earlier immigration (Zhuang, 2009). Hence, the number of product categories is also related to the current size of the Chinese diaspora. As the independent variable is the population share of the Chinese diaspora, the instrument is adjusted by the land area of each country.[45] Data on the number of categories of mineral and plant products is obtained from the Nanyang Yearbook (1939), and the variable is assigned 1 for Singapore as its primary function was to provide the port service. The second instrument is a dummy of the massacre, with this reflecting whether there was any massacre during the colonial period. There were massacres targeting the Chinese diaspora perpetrated by colonists in Indonesia and the Philippine, which may have discouraged migration from China to these two countries.

[45] The unit of land area is 100 square kilometers.

In the pooled 2SLS regressions, both instruments will be used singly in one regression.

After conducting regressions on the whole sample, I examine the effect of the Chinese diaspora under different economic environments to test Hypothesis 2. Regressions are therefore carried out on the subsample where the economic environment is adverse and the subsample where the economic environment is friendly. In addition, to test Hypothesis 3, regressions are conducted on the sample when Singapore is taken into account. Furthermore, I use pooled OLS and pooled 2SLS based on the basic specification model in all the regressions.

4.4 Results

Results of the baseline regression

Table 4.5 reports the results of the regressions on the whole sample. Columns (1)-(3) are estimations using pooled OLS where control variables are added step by step. We observe that the coefficients of the Chinese share are positive and significant at the 1-percent level in all the regressions. The R-squared is also very high, but tests show that there is a cointegration relationship between the Chinese share and economic development, which means that the OLS model does not result in spurious regressions. The high R-squared is more likely to be a consequence of the limited sample size. Furthermore, since the coefficient changes when geographical variables are included, all the regressions in the following include all the control variables in Column (3). Columns (4)-(5) display the results of the pooled 2SLS regressions for the whole sample. The instrumental variable is the number of product categories per unit area in the estimation of column (4) and the dummy of the massacre is the instrument of column (5). The results show that the F-statistics of the first-stage regression are greater than 10 and, therefore, every single instrument passes the test of weak identification. Furthermore, the exclusion of instruments is examined by including them in the regressions directly. The results show that both instruments are significant at the 1-percent level when the Chinese share is not included in the regression. Once the Chinese share is included in the regression, the number of product categories is not significant, and the dummy of the massacre experiences decreases in both magnitude and the significance level of its coefficient (See Table D.1 in the Appendix). Hence, both instruments are valid. Estimations of the second stage show that coefficients of the

Chinese share are still positive and significant at the 1-percent level. Hence, economic growth is faster for countries with a higher population share of the Chinese diaspora in Southeast Asia over the last few decades. By controlling economic factors in the regressions, the effect can be attributed to the group traits of the Chinese diaspora, including their cultural traditions and business network.

Table 4.5. Results of regressions for the whole sample.

	Pooled OLS			Pooled 2SLS	
Variable	(1)	(2)	(3)	(4)	(5)
Chinese share	0.006***	0.006***	0.010***	0.008***	0.013***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
GDP per capita in the lagged period	0.808***	0.740***	0.749***	0.766***	0.703***
	(0.029)	(0.047)	(0.044)	(0.037)	(0.040)
Gross fixed capital formation.	0.248***	0.209***	0.237***	0.240***	0.230***
	(0.048)	(0.050)	(0.046)	(0.037)	(0.036)
Trade	-0.093**	-0.014	0.027	0.033	0.009
	(0.041)	(0.051)	(0.057)	(0.043)	(0.047)
Financial development	0.058**	0.040	0.001	0.003	-0.003
	(0.025)	(0.024)	(0.031)	(0.026)	(0.024)
Natural resources rents	0.000	-0.020*	-0.070***	-0.061***	-0.092***
	(0.008)	(0.010)	(0.019)	(0.021)	(0.018)
Ethnic diversity		0.281***	0.167**	0.174***	0.150***
		(0.083)	(0.062)	(0.051)	(0.056)
Population		-0.003	-0.021	-0.018	-0.030**
		(0.015)	(0.016)	(0.014)	(0.012)
Human capital		0.177	0.280*	0.219	0.441***
		(0.138)	(0.148)	(0.141)	(0.138)
Polity		-0.001	-0.005***	-0.005***	-0.007***
		(0.001)	(0.002)	(0.002)	(0.002)
Island			-0.002	-0.001	-0.004
			(0.025)	(0.020)	(0.020)
Total area			0.068***	0.057**	0.096***
			(0.021)	(0.025)	(0.021)
Time effect	Yes	Yes	Yes	Yes	Yes
Constant	1.227***	1.424***	0.462	0.438	0.525
	(0.369)	(0.437)	(0.585)	(0.452)	(0.473)
Observations	53	53	53	53	53
R-squared	0.997	0.998	0.999	0.999	0.998
F-statistic in the 1st stage				12.98	14.51
Number of product categories				0.973***	
				(0.27)	
Massacre					-25.473***
					(6.688)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The Influence of the economic environment

The results of the regressions considering the influence of the social environment on ethnic Chinese are presented in Table 4.6. Columns (1)-(3) contain the estimations for the subsample when the economic environment is adverse for the Chinese diaspora, and columns (4)-(6) the estimations when the economic environment is favorable. Columns (1) and (4) show the results of pooled OLS regressions and the other columns display the results obtained using pooled 2SLS regressions. The result in column (1) shows that the effect of the Chinese share is not significant in the economic environment that is adverse for the Chinese diaspora, but the results of IV regressions show that the effect is negative and significant at the 1-percent level, which is consistent with Hypothesis 2. When the economic environment is discriminatory against the Chinese diaspora, Chinese immigrants are forced to quit some businesses, which are then taken over by indigenous groups or the state. Therefore, the conversion in the economic role from the Chinese diaspora to other groups is detrimental to economic growth, and this increases with the population share of the Chinese diaspora. However, we observe a positive and significant effect of the Chinese share on economic growth in an economic environment that is favorable for ethnic Chinese. Thus, economic growth benefits from the Chinese diaspora when the ethnic Chinese are free to undertake economic activities. The results are also consistent with the hypothesis on the difference in the effect between a bad economic environment and a good economic environment for the Chinese diaspora. Hence, in addition to material inputs, the critical issue in relation to economic growth is who is engaged in economic activities. Furthermore, instrumental variables have significant effects on the Chinese share in the first-stage regressions, but no direct influence on economic growth when the Chinese share is controlled in the regressions (See Table D.2 in the Appendix). Thus, both instruments account for the exogenous variation in the Chinese share in each subsample. Moreover, as the coefficients in columns (4)-(6) are greater than those in Table 4.5, the results in Table 4.6 are also consistent with estimations for the whole sample.

Table 4.6. Results of regressions for subsamples in different social environments.

	Economic environment=0			Economic environment=1		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Chinese share	-0.009	-0.007**	-0.011***	0.030***	0.026***	0.039***
	(0.006)	(0.003)	(0.003)	(0.006)	(0.004)	(0.004)
GDP per capita in	0.620***	0.629***	0.608***	0.635***	0.641***	0.621***
the lagged period	(0.094)	(0.045)	(0.053)	(0.110)	(0.059)	(0.066)
Gross fixed capital formation.	0.506**	0.482***	0.534***	0.101**	0.104***	0.095***
	(0.158)	(0.070)	(0.077)	(0.039)	(0.027)	(0.022)
Trade	0.064	0.064	0.064	-0.323***	-0.272***	-0.428***
	(0.095)	(0.050)	(0.046)	(0.058)	(0.047)	(0.052)
Financial development	0.026	0.018	0.036	0.007	0.012	-0.004
	(0.046)	(0.020)	(0.022)	(0.050)	(0.027)	(0.029)
Natural resources rents	0.085	0.071**	0.102***	-0.110**	-0.091***	-0.149***
	(0.062)	(0.030)	(0.034)	(0.045)	(0.024)	(0.032)
Ethnic diversity	-0.065	-0.044	-0.090*	-0.447	-0.300	-0.751***
	(0.102)	(0.047)	(0.050)	(0.336)	(0.209)	(0.212)
Population	-0.251**	-0.229***	-0.277***	-0.076***	-0.068***	-0.094***
	(0.080)	(0.041)	(0.047)	(0.015)	(0.009)	(0.013)
Human capital	1.372*	1.329***	1.423***	1.133***	1.040***	1.325***
	(0.687)	(0.345)	(0.384)	(0.266)	(0.148)	(0.168)
Polity	0.007	0.005**	0.008***	-0.008	-0.006**	-0.011***
	(0.006)	(0.003)	(0.003)	(0.006)	(0.003)	(0.004)
Island	-0.163*	-0.159***	-0.168***	-0.220***	-0.189***	-0.283***
	(0.082)	(0.041)	(0.047)	(0.059)	(0.038)	(0.042)
Total area	0.335***	0.315***	0.358***	0.234**	0.190***	0.324***
	(0.083)	(0.045)	(0.050)	(0.079)	(0.048)	(0.056)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.974***	-2.784***	-3.278***	1.109	1.316**	0.684
	(0.690)	(0.445)	(0.394)	(1.210)	(0.637)	(0.746)
Observations	24	24	24	29	29	29
R-squared	0.999	0.999	0.999	0.9998	0.998	0.9998
F-statistic in the 1st stage		7.80	12.98		10.21	5.24
Number of product categories		3.820**			-1.427**	
		(1.368)			(0.447)	
Dummy of the massacre			-21.627**			-10.307*
			(6.003)			(4.501)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The Influence of the development level

To test the influence of the development level of Hypothesis 3, regressions are run on the sample without Singapore and the results are shown in Table 4.7. Column (1) displays the result of a pooled OLS regression, and the results of the remaining columns are obtained using pooled 2SLS estimations. Firstly, we observe that the coefficients of the Chinese share are all positive and significant at the 1-percent level. Therefore, the population share of the Chinese diaspora still has a positive effect on economic growth in developing countries. Secondly, the coefficients of the Chinese share in Table 4.7 are greater than those in Table 4.5. By running regressions using models of column (3) in Table 4.5 and column (1) in Table 4.7 without robust error, the difference between the two coefficients of the Chinese share is examined, and we find the difference is significant. By including instruments in OLS regressions directly, we also observe that their effects on economic growth are not significant when the Chinese share is regressed simultaneously (See Table D.3 in the Appendix). Thus, the results of the IV regressions are reliable and the exclusion of Singapore from the sample results in higher coefficients of the Chinese share. Hence, the effect of the Chinese diaspora is stronger in developing economies than in the developed economy, and Hypothesis 3 is proved.

Table 4.7. Results of regressions for subsamples without Singapore

Variables	(1)	(2)	(3)
Chinese share	0.014***	0.019***	0.016***
	(0.003)	(0.005)	(0.002)
GDP per capita in the lagged period	0.739***	0.739***	0.739***
	(0.061)	(0.045)	(0.044)
Gross fixed capital formation.	0.235***	0.228***	0.232***
	(0.056)	(0.042)	(0.040)
Trade	-0.012	-0.049	-0.025
	(0.085)	(0.069)	(0.059)
Financial development	-0.013	-0.031	-0.019
	(0.029)	(0.025)	(0.022)
Natural resources rents	-0.093***	-0.118***	-0.102***
	(0.020)	(0.032)	(0.018)
Ethnic diversity	0.193**	0.221***	0.203***
	(0.092)	(0.081)	(0.071)
Population	0.009	0.045	0.021
	(0.052)	(0.040)	(0.036)
Human capital	0.302	0.274	0.292
	(0.283)	(0.202)	(0.201)
Polity	-0.009***	-0.012***	-0.010***
	(0.002)	(0.004)	(0.002)
Island	0.001	0.003	0.002
	(0.030)	(0.022)	(0.022)
Total area	0.037	0.002	0.025
	(0.070)	(0.048)	(0.047)
Time effect	Yes	Yes	Yes
Constant	1.041	1.658**	1.254*
	(1.031)	(0.827)	(0.697)
Observations	44	44	44
R-squared	0.997	0.997	0.997
F-statistic in the 1st stage		6.73	32.64
Number of product categories		2.279**	
		(0.878)	
Dummy of the massacre			-17.523***
			(3.068)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5 Robustness checks

The above analysis suggests a positive relationship between Chinese share and economic growth in Southeast Asia over the last few decades, but the relationship is influenced by the economic environment for the Chinese diaspora and the economic development level. In the following analysis, I will reexamine the relationship with an alternative instrument, a dummy of the sea route between China and Southeast Asia. Large numbers of Chinese immigrants took the sea route to Southeast Asia (Guo, 1998). Therefore, whether there was a port in the country along the sea route from China also influences the scale of Chinese immigration to the country. Indeed, the relationship between China and Southeast Asia had already been established before the arrival of the colonists. However, it was primarily maintained by the tributary trade system because of the seafaring prohibition policy during the Ming dynasty. The greatest overseas event during the Ming dynasty was Zheng He's voyages from 1405 to 1433. According to the research of Wen (1929), there were eight ports located in Southeast Asia where he stopped during his voyages. Based on the current map, these ports are in Cambodia, Indonesia, Malaysia, Singapore, Thailand, and Vietnam. The connections between these ports and China may have made it easier for these countries to accept more immigrants from China during the colonial period. Therefore, a dummy of the port is constructed. If a country has a port along the sea route of Zheng He, the dummy takes the value 1. Otherwise, the dummy takes the value 0.

Then, using the dummy of the port as the instrument, I run pooled 2SLS regressions on the whole sample, with subsamples divided according to the economic environment and the sample without Singapore. The results are reported in Table 4.8. Column (1) shows that the positive effect of the Chinese diaspora persists at the 1-percent level for the whole sample, which is similar to estimations for the whole sample in Table 5. Furthermore, columns (2) and (3) show that the negative effect in a bad economic environment and the positive effect in a good economic environment still exist. When Singapore is excluded, the coefficient of the Chinese share is smaller than those in Table 4.7, but it is still larger than the coefficient in column (3) of Table 4.5. In addition, the results of the first-stage regressions suggest a positive effect of the port on the share of the Chinese diaspora. The validity of the instrument is also examined and we can see that the dummy affects economic growth through the

influence of the Chinese diaspora (See Table D.4 in the Appendix). Hence, the effect of the Chinese diaspora on economic growth is robust.

Table 4. 8. Results of regressions with an alternative instrument – dummy of the port

VARIABLES	Whole sample	Economic environment=0	Economic environment=1	Singapore=0
	(1)	(2)	(3)	(4)
Chinese share	0.009***	-0.011***	0.033***	0.013***
	(0.002)	(0.003)	(0.004)	(0.004)
GDP per capita in the lagged period	0.751***	0.608***	0.630***	0.739***
	(0.038)	(0.053)	(0.059)	(0.045)
Gross fixed capital formation.	0.237***	0.534***	0.098***	0.236***
	(0.037)	(0.077)	(0.019)	(0.041)
Trade	0.027	0.064	-0.361***	-0.002
	(0.042)	(0.046)	(0.043)	(0.060)
Financial development	0.002	0.036	0.003	-0.008
	(0.025)	(0.022)	(0.027)	(0.025)
Natural resources rents	-0.069***	0.103***	-0.124***	-0.087***
	(0.019)	(0.035)	(0.029)	(0.023)
Ethnic diversity	0.168***	-0.091*	-0.556***	0.186***
	(0.049)	(0.050)	(0.199)	(0.067)
Population	-0.021*	-0.277***	-0.083***	-0.001
	(0.012)	(0.049)	(0.011)	(0.044)
Human capital	0.273**	1.423***	1.202***	0.309
	(0.130)	(0.388)	(0.146)	(0.211)
Polity	-0.005***	0.008***	-0.009**	-0.008***
	(0.002)	(0.003)	(0.004)	(0.003)
Island	-0.002	-0.168***	-0.242***	0.001
	(0.019)	(0.047)	(0.034)	(0.022)
Total area	0.066***	0.358***	0.266***	0.046
	(0.023)	(0.052)	(0.052)	(0.053)
Time effect	Yes	Yes	Yes	Yes
Constant	0.459	-3.280***	0.956	0.886
	(0.448)	(0.425)	(0.677)	(0.764)
Observations	53	24	29	44
R-squared	0.999	0.999	0.9998	0.997
F-statistic in the 1st stage	26.02	7.12	5.07	25.79
Dummy of the port	14.449***	25.659**	7.502*	8.253***
	(2.832)	（9.614)	(3.332)	(1.625)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.6 Conclusions

In this chapter, the effect of the Chinese diaspora on economic growth in Southeast Asian countries is explored with a pooled OLS model and IV approach. With 5-year average data over the period 1959-2014, the relationship between the population share of the Chinese diaspora and economic growth is estimated. Considering the potential endogeneity between Chinese immigration and economic development in Southeast Asia, the population share of the Chinese diaspora is instrumented using three historical variables, the number of product categories in the 1930s, the dummy of the massacre by colonists, and the dummy of the port along the sea route of Zheng He's voyages. I also consider the influences of a discriminatory economic environment against the Chinese diaspora and the economic development level.

I find that, the population share of the Chinese diaspora is positively associated with the economic growth of the last few decades. However, a discriminatory economic environment results in lower economic growth in countries with higher population shares of the Chinese diaspora. This also implies that it is detrimental to implement discriminatory policies against an efficient fraction of the economy. Hence, local governments should find better ways to promote integration between the Chinese diaspora economy and the local economy of indigenous groups. Furthermore, the regressions on the sample without Singapore show that the positive effect of the Chinese diaspora is more potent in developing countries. The regressions using different instruments moreover show that the effects are robust. What is more, since economic factors are controlled in the regressions, the effect of the Chinese diaspora can be attributed to the superiority of the Chinese diaspora in their cultural traditions and business networks. However, due to the limited availability of data, the sample is small and the effect in developed countries cannot be examined directly. Further study may be possible when more data is available.

Conclusions

The dissertation analyzes the effect of cultural diversity and historical factors on economic outcomes through theoretical and empirical analysis. In the first chapter, I study the relationship between cultural diversity and public spending under different political systems through a theoretical model. The second chapter explores the relationship between dialect diversity and economic performance at the prefectural-level in China. The rest two chapters are cross country studies about state antiquity and the Chinese diaspora in Southeast Asia, respectively.

In Chapter 1, I develop a theoretical model of how cultural fractionalization affects the level of public spending under direct and representative democracy, and soft and repressive authoritarianism. In the model, the individual utility is affected by cultural diversity through limited satisfaction with public goods and antagonism against other cultural groups. Under different political regimes, cultural groups have different political influences on public decision making and politicians also have different motivations to stay in the office. According to the discussion of interactions of citizens and politicians, I find that this relationship varies according to political regimes and the level of cultural diversity. The monotone decreasing relationship is found only under soft authoritarianism. In a direct democracy, public spending only decreases monotonically with cultural diversity when cultural diversity is low. When cultural diversity is intermediate or high, the relationship is inverse U-shaped. Under representative democracy with accountable politicians, public spending decreases monotonically with cultural diversity when diversity is low and intermediate if all electoral districts have the same population distribution over cultural groups. If the two largest groups concentrate in each half of electoral districts, the relationship is inverted U-shaped at the intermediate level of diversity, and the coalition is formed between representatives of the two largest groups. At high cultural diversity, rise and fall in public spending take place by turn as diversity increases regardless of the population distribution of different groups. When political representatives are rent-seeking under representative democracy, public spending decreases as cultural diversity increases when diversity is low or high, but it increases first and then decreases at the intermediate level. Under repressive authoritarianism, the level of

public spending is mainly determined by the probability of rebellion and the cost of repression. decreases first and then increases at a low level of diversity. Then, rise and fall alternate from the intermediate diversity.

Hence, the pattern of the relationship between public spending and cultural diversity is related to political systems and the interval of cultural diversity. The results provide an explanation for inconsistent conclusions of the empirical literature. Therefore, future empirical studies should consider the effect of political institutions and the nonmonotonic relationship. However, another issue that deserves further discussion is the co-evolution of cultural diversity and political institutions. A society that is diverse in culture has higher requirements for the efficiency of public decision-making and political institutions may change accordingly. It would, therefore, be interesting to explore how cultural diversity contributes to institution changes.

The relationship between cultural diversity and economic performance is also reexamined by exploring the effect of dialectal diversity on economic development at the prefecture-level in China in Chapter 2. We show that dialectal diversity is a proper measure of cultural diversity in China because different dialectal groups are inclined to have different values and behavior. We improve the empirical analysis based on the research of Xu et al. (2015) by using five indices of dialectal diversity and running fixed effect regressions for a panel sample of 5-year average data covering the period 2001-2015. To solve the endogeneity problem, pooled 2SLS, FE-2SLS, and IV-GMM are also applied. Furthermore, differences in the effect between cities that were governed by the CCP during the revolutionary war and those that were not are also explored.

In contrast to the negative effect found in literature, we find that dialectal fractionalization and dialectal polarization have a positive and robust effect on both the level of economic development and economic growth. Of the indices considering dialectal distances, only periphery heterogeneity has a robust and positive effect on economic growth. Adjusted dialectal fractionalization, however, shows a significant effect on the change in economic growth over time, while adjusted dialectal polarization does not have any robust effects. The result implies that dialect distances play a role in affecting economic development, but the dialectal distance between two polarized groups is not critical. Furthermore, the experience of being governed by the Chinese Communist Party during the revolutionary war augments the positive influence of dialectal diversity in eastern China, while it impairs the positive

relationship in central and north-eastern regions of the country. Above all, this study contributes to a better understanding of how cultural diversity affects economic development. But the research is based on the data available. Future studies can be done to identify the long-run effect of dialectal diversity on economic development when more data is revealed. Besides, the potential channels behind the effect of dialectal diversity also deserve further study.

The third chapter explores the relationship between state antiquity and the working of capitalism form the finance-growth perspective. As the financial sector has a decisive role in economic growth under capitalism, we argue that finance-growth nexus is impaired in more ancient countries where interest groups might be more entrenched and powerful to capture lending activities. We have two steps to prove our theory. First, we develop a theoretical model illustrating how antiquity may support the emergence of extractive institutions and deeper entrenchment of interest groups in lending. The model provides two equilibria: (1) Economic elites are not capable to capture the financial sector in countries with a shorter state history; (2) Economic elites in older countries are strong enough to capture banks in their lending activity.

Second, the less favorable effect of financial development, measured by the amount of credit, is examined in more ancient states through the method of dynamic panel threshold regressions. Our sample has 118 countries covering the period from 1970 to 2014. To measure the state antiquity, we applied the index of statehood length considering the last six millennia, constructed by Borcan et al. (2018), and the agricultural years constructed by Putterman and Trainor (2018). Through our theoretical model and empirical analysis, we present robust results supporting the argument that antiquity harms the finance-growth nexus. We find that the effect of financial development on economic growth becomes negative in older societies, while the effect of financial development is positive in younger societies.

The first contribution of this study contributes to the literature is that we provide a profound establishment in the non-linear finance-growth literature from the perspective of state antiquity. Besides, the deep historical roots of corruption in the financial market are revealed. We also contribute to elaborating on a channel behind the persistent effect of state history on contemporary socio-economic outcomes. Furthermore, our empirical results also demonstrate that the investment-growth nexus and the government expenditures-growth nexus are alternative promising

channels that might help to elaborate the link between the deep roots and economic development further. The investigation of these can be a subject for future research.

In the fourth chapter, I explore the effect of ethnic Chinese on economic growth in Southeast Asian countries through empirical estimation. The Chinese diaspora has superiority in work ethic and entrepreneurial abilities and plays a critical role in the private economy in Southeast Asia as the legacy of colonial development. Therefore, I hypothesize that countries with a higher population share of ethnic Chinese are inclined to have higher economic growth. Besides, I argue that the effect is conditional on the economic environment of doing business for the Chinese diaspora and the development level.

To to the estimation, I apply a pooled OLS model and IV approach using a dataset with the 5-year average data over the period 1959-2014. In IV regressions, the population share of the Chinese diaspora is instrumented using three historical variables, the number of product categories in the 1930s, the dummy of the massacre by colonists, and the dummy of the port along the sea route of Zheng He's voyages. Regressions are also run for samples in accordance with different economic environments and the sample excluded Singapore.

The empirical results show that economic growth is positively associated with the population share of the ethnic Chinese in the last few decades. However, as a consequence of the discriminatory economic environment results, countries with higher population shares of the Chinese diaspora have lower economic growth. This also indicates that discriminatory policies against an efficient fraction of the economy are harmful to economic growth. Besides, the regressions on the sample without Singapore show that the positive effect is more prominent in developing countries. Hence, local governments should find better ways to promote integration between the Chinese diaspora business and the economy of indigenous groups. The primary contribution of this chapter to the literature is that we present an empirical analysis of the relationship between ethnic Chinese and economic growth in Southeast Asia. However, due to the limited availability of data, the sample is small. Further study also deserves attention when more data is available.

Appendix A.

Appendix to Chapter 1

A.1 The relationship between ELF and GI.

Suppose that J_1 and J_2 are two groups whose population share changes. In terms of culture, group J_1 is most distant from other groups and group J_2 closest to the other groups.

$$GI = \sum_{j \neq J_1}^{K} s_{J_1} s_j r_{J_1 j} + \sum_{k \neq J_1}^{K} \sum_{j=1}^{K} s_k s_j r_{kj}$$

$$= 2 \sum_{j \neq J_1, J_2}^{K} s_{J_1} s_j r_{J_1 j} + 2\, s_{J_1} s_{J_2} r_{J_1 J_2} + 2 \sum_{j \neq J_1, J_2}^{K} s_{J_2} s_j r_{J_2 j} + \sum_{k \neq J_1, J_2}^{K} \sum_{j \neq J_1, J_2}^{K} s_k s_j r_{kj}$$

When s_{J_1} decreases by Δ, s_{J_2} increases by Δ,

$$GI' = 2 \sum_{j \neq J_1, J_2}^{K} (s_{J_1} - \Delta) s_j r_{J_1 j} + 2\, (s_{J_1} - \Delta)(s_{J_2} + \Delta) r_{J_1 J_2} + 2 \sum_{j \neq J_1}^{K} (s_{J_2} + \Delta) s_j r_{J_2 j} + + \sum_{k \neq J_1, J_2}^{K} \sum_{j \neq J_1, J_2}^{K} s_k s_j r_{kj} .$$

$$GI' - GI = 2\Delta \sum_{j \neq J_1, J_2}^{K} s_j (r_{J_2 j} - r_{J_1 j}) + 2\Delta\, s_{J_1} r_{J_1 J_2} - 2\Delta\, s_{J_2} r_{J_1 J_2} - 2\Delta^2 r_{J_1 J_2}$$

$$= 2\Delta \sum_{j \neq J_1, J_2}^{K} s_j (r_{J_2 j} - r_{J_1 j}) + 2\Delta r_{J_1 J_2} (\, s_{J_1} - s_{J_2} - \Delta)$$

.

Suppose that $r_{J_1 j} = \delta r_{J_2 j}, r_{J_1 J_2} = \rho r_{J_2 j}$,

$$GI' - GI = 2\rho \Delta r_{J_2 j} [s_{J_1} - s_{J_2} - \Delta + \frac{1-\delta}{\rho} \sum_{j \neq J_1, J_2}^{K} s_j] \;\; (j \neq J_1, J_2).$$

If $r_{J_1 j} < r_{J_2 j}, r_{J_1 J_2} < r_{J_2 j}, \delta < 1$. Then $s_{J_1} - s_{J_2} - \Delta + \frac{1-\delta}{\rho} \sum_{j \neq J_1, J_2}^{K} s_j > 0$ when $s_{J_1} > s_{J_2}$. Therefore, $GI' - GI > 0$ as long as $s_{J_1} > s_{J_2}$. However, if $r_{J_1 j} > r_{J_1 J_2} > r_{J_2 j}$, $\delta > 1$. Then, it is possible that $GI' - GI < 0$. For example, if $r_{J_1 j} = 0.6, r_{J_1 J_2} = 0.3$ and $r_{J_2 j} = 0.2$, $\delta = 3$ and $\rho = 1.5$. Then, $\frac{1-\delta}{\rho} = -\frac{4}{3}$ and $GI' - GI = 3\Delta r_{J_2 j} [s_{J_1} - s_{J_2} - \Delta - \frac{4}{3} \sum_{j \neq J_1, J_2}^{K} s_j] \;\; (j \neq J_1, J_2)$. In this case, $GI' - GI < 0$ when group J_1 is not the majority. Hence, only when the population distribution is more balanced among groups who are more distant from each other in

culture, the change in ELF and the change in GI are consistent.

A.2 Proof of Lemma 1.1

It is obvious that $\frac{\partial a_k}{\partial s_k} > 0$ since $\beta < 1$. Since the decrease s_k means an increase in the population share of other cultural groups, we cannot obtain the relationship between b_k and s_k by partial derivation. Assume s_k decreases by Δs_k and s_j increases by Δs_j ($j = 1,...,K$ and $j \neq k$). Then

$$\Delta b_k = -\Delta s_k \theta_k + \beta \sum_{j=1, j\neq k}^{K} \Delta s_j \theta_j$$

Since $\Delta s_k = \sum_{j=1, j\neq k}^{K} \Delta s_j$, if $\theta_k \geq \theta_j$,

$$\frac{|\Delta b_k|}{|\Delta a_k|} = \frac{\theta_k - \beta \sum_{j=1, j\neq k}^{K} \Delta s_j \theta_j \Big/ \Delta s_k}{1-\beta} > \theta_k \text{ , } \quad \frac{b_k}{a_k} = \frac{(1-\beta)\theta_k + \beta \sum_{j=1}^{K} s_j \theta_j \Big/ s_k}{(1-\beta) + \beta / s_k} < \theta_k \text{ .}$$

Hence, $\frac{|\Delta b_k|}{|\Delta a_k|} > \frac{b_k}{a_k}$ and we know that $\frac{\partial (b_k / a_k)}{\partial s_k} > 0$.

If $\theta_k < \theta_j$, the result is reversed. Then Lemma 1 is proved.

A.3 Proof of Lemma 1.4

Suppose that for the two groups k and j, $s_k > s_j$ and $\frac{f_k}{f_j} = \frac{s_k}{s_j}$ with $f_k + f_j = 1$. Let $s_j + s_k = s$. If the public spending is determined through maximizing the joint utility of group k and j,

$$a_k s_k + a_j s_j = (1-\beta)(s_k^{\ 2} + s_j^{\ 2}) + \beta(s_k + s_j)$$

$$b_k s_k + b_j s_j = s_k^2 + s_j^2 + 2\beta s_k s_j - (1+\beta) s_k s_j r_{kj} + \beta \sum_{i \neq j,k}^{K} s_i (s_k r_{ki} + s_j r_{ji})$$

$$= a_k s_k + a_j s_j + \beta(s_k^2 + s_j^2) - \beta(s_k + s_j) + 2\beta s_k s_j - (1+\beta) s_k s_j r_{kj} + \beta \sum_{i \neq j,k}^{K} s_i (s_k r_{ki} + s_j r_{ji})$$

.

Then, $$\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j} = 1 - \frac{\beta(s_k^2 + s_j^2) - \beta(s_k + s_j) + 2\beta s_k s_j - (1+\beta) s_k s_j r_{kj} + \beta \sum_{i \neq j,k}^{K} s_i (s_k r_{ki} + s_j r_{ji})}{(1-\beta)(s_k^{\ 2} + s_j^{\ 2}) + \beta(s_k + s_j)}$$

Substituting $s_j = s - s_k$, we have

$$\frac{\partial\left(\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j}\right)}{\partial s_k} = -\frac{\Delta}{(a_k s_k + a_j s_j)^2}$$

$$\Delta = (a_k s_k + a_j s_j)\left[(1+\beta) r_{kj}(s - 2s_k) + \beta \sum_{i \neq j,k}^{K} s_i (r_{ki} - r_{ji})\right] - \left[(1+\beta) s_k s_j r_{kj} + \beta \sum_{i \neq j,k}^{K} s_i (s_k r_{ki} + s_j r_{ji})\right](1-\beta)(4s_k - 2)$$

If $s_k \geq 1/2$, we know that $s_k > s_j + \sum_{i \neq j,k}^{K} s_i$ and $4s_k - 2 > 0$. Furthermore, $1 + \beta > 2\beta$, $|r_{ki} - r_{ji}| < r_{kj}$, and $s - 2s_k < 0$. Therefore, $\Delta < 0$. Then $\frac{\partial\left(\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j}\right)}{\partial s_k} > 0$. Since g is monotonically increasing in $\frac{b}{a}$, we know that the public spending level maximizing the joint utility is decreasing in the decreasing of s_k when $s_k \geq 1/2$. If $s_k < 1/2$ and $s_k > s_j$, we have a lower limit of $\underline{s_k}$ which makes $\frac{\partial\left(\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j}\right)}{\partial s_k} > 0$. If $s_k \leq \underline{s_k}$, we have

$\frac{\partial(\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j})}{\partial s_k} \le 0$ and we know that $\frac{\partial(\frac{b_k s_k + b_j s_j}{a_k s_k + a_j s_j})}{\partial s_k} < 0$ when $s_k = s_j$.

A.4 Proof of Lemma 1.5

We know that $(g_k)^\sigma = p_k(ty)^\sigma + (1-p_k)\frac{b_k''}{b_k}(g_a^*)^\sigma - (1-p_k)\frac{\beta(1-s_k)}{b_k}(y-ty)$. Thus, g_k is increasing in p_k, $\frac{b_k''}{b_k}$, s_k and b_k. Suppose that there are two groups J_1 and J_2, group J_1 is the largest group and closer to other groups in cultural distances. Therefore, $s_{J_1} \ge s_{J_2}$, $p_{J_1} > p_{J_2}$ and $b_{J_1} > b_{J_2}$. As $\frac{b_{J_1}''}{b_{J_1}} = \frac{s_{J_1}\theta_{J_1}''}{s_{J_1}\theta_{J_1} + \beta s_{J_2}\theta_{J_2} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i}$ and

$$\frac{b_{J_2}''}{b_{J_2}} = \frac{s_{J_2}\theta_{J_2}''}{s_{J_2}\theta_{J_2} + \beta s_{J_1}\theta_{J_1} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i},$$

$$\frac{b_{J_1}''}{b_{J_1}} - \frac{b_{J_2}''}{b_{J_2}} = \frac{s_{J_1}\theta_{J_1}''}{s_{J_1}\theta_{J_1} + \beta s_{J_2}\theta_{J_2} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i} - \frac{s_{J_2}\theta_{J_2}''}{s_{J_2}\theta_{J_2} + \beta s_{J_1}\theta_{J_1} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i}$$

$$= \frac{s_{J_1}\theta_{J_1}''(s_{J_2}\theta_{J_2} + \beta s_{J_1}\theta_{J_1} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i) - s_{J_2}\theta_{J_2}''(s_{J_1}\theta_{J_1} + \beta s_{J_2}\theta_{J_2} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i)}{(s_{J_2}\theta_{J_2} + \beta s_{J_1}\theta_{J_1} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i)(s_{J_1}\theta_{J_1} + \beta s_{J_2}\theta_{J_2} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i)}$$

$$= \frac{s_{J_1}s_{J_2}(\theta_{J_1}''\theta_{J_2} - \theta_{J_2}''\theta_{J_1}) + \beta s_{J_1}\theta_{J_1}''(s_{J_1}\theta_{J_1} + \sum_{i\neq J_1,J_2}^{K} s_i\theta_i) - \beta s_{J_2}\theta_{J_2}''(s_{J_2}\theta_{J_2} + \sum_{i\neq J_1,J_2}^{K} s_i\theta_i)}{(s_{J_2}\theta_{J_2} + \beta s_{J_1}\theta_{J_1} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i)(s_{J_1}\theta_{J_1} + \beta s_{J_2}\theta_{J_2} + \beta\sum_{i\neq J_1,J_2}^{K} s_i\theta_i)}.$$

First, since $s_{J_1} \ge s_{J_2}$ and group J_1 is closer to other groups in cultural distances, we have $\theta_{J_1} > \theta_{J_2}$ and $\theta_{J_1}'' > \theta_{J_2}''$. Therefore, $\beta s_{J_1}\theta_{J_1}''(s_{J_1}\theta_{J_1} + \sum_{i\neq J_1,J_2}^{K} s_i\theta_i) > \beta s_{J_2}\theta_{J_2}''(s_{J_2}\theta_{J_2} + \sum_{i\neq J_1,J_2}^{K} s_i\theta_i)$. Second, we have $\frac{\theta_{J_1}''}{\theta_{J_2}''} > 1$ and $\frac{\theta_{J_1}}{\theta_{J_2}} > 1$. When only essential public goods are provided, the autocrat cares more

about the preference of the largest group compared to the case when different groups bargain with the government. Thus, the difference between θ''_{J_1} and θ_{J_1} is smaller than the difference between θ''_{J_1} and θ_{J_2}, which means $\frac{\theta_{J_1}-\theta''_{J_1}}{\theta_{J_2}-\theta''_{J_2}}<1$. Thus, $\frac{\theta''_{J_1}}{\theta''_{J_2}}>\frac{\theta_{J_1}}{\theta_{J_2}}$ and $\theta''_{J_1}\theta_{J_2}-\theta''_{J_2}\theta_{J_1}>0$. Then,

$\beta s_{J_1}\theta''_{J_1}(s_{J_1}\theta_{J_1}+\sum_{i\neq J_1,J_2}^{K}s_i\theta_i)-\beta s_{J_2}\theta''_{J_2}(s_{J_2}\theta_{J_2}+\sum_{i\neq J_1,J_2}^{K}s_i\theta_i)>0$ and $s_{J_1}s_{J_2}(\theta''_{J_1}\theta_{J_2}-\theta''_{J_2}\theta_{J_1})>0$.

Therefore, $\frac{b''_{J_1}}{b_{J_1}}-\frac{b''_{J_2}}{b_{J_2}}>0$ and $\frac{b''_{J_1}}{b_{J_1}}>\frac{b''_{J_2}}{b_{J_2}}$. Hence, g_{J_1} is the highest at any level of cultural diversity when group J_1 is the largest group closer to other groups in cultural distances.

Moreover, in the same way as above, we can prove that g_{J_1} decreases as s_{J_1} decreases. Suppose that group J_1 becomes smaller to group J_1' and group J_2 becomes larger to group J_2'. Then $\theta_{J_1}>\theta_{J_1'}$ and $\theta''_{J_1}>\theta''_{J_1'}$. Thus, $\beta s_{J_1}\theta''_{J_1}(s_{J_1}\theta_{J_1}+\sum_{i\neq J_1,J_2}^{K}s_i\theta_i)-\beta s_{J_1'}\theta''_{J_1'}(s_{J_1'}\theta_{J_1'}+\sum_{i\neq J_1,J_2}^{K}s_i\theta_i)>0$ Besides, $\frac{\theta''_{J_1}}{\theta_{J_1}}<1$ and $\frac{\theta''_{J_1'}}{\theta_{J_1'}}<1$. Because the allocation of essential public resources is more sensitive to the population distribution, $\frac{\theta''_{J_1}}{\theta_{J_1}}<\frac{\theta''_{J_1}-\theta''_{J_1'}}{\theta_{J_1'}-\theta_{J_1}}$. Then $\frac{\theta''_{J_1'}}{\theta_{J_1'}}<\frac{\theta''_{J_1}}{\theta_{J_1}}$ and $\theta''_{J_1'}\theta_{J_1}-\theta''\theta_{J_1'}>0$. Therefore, $\frac{b''_{J_1}}{b_{J_1}}>\frac{b''_{J_1'}}{b_{J_1'}}$. Besides, as we also have $s_{J_1}>s_{J_1'}$, $p_{J_1}>p_{J_1'}$, $b_{J_1}>b_{J_1'}$, we know that g_{J_1} decreases to $g_{J_1'}$ as the population share decreases. Then Lemma 5 is proved.

A.5 The composition of preferred groups

According to the setting of the changing pattern in cultural diversity, $s_M = \frac{K^2 - K + 1}{K^2}$ and $s_{L_i} = \frac{1}{K^2}(i \geq 2)$ at the initial point. Then $\frac{1}{3} - \sum_{i \geq 5} s_{L_i} = \frac{1}{3} - \frac{K-4}{K^2} = \frac{K^2 - 3K + 12}{3K^2}$.

If $s_{L_4} = \frac{1}{3} - \sum_{i \geq 5} s_{L_i} = \frac{K^2 - 3K + 12}{3K^2}$, $s_{L_1} = s_{L_2} = s_{L_3} = \frac{2}{9}$. Since

$\frac{K^2 - 3K + 12}{3K^2} - \frac{2}{9} = \frac{3K^2 - 9K + 36 - 2K^2}{9K^2} = \frac{K^2 - 9K + 36}{9K^2} > 0$, $s_{L_4} > s_{L_3}$ which is not possible according to our assumptions. Besides, as $\sum_{i \geq 3} s_{L_i} = \frac{1}{3}$ when $s_{L_1} = s_{L_2} = \frac{1}{3}$, the set of preferred groups must include , group L_3 when group L_4 grows.

When $s_{L_1} = s_{L_2} = s_{L_3} = s_{L_4}$ and $s_{L_i} = \frac{1}{K^2}(i \geq 5)$, $s_{L_3} = s_{L_4} = \frac{K^2 - K + 4}{4K^2}$ and $s_{L_3} + s_{L_4} = \frac{K^2 - K + 4}{2K^2} > \frac{1}{3}$. Thus, no small groups are included in the set of preferred groups.

When group L_5 becomes larger, the population share of both group L_3 and group L_4 declines. $s_{L_1} = s_{L_2} = s_{L_3} = s_{L_4} = s_{L_5}$, $s_{L_3} + s_{L_4} = \frac{K^2 - K + 4}{2K^2} > \frac{1}{3}$ $s_{L_3} = s_{L_4} = \frac{K^2 - K + 5}{5K^2}$ and

$s_{L_3} + s_{L_4} - \frac{1}{3} = \frac{2K^2 - 2K + 10}{5K^2} - \frac{1}{3} = \frac{K^2 - 6K + 30}{15K^2} > 0.$ Thus, $s_{L_1} + s_{L_2} + s_{L_3} + s_{L_4} > \frac{2}{3}$ and $s_{L_5} + \sum_{i \geq 6} s_{L_6} < \frac{1}{3}$. Thereby, the set of preferred groups must include at least one group that falls in the population size. The situation is also true when the population distribution becomes balanced among more groups.

A.6 Proof for the change in public spending under repressive authoritarianism at high diversity

When group $s_{L_3}+\sum_{i\geq 5}s_{L_i}<\frac{1}{3}$ as group s_{L_4} increases, the autocrat would also provide public goods to group L_4.

$g^e(\mathrm{P}_L)=s_{L_3}g^*_{L_3}+s_{L_4}g^*_{L_4}+\sum_{i\geq 5,L_i\in \mathrm{P}_L}s_{L_i}g^*_{L_i}+s_{L_2}g_a+s_{L_1}g_a+\sum_{j\geq 5,L_i\notin \mathrm{P}_L}s_{L_i}g_a$. After s_{L_3} decreases by Δ, s_{L_4} increases by 3Δ. Then,

$$g^{e'}(\mathrm{P}_L)=(s_{L_3}g^*_{L_3})'+(s_{L_4}g^*_{L_4})'+\sum_{i\geq 5,L_i\in \mathrm{P}_L}s_{L_i}g^*_{L_i}+(s_{L_2}-\Delta)g_a+(s_{L_1}-\Delta)g_a+\sum_{j\geq 5,L_i\notin \mathrm{P}_L}s_{L_i}g_a.$$

Thus,

$$\begin{aligned}g^{e'}(\mathrm{P}_L)-g^e(\mathrm{P}_L)&=(s_{L_3}g^*_{L_3})'-s_{L_3}g^*_{L_3}+(s_{L_4}g^*_{L_4})'-s_{L_4}g^*_{L_4}-2\Delta g_a\\&=3\Delta\frac{d(s_{L_4}g^*_{L_4})}{ds_{L_4}}-\Delta\frac{d(s_{L_3}g^*_{L_3})}{ds_{L_3}}-2\Delta g_a.\end{aligned}$$

Then,

$$\frac{d(s_{L_3}g^*_{L_3})}{ds_{L_3}}=g^*_{L_3}\left\{1+\frac{\frac{\eta}{\sigma}s_{L_3}\left[(ty)^\sigma-(g_a)^\sigma\right]}{(s_{L_3})^\eta\left[(ty)^\sigma-(g_a)^\sigma\right]+(g_a)^\sigma}\right\}>g^*_{L_3}$$

$$\frac{d(s_{L_4}g^*_{L_4})}{ds_{L_4}}=g^*_{L_4}\left\{1+\frac{\frac{\eta}{\sigma}s_{L_4}\left[(ty)^\sigma-(g_a)^\sigma\right]}{(s_{L_4})^\eta\left[(ty)^\sigma-(g_a)^\sigma\right]+(g_a)^\sigma}\right\}>g^*_{L_4}$$

When $s_{L_3}=s_{L_4}$, $g^*_{L_3}=g^*_{L_4}$ and $g^{e'}(\mathrm{P}_L)-g^e(\mathrm{P}_L)=3\Delta g^*_{L_3}-\Delta g^*_{L_3}-2\Delta g_a>0$. Therefore, public spending increases when the difference in the population share is small enough between group L_3 and L_4.

The threshold of the difference is related to the value of η and the number of cultural groups K. The essential idea here is that public spending increases as the population share of the rising group rises when the group is large enough.

Appendix B.

Appendix to Chapter 2

B.1 Additional tables

Table B.1. List of Chinese Dialects

Dialect supergroup	Dialect group	Dialect subgroup	Dialect code[46]	Dialect supergroup	Dialect group	Dialect subgroup	Dialect code
Mandarin	Dongbei	Jishen	1101	Mandarin	Southwest	Changhe	1712
		Hafu	1102		Jianghui	Hongchao	1801
		Heisong	1103			Tairu	1802
	Beijing	Jingshi	1201			Huangxiao	1803
		Huaicheng	1202	Jin	Bingzhou	Bingzhou	2100
		Chaofeng	1203		Luliang	Luliang	2200
		Shike	1204		Shangdang	Shangdang	2300
	Jilu	Baotang	1301		Wutai	Wutai	2400
		Shiji	1302		Dabao	Dabao	2500
		Canghui	1303		Zhanghu	Zhanghu	2600
	Jiaoliao	Qingzhou	1401		Hanxin	Hanxin	2700
		Denglian	1402		Zhiyan	Zhiyan	2800
		Gaihuan	1403	Wu	Taihu	Taihu	3100
	Zhongyuan	Zhengcao	1501		Taizhou	Taizhou	3200
		Cailu	1502		Oujiang	Oujiang	3300
		Luoxu	1503		Wuzhou	Wuzhou	3400
		Xinbeng	1504		Chuqu	Chuqu	3500
		Fenhe	1505		Xuanzhou	Xuanzhou	3600
		Guanzhong	1506	Jiangxi	Changjing	Changjing	4100
		Qinlong	1507		Yiliu	Yiliu	4200
		Longzhong	1508		Jicha	Jicha	4300
		Nanjiang	1509		Fuguang	Fuguang	4400
	Lanyin	Jincheng	1601		Yingyi	Yingyi	4500

[46] Lavely, William; Berman, Lex, 2012, "Language Atlas of China", https://hdl.handle.net/1902.1/19004 , Harvard Dataverse, V1

	Lanyin	Yinwu	1602	Jiangxi	Leizi	Leizi	4700
		Hexi	1603		Dongsui	Dongsui	4800
		Beijiang	1605		Huaiyue	Huaiyue	4900
	Southwest	Chengyu	1701	Hunan	Changyi	Changyi	5100
		Dianxi	1702		Loushao	Loushao	5200
		Qianbei	1703		Jixu	Jixu	5300
		Kungui	1704	Fukienese	Minnan	Minnan	6100
		Guanchi	1705		Puxian	Puxian	6200
		Ebei	1706		Mindong	Mindong	6300
		Wutian	1707		Minbei	Minbei	6400
		Cenjiang	1708		Minzhong	Minzhong	6500
		Qiannan	1709		Qiongwen	Qiongwen	6600
		Xiangnan	1710		Leizhou	Leizhou	6700
		Guiliu	1711		Shaojiang	Shaojiang	6800
Cantonese	Guangfu	Guangfu	7100	Hakka	Ninglong	Ninglong	8600
	Siyi	Siyi	7200		Yugui	Yugui	8700
	Gaoyang	Gaoyang	7300		Tonggu	Tonggu	8800
	Goulou	Goulou	7400	Hui	Jingzhan	Jingzhan	9100
	Yongxun	Yongxun	7600		Jishe	Jishe	9200
	Qinlian	Qinlian	7700		Xiuyi	Xiuyi	9300
Hakka	Yuetai	Yuetai	8100		Qide	Qide	9400
	Yuezhong	Yuezhong	8200		Yanzhou	Yanzhou	9500
	Huizhou	Huizhou	8300	Pinghua	Pinghua	Pinghua	100
	Yuebei	Yuebei	8400	Other	Shaozhou Tuhua	Shaozhou Tuhua	400
	Tingzhou	Tingzhou	8500				

Table B.2. Pearson Correlation Matrix (5-year average data)

	Income	ELF	GI	RQ	ER	PH	Public expenditure
ELF	-0.199**						
GI	-0.131**	0.888**	1				
RQ	-0.194**	0.957**	0.813**	1			
ER	-0.090*	0.726**	0.816**	0.642**	1		
PH	-0.128**	0.867**	0.970**	0.853**	0.784**	1	
Public expenditure	0.822**	-0.154**	-0.126**	-0.151**	-0.055	-0.129**	1
Fixed asset investment	0.895**	-0.124**	-0.070*	-0.110**	-0.013	-0.064*	0.915**
Ratio of the primary industry	-0.719**	0.116**	0.053	0.099**	0.028	0.041	-0.549**
Ratio of the secondary industry	0.526**	-0.139**	-0.083*	-0.130**	-0.043	-0.079*	0.322**
Ratio of loans	-0.007	-0.024	-0.044	-0.017	-0.091**	-0.039	0.053
Ratio of residential deposit	0.093**	-0.017	-0.025	-0.011	-0.074*	-0.02	0.191**
Population	-0.141**	0.190**	0.153**	0.206**	0.160**	0.177**	-0.223**
Employment rate	0.214**	0.007	0.013	0.014	0.025	0.016	0.218**
Education level	0.720**	-0.146**	-0.082*	-0.133**	-0.111**	-0.068*	0.676**
Number of key universities	0.274**	-0.065*	-0.066*	-0.044	-0.066*	-0.052	0.205**
Enrolment of students	-0.218**	0.192**	0.154**	0.210**	0.160**	0.179**	-0.335**
Market institution and intermediary organization	0.385**	-0.097**	-0.043	-0.100**	0.045	-0.042	0.296**
Land area	-0.280**	0.200**	0.182**	0.163**	0.183**	0.159**	-0.156**
Number of special zones	0.503**	-0.117**	-0.101**	-0.107**	-0.091**	-0.095**	0.385**
Highway freight traffic	0.061*	0.046	0.078*	0.051	0.091**	0.094**	-0.035

Continued Table B2. Correlation matrix (5-year average data)

	Fixed asset investment	Ratio of the primary industry	Ratio of the secondary industry	Ratio of loans	Ratio of residential deposit	Population	Employment rate
Ratio of the primary industry	-0.654**	1					
Ratio of the secondary industry	0.484**	-0.718**	1				
Ratio of loans	0.012	-0.106**	0.032	1			
Ratio of residential deposit	0.152**	-0.186**	0.080*	0.838**	1		
Population	-0.115**	0.160**	-0.230**	-0.130**	-0.101**	1	
Employment rate	0.271**	-0.254**	0.197**	-0.102**	-0.003	0.029	1
Education level	0.678**	-0.520**	0.266**	0.115**	0.213**	-0.081*	0.152**
Number of key universities	0.239**	-0.263**	-0.023	0.095**	0.062*	0.234**	-0.039
Enrolment of students	-0.241**	0.158**	-0.210**	-0.132**	-0.107**	0.944**	0.054
Market institution and intermediary organization	0.349**	-0.254**	0.106**	-0.135**	-0.074*	0.142**	0.155**
Land area	-0.219**	0.409**	-0.387**	-0.054	-0.05	0.352**	-0.110**
Number of special zones	0.413**	-0.432**	0.148**	0.089*	0.145**	0.209**	0.131**
Highway freight traffic	0.034	0.014	-0.007	-0.202**	-0.176**	0.154**	0.062*

	Education level	Number of key universities	Enrolment of students	Market institution and intermediary organization	Land area	Number of special zones	Highway freight traffic
Education level	1						
Number of key universities	0.341**	1					
Enrolment of students	-0.164**	0.206**	1				
Market institution and intermediary organization	0.056	0.052	0.118**	1			
Total land area	-0.208**	-0.014	0.290**	-0.248**	1		
Number of special zones	0.507**	0.437**	0.176**	0.133**	-0.073*	1	
Highway freight traffic	0.067*	-0.067*	0.133**	0.189**	-0.116**	-0.001	1

Notes: ** *significant at 0.01, ** significant at 0.05, * significant at 0.1.

Table B.3. Baseline results of the relationship between GI and economic development

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GI	1.572**	0.771	0.657	0.631	0.670	0.599	0.756	1.111**
	(0.754)	(0.754)	(0.648)	(0.662)	(0.702)	(0.713)	(0.509)	(0.556)
Public expenditure		0.216***	0.144***	0.145***	0.129**	0.135**	0.110*	0.076
		(0.064)	(0.055)	(0.055)	(0.056)	(0.059)	(0.066)	(0.083)
Fixed asset		0.167***	0.084***	0.088***	0.083***	0.087***	0.116***	0.052
investment		(0.031)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.056)
Ratio of primary			-0.005*	-0.005*	-0.006**	-0.006*	-0.003	-0.007*
industry			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Ratio of secondary			0.009***	0.009***	0.009***	0.009***	0.009***	0.011***
industry			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ratio of loans				-0.000	-0.000	-0.000	0.000	0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of residents'				-0.000	-0.000	-0.000	-0.000	-0.000**
deposit				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population					-0.076	-0.080	-0.067	-0.415***
					(0.131)	(0.166)	(0.154)	(0.140)
Employment rate					0.448*	0.421	0.112	-0.138
					(0.254)	(0.263)	(0.251)	(0.214)
Education level					0.004	0.000	-0.047*	-0.011
					(0.041)	(0.042)	(0.026)	(0.028)
Number of key					-0.011	-0.010	0.002	-0.181
universities					(0.017)	(0.017)	(0.014)	(0.136)
Enrolment of students					-0.055	-0.053	-0.006	-0.050
					(0.039)	(0.039)	(0.039)	(0.049)
Market institutions						0.002	0.001	0.003
and organizations						(0.004)	(0.003)	(0.008)
Land area						0.025	-0.015	0.028
						(0.099)	(0.096)	(0.074)
High technology								
zones						0.001	-0.024	-0.014
						(0.029)	(0.019)	(0.022)
Highway freight								
traffic						-0.029	-0.031	-0.066**
						(0.025)	(0.025)	(0.027)
Income per capita in							0.288***	0.068
lagging period 1							(0.039)	(0.060)
Income per capita in								0.021
lagging period 2								(0.069)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	9.880***	6.506***	7.545***	7.511***	7.833***	7.664***	5.692***	10.331***
	(0.063)	(0.486)	(0.468)	(0.471)	(1.201)	(1.220)	(1.327)	(1.609)
Observations	801	729	728	723	723	712	656	412
R-squared	0.932	0.956	0.963	0.963	0.964	0.964	0.972	0.954
Number of cities	275	253	253	253	253	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.4. Baseline results of the relationship between ER and economic development

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ER	0.070	-0.017	0.034	0.025	0.048	0.061	0.092	-0.229
	(0.209)	(0.166)	(0.146)	(0.145)	(0.146)	(0.147)	(0.164)	(0.224)
Public expenditure		0.218***	0.147***	0.147***	0.130**	0.137**	0.111*	0.084
		(0.064)	(0.055)	(0.055)	(0.056)	(0.059)	(0.067)	(0.084)
Fixed asset		0.168***	0.084***	0.088***	0.084***	0.087***	0.116***	0.055
investment		(0.031)	(0.031)	(0.031)	(0.031)	(0.033)	(0.033)	(0.057)
Ratio of primary			-0.005*	-0.005*	-0.006**	-0.006**	-0.003	-0.007
industry			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Ratio of secondary			0.009***	0.009***	0.009***	0.009***	0.009***	0.011***
industry			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Ratio of loans				-0.000	-0.000	-0.000	0.000	0.001**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of residents'				-0.000	-0.000	-0.000	-0.000	-0.000*
deposit				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population					-0.083	-0.085	-0.075	-0.439***
					(0.130)	(0.167)	(0.155)	(0.131)
Employment rate					0.414	0.391	0.070	-0.217
					(0.256)	(0.265)	(0.251)	(0.223)
Education level					0.001	-0.003	-0.051*	-0.023
					(0.041)	(0.041)	(0.026)	(0.028)
Number of key					-0.013	-0.011	0.001	-0.147
universities					(0.017)	(0.017)	(0.015)	(0.137)
Enrolment of					-0.055	-0.054	-0.006	-0.049
students					(0.039)	(0.039)	(0.039)	(0.049)
Market institutions						0.002	0.001	0.002
and organizations						(0.004)	(0.003)	(0.008)
Land area						0.024	-0.016	0.030
						(0.099)	(0.096)	(0.074)
High technology						0.000	-0.024	-0.016
zones						(0.029)	(0.019)	(0.023)
Highway freight						-0.030	-0.032	-0.066**
traffic						(0.025)	(0.025)	(0.029)
Income per capita in							0.291***	0.076
lagging period 1							(0.039)	(0.059)
Income per capita in								0.035
lagging period 2								(0.072)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.010***	6.542***	7.580***	7.543***	7.985***	7.806***	5.857***	10.415***
	(0.008)	(0.489)	(0.471)	(0.474)	(1.173)	(1.187)	(1.306)	(1.567)
Observations	801	729	728	723	723	712	656	412
R-squared	0.932	0.956	0.963	0.963	0.964	0.964	0.972	0.954
Number of cities	275	253	253	253	253	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table B.5. Results of IV regression on ELF-Pooled 2SLS (one instrument in each regression)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ELF	0.464**	1.929***	0.939*	0.079	0.745***	0.227	-0.114	0.521*	-0.060
	(0.212)	(0.602)	(0.561)	(0.098)	(0.237)	(0.254)	(0.116)	(0.276)	(0.324)
Income in lagging period 1				0.683***	0.708***	0.688***	0.795***	0.761***	0.792***
				(0.025)	(0.037)	(0.028)	(0.053)	(0.073)	(0.054)
Income in lagging period 2							-0.093**	-0.030	-0.088
							(0.046)	(0.066)	(0.053)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	712	712	656	656	656	412	412	412
R-squared	0.897	0.575	0.835	0.972	0.918	0.967	0.965	0.930	0.966
F-statistic of the 1st stage	20.93	15.08	4.60	24.43	17.11	3.62	17.02	8.88	1.54
Historical migration	0.092***			0.101***			0.108***		
	(0.020)			(0.020)			(0.026)		
Altitude		-0.042***			-0.048***			-0.047***	
		(0.011)			(0.012)			(0.016)	
Share of land with altitude below 500m			0.060**			0.057*			0.050
			(0.020)			(0.030)			(0.040)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.6. Results of IV regression on GI-Pooled 2SLS (one instrument in each regression)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GI	0.849**	2.827***	1.544*	0.149	1.154***	0.390	-0.217	0.818**	-0.112
	(0.375)	(0.672)	(0.812)	(0.185)	(0.312)	(0.423)	(0.218)	(0.391)	(0.602)
Income in lagging period 1				0.681***	0.693***	0.684***	0.788***	0.791***	0.788***
				(0.025)	(0.029)	(0.026)	(0.054)	(0.061)	(0.053)
Income in lagging period 2							-0.086*	-0.064	-0.084*
							(0.046)	(0.051)	(0.046)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	712	712	656	656	656	412	412	412
R-squared	0.903	0.766	0.871	0.971	0.944	0.969	0.966	0.945	0.967
F-statistic of the 1st stage	27.53	33.5	8.16	30.56	32.56	5.80	21.48	16.14	2.03
Historical migration	0.050***			0.053***			0.057***		
	(0.010)			(0.010)			(0.012)		
Altitude		-0.029***			-0.031***			-0.030***	
		(0.005)			(0.005)			(0.007)	
Share of land with altitude below 500m			0.037***			0.033**			0.027
			(0.013)			(0.014)			(0.019)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.7. Results of IV regression on RQ-Pooled 2SLS (one instrument in each regression)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RQ	1.251**	6.002***	1.437**	0.207	2.121***	0.328	-0.317	1.442*	-0.080
	(0.602)	(2.285)	(0.705)	(0.259)	(0.753)	(0.343)	(0.325)	(0.807)	(0.433)
Income in lagging period 1				0.685***	0.736***	0.688***	0.795***	0.760***	0.790***
				(0.026)	(0.044)	(0.027)	(0.054)	(0.076)	(0.053)
Income in lagging period 2							-0.097**	-0.014	-0.085*
							(0.047)	(0.072)	(0.048)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	712	712	656	656	656	412	412	412
R-squared	0.888	0.321	0.879	0.971	0.894	0.970	0.964	0.919	0.966
F-statistic of the 1st stage	16.55	9.01	13.65	20.12	12.42	12.23	12.71	6.84	6.46
Historical migration	0.034***			0.038***			0.039***		
	(0.008)			(0.009)			(0.011)		
Altitude		-0.014***			-0.017***			-0.017***	
		(0.005)			(0.005)			(0.006)	
Share of land with altitude below 500m			0.039***			0.039**			0.037**
			(0.011)			(0.011)			(0.015)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.8. Results of IV regression on ER-Pooled 2SLS (one instrument in each regression)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ER	2.592**	10.314***	6.734	0.440	3.884***	1.742	-0.602	2.545**	-0.262
	(1.187)	(2.859)	(4.340)	(0.548)	(1.131)	(2.024)	(0.599)	(1.274)	(1.414)
Income in lagging period 1				0.681***	0.695***	0.686***	0.785***	0.806***	0.787***
				(0.025)	(0.031)	(0.028)	(0.054)	(0.064)	(0.055)
Income in lagging period 2							-0.083*	-0.075	-0.082*
							(0.046)	(0.051)	(0.045)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	712	712	656	656	656	412	412	412
R-squared	0.900	0.666	0.808	0.971	0.933	0.964	0.966	0.939	0.967
F-statistic of the 1st stage	22.99	21.10	3.95	27.28	24.79	2.82	20.81	12.54	3.50
Historical migration	0.016***			0.018***			0.020***		
	(0.003)			(0.003)			(0.004)		
Altitude		-0.008***			-0.009***			-0.010***	
		(0.002)			(0.002)			(0.003)	
Share of land with altitude below 500m			0.008**			0.007**			0.011*
			(0.004)			(0.004)			(0.006)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.9. Results of IV regression on PH-Pooled 2SLS (one instrument in each regression)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PH	1.064**	3.697***	1.342**	0.184	1.485***	0.326	-0.270	1.010**	-0.085
	(0.482)	(0.913)	(0.637)	(0.229)	(0.418)	(0.341)	(0.271)	(0.485)	(0.458)
Income in lagging period 1				0.682***	0.699***	0.684***	0.787***	0.794***	0.788***
				(0.025)	(0.031)	(0.025)	(0.054)	(0.061)	(0.053)
Income in lagging period 2							-0.087*	-0.063	-0.083*
							(0.046)	(0.050)	(0.045)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	712	712	656	656	656	412	412	412
R-squared	0.900	0.724	0.890	0.971	0.937	0.970	0.966	0.943	0.967
F-statistic of the 1st stage	24.34	29.81	18.11	27.8	29.91	14.17	19.55	15.42	6.14
Historical migration	0.040***			0.043***			0.045***		
	(0.008)			(0.008)			(0.010)		
Altitude		-0.022***			-0.024***			-0.024***	
		(0.004)			(0.004)			(0.006)	
Share of land with altitude below 500m			0.042***			0.040***			0.035**
			(0.010)			(0.011)			(0.014)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.10. Results of IV regression on ELF: FE-2SLS &IV-GMM (one instrument in each regression)

	FE-2SLS						IV-GMM								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ELF	11.553*	12.762**	16.185*	10.586	11.878**	11.550*	7.327	5.809	5.315	11.177*	12.793**	16.511*	11.425	11.996**	11.791*
	(6.412)	(5.674)	(8.663)	(7.003)	(6.023)	(6.818)	(5.655)	(4.026)	(4.684)	(6.407)	(5.670)	(8.570)	(6.978)	(5.968)	(6.759)
Income in lagging				0.182**	0.169**	0.172*	-0.048	-0.022	-0.013				0.168*	0.167**	0.169*
period 1				(0.093)	(0.084)	(0.094)	(0.141)	(0.110)	(0.114)				(0.092)	(0.083)	(0.093)
Income in lagging							-0.122	-0.091	-0.080						
period 2							(0.147)	(0.100)	(0.121)						
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	704	706	706	629	631	631	366	366	366	704	706	706	629	631	631
R-squared	0.766	0.901	0.858	0.639	0.906	0.910	0.870	0.903	0.912	0.760	0.900	0.854	0.639	0.905	0.907
Number of cities	245	246	246	224	225	225	183	183	183	245	246	246	224	225	225
F-statistic in 1st stage	2.31	4.35	2.38	1.52	3.27	2.18	1.21	3.8	2.14	2.31	4.35	2.38	1.52	3.27	2.18
Historical migration*t1	0.004*			0.004						0.004*			0.004		
	(0.002)			(0.002)						(0.002)			(0.002)		
Historical migration*t2	0.005**			0.004			0.004			0.005**			0.004		
	(0.002)			(0.002)			(0.003)			(0.002)			(0.002)		
Altitude*t1		-0.003***			-0.003**						-0.003***			-0.003**	
		(0.001)			(0.001)						(0.001)			(0.001)	
Altitude*t2		-0.002*			-0.002			-0.004*			-0.002*			-0.002	
		(0.001)			(0.001)			(0.001)			(0.001)			(0.001)	
Share of land with altitude			0.005**			0.006**						0.005**			0.006**
below 500m*t1			(0.002)			(0.003)						(0.002)			(0.003)
Share of land with altitude			0.004*			0.004			0.006			0.004*			0.004
below 500m*t2			(0.003)			(0.003)			(0.004)			(0.003)			(0.003)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.11. Results of IV regression on GI: FE-2SLS &IV-GMM (one instrument in each regression)

	FE-2SLS									IV-GMM					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
GI	20.174	33.506	34.273	18.308**	37.672	17.434	9.716	36.092	10.841	27.916*	32.715	34.380	37.644	18.589**	17.890*
	(17.421)	(28.424)	(21.483)	(8.386)	(26.155)	(10.849)	(6.034)	(60.697)	(10.052)	(16.653)	(21.585)	(28.416)	(26.154)	(8.382)	(10.842)
Income in lagging period 1				0.219***	0.143	0.222***	-0.015	-0.268	-0.025				0.143	0.217***	0.216***
				(0.057)	(0.137)	(0.064)	(0.087)	(0.633)	(0.117)				(0.137)	(0.057)	(0.063)
Income in lagging period 2							-0.042	-0.234	-0.050						
							(0.072)	(0.506)	(0.097)						
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	706	706	706	631	631	631	366	366	366	706	706	706	631	631	631
R-squared	0.893	0.765	0.755	0.927	0.775	0.931	0.916	0.320	0.905	0.826	0.774	0.754	0.775	0.926	0.929
Number of cities	246	246	246	225	225	225	183	183	183	246	246	246	225	225	225
F-statistic in 1st stage	1.30	1.43	0.74	1.22	4.95	2.02	0.32	6.68	1.68	1.30	1.43	0.74	1.22	4.95	2.02
Historical migration*t1	0.001			0.002						0.001			0.002		
	(0.001)			(0.001)						(0.001)			(0.001)		
Historical migration*t2	-0.001			0.001			0.001			-0.001			0.001		
	(0.002)			(0.001)			(0.002)			(0.002)			(0.001)		
Altitude*t1		0.001			-0.002***						0.001			-0.002***	
		(0.001)			(0.001)						(0.001)			(0.001)	
Altitude*t2		0.001			-0.001***			-0.002**			0.001			-0.001***	
		(0.001)			(0.000)			(0.001)			(0.001)			(0.000)	
Share of land with altitude below 500m*t1			0.001			0.002*						0.001			0.002*
			(0.001)			(0.001)						(0.001)			(0.001)
Share of land with altitude below 500m*t2			0.002			0.003*			0.003			0.002			0.003*
			(0.002)			(0.002)			(0.002)			(0.002)			(0.002)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.12. Results of IV regression on RQ: FE-2SLS &IV-GMM (one instrument in each regression)

	FE-2SLS						IV- GMM								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
RQ	26.149*	27.244**	30.744*	24.249	24.388**	20.584*	16.803	12.784	9.864	25.474*	27.372**	31.876**	25.954	24.618**	21.217*
	(14.673)	(12.278)	(16.139)	(17.180)	(12.321)	(11.455)	(13.552)	(9.119)	(8.072)	(14.667)	(12.247)	(15.998)	(17.137)	(12.197)	(11.378)
Income in lagging period 1				0.168	0.168**	0.187**	-0.074	-0.038	-0.011				0.155	0.166**	0.181**
				(0.108)	(0.084)	(0.081)	(0.168)	(0.124)	(0.108)				(0.108)	(0.083)	(0.080)
Income in lagging period 2							-0.140	-0.100	-0.071						
							(0.169)	(0.110)	(0.107)						
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	706	706	706	631	631	631	366	366	366	706	706	706	631	631	631
R-squared	0.906	0.901	0.882	0.912	0.911	0.929	0.855	0.899	0.923	0.910	0.900	0.875	0.903	0.910	0.927
Number of cities	246	246	246	225	225	225	183	183	183	246	246	246	225	225	225
F-statistic in 1st stage	2.13	3.99	2.46	1.27	3.32	2.69	1.72	3.37	2.95	2.13	3.99	2.46	1.27	3.32	2.69
Historical migration*t1	0.002*			0.002						0.002*			0.002		
	(0.001)			(0.001)						(0.001)			(0.001)		
Historical migration*t2	0.002*			0.002			0.002			0.002*			0.002		
	(0.001)			(0.001)			(0.001)			(0.001)			(0.001)		
Altitude*t1		-0.001***			-0.001***						-0.001***			-0.001***	
		(0.000)			(0.001)						(0.000)			(0.001)	
Altitude*t2		-0.001*			-0.001			-0.002*			-0.001*			-0.001	
		(0.000)			(0.000)			(0.001)			(0.000)			(0.000)	
Share of land with altitude below 500m*t1			0.003**			0.003**						0.003**			0.003**
			(0.001)			(0.001)						(0.001)			(0.001)
Share of land with altitude below 500m*t2			0.002*			0.003*			0.003*			0.002*			0.003*
			(0.001)			(0.001)			(0.002)			(0.001)			(0.001)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.13. Results of IV regression on ER: FE-2SLS &IV-GMM (one instrument in each regression)

	FE-2SLS						IV-GMM								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ER	-5.948	-4.412	-0.512	-5.788	-0.192	-0.481	-7.923	11.339	2.244	-6.599	-2.347	0.975	-6.615	0.704	-0.030
	(4.338)	(4.067)	(1.438)	(5.059)	(2.234)	(1.225)	(10.134)	(15.520)	(1.765)	(4.324)	(3.999)	(1.343)	(5.032)	(2.214)	(1.213)
Income in lagging period 1				0.290***	0.291***	0.291***	-0.024	0.225	0.108				0.300***	0.270***	0.281***
				(0.057)	(0.040)	(0.041)	(0.186)	(0.281)	(0.074)				(0.057)	(0.040)	(0.041)
Income in lagging period 2							0.244	-0.279	-0.032						
							(0.289)	(0.425)	(0.090)						
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	706	706	706	631	631	631	366	366	366	706	706	706	631	631	631
R-squared	0.910	0.934	0.963	0.916	0.971	0.971	0.697	0.373	0.927	0.897	0.955	0.962	0.899	0.971	0.971
Number of cities	246	246	246	225	225	225	183	183	183	246	246	246	225	225	225
F-statistic in 1st stage	1.71	2.26	5.90	0.98	2.82	5.99	0.69	0.67	6.30	1.71	2.26	5.90	0.98	2.82	5.99
Historical migration*t1	-0.006*			-0.004						-0.006*			-0.004		
	(0.003)			(0.004)						(0.003)			(0.004)		
Historical migration*t2	0.002			0.003			-0.004			0.002			0.003		
	(0.004)			(0.004)			(0.005)			(0.004)			(0.004)		
Altitude*t1		0.003*			0.001						0.003*			0.001	
		(0.002)			(0.002)						(0.002)			(0.002)	
Altitude*t2		-0.001			-0.003**			-0.002			-0.001			-0.003**	
		(0.002)			(0.002)			(0.002)			(0.002)			(0.002)	
Share of land with altitude below 500m*t1			-0.007*			-0.007*						-0.007*			-0.007*
			(0.004)			(0.004)						(0.004)			(0.004)
Share of land with altitude below 500m*t2			0.011**			0.012***			0.015**			0.011**			0.012***
			(0.004)			(0.005)			(0.006)			(0.004)			(0.005)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.14. Results IV regression on PH: FE-2SLS &IV-GMM (one instrument in each regression)

	FE-2SLS						IV-GMM								
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
PH	43.039	16.680**	9.097*	30.293	14.568**	7.978*	-106.280	9.712	6.242	40.986	15.961**	10.421**	30.140	14.403**	8.083*
	(32.882)	(7.060)	(5.172)	(21.056)	(6.806)	(4.461)	(620.445)	(6.084)	(4.667)	(32.589)	(7.041)	(5.129)	(21.054)	(6.805)	(4.460)
Income in lagging				0.047	0.174**	0.227***	1.316	-0.034	0.006				0.038	0.170**	0.216***
period 1				(0.191)	(0.072)	(0.055)	(7.115)	(0.096)	(0.080)				(0.190)	(0.072)	(0.055)
Income in lagging							0.570	-0.021	-0.003						
period 2							(3.115)	(0.063)	(0.066)						
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	706	706	706	631	631	631	366	366	366	706	706	706	631	631	631
R-squared	0.696	0.927	0.954	0.835	0.943	0.964	-5.223	0.916	0.941	0.722	0.930	0.950	0.836	0.944	0.964
Number of cities	246	246	246	225	225	225	183	183	183	246	246	246	225	225	225
F-statistic in 1st stage	0.97	4.51	3.90	1.24	4.74	4.57	0.03	5.87	4.71	0.97	4.51	3.90	1.24	4.74	4.57
Historical migration*t1	0.002			0.002						0.002			0.002		
	(0.001)			(0.001)						(0.001)			(0.001)		
Historical migration*t2	0.000			-0.000			-0.000			0.000			-0.000		
	(0.001)			(0.001)			(0.002)			(0.001)			(0.001)		
Altitude*t1		-0.001*			-0.002***						-0.001*			-0.002***	
		(0.001)			(0.001)						(0.001)			(0.001)	
Altitude*t2		-0.001***			-0.002***			-0.002**			-0.001***			-0.002***	
		(0.001)			(0.001)			(0.001)			(0.001)			(0.001)	
Share of land with altitude			0.002			0.003**						0.002			0.003**
below 500m*t1			(0.002)			(0.002)						(0.002)			(0.002)
Share of land with altitude			0.005***			0.006***			0.005**			0.005***			0.006***
below 500m*t2			(0.002)			(0.002)			(0.002)			(0.002)			(0.002)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Additional control variables include all those in column (7) of Table B.3.

Table B.15. Results of IV regression on GI (selected instruments)

	Pooled 2sls			FE 2sls			IV-GMM	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GI	1.768***	0.586***	0.134	18.113*	18.034**	9.599	17.657*	18.342**
	(0.381)	(0.175)	(0.193)	(9.380)	(8.299)	(6.012)	(9.290)	(8.247)
Income in lagging		0.686***	0.789***		0.220***	-0.014		0.223***
period 1		(0.026)	(0.053)		(0.056)	(0.086)		(0.056)
Income in lagging			-0.079*			-0.041		
period 2			(0.044)			(0.072)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	656	412	706	631	366	706	631
R-squared	0.857	0.965	0.966	0.907	0.929	0.917	0.910	0.927
Number of cities				246	225	183	246	225
F-statistic of the 1st stage	24.29	26.45	17.05	1.43	4.95	6.68	1.43	4.95
Historical migration	0.042***	0.046***	0.051***					
	(0.009)	(0.010)	(0.012)					
Altitude*t1	-0.024***	-0.025***	-0.024***	0.001	-0.002***		0.001	-0.002***
	(0.005)	(0.005)	(0.007)	(0.001)	(0.001)		(0.001)	(0.001)
Altitude*t2				0.001	-0.001***	-0.002***	0.001	-0.001***
				(0.001)	(0.000)	(0.001)	(0.001)	(0.000)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Additional control variables include all those in column (7) of Table B.3. In the regression on instrumental variables, t1 means the period 2001-2005 and t2 means the period 2006-2010. However, in the first stage of the pooled 2SLSsls regression, instrumental variables are regressed without interacting with period dummies.

Table B.16. Results of IV regression on ER (selected instruments)

	Pooled 2sls		FE 2sls			IV-GMM		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ER	5.341***	1.671***	0.280	-0.512	-0.481	2.244	0.975	-0.030
	(1.311)	(0.545)	(0.551)	(1.438)	(1.225)	(1.765)	(1.343)	(1.213)
Income in lagging		0.686***	0.791***		0.291***	0.108		0.281***
period 1		(0.026)	(0.054)		(0.041)	(0.074)		(0.041)
Income in lagging			-0.081*			-0.032		
period 2			(0.044)			(0.090)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	712	656	412	706	631	366	706	631
R-squared	0.847	0.965	0.966	0.963	0.971	0.927	0.962	0.971
Number of cities				246	225	183	246	225
F-statistic of the 1st stage	17.48	21.51	14.05	5.9	5.99	6.3	5.9	5.99
Historical migration*t1	0.014***	0.016***	0.019***					
	(0.003)	(0.003)	(0.004)					
Altitude	-0.006***	-0.007***	-0.008***					
	(0.002)	(0.002)	(0.002)					
Share of land with altitude				-0.007*	-0.008*		-0.007*	-0.008*
below 500m *t1				(0.004)	(0.004)		(0.004)	(0.004)
Share of land with altitude				0.011**	0.012***	-0.015**	0.011**	0.012***
below 500m*t2				(0.004)	(0.005)	(0.006)	(0.004)	(0.005)

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Additional control variables include all those in column (7) of Table B.3. In the regression on instrumental variables, t1 means the period 2001-2005 and t2 means the period 2006-2010. However, in the first stage of the pooled 2SLSsls regression, instrumental variables are regressed without interacting with period dummies.

Table B.17. Results of regressions using dialectal diversity in year 2000 (single-year data)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variable	ELF00	ELF00	ELF00	GI00	GI00	GI00	RQ00	RQ00	RQ00	ER00	ER00	ER00	PH00	PH00	PH00
Dialect diversity	1.414***	1.238***	1.387***	5.317***	5.423***	5.592***	2.724***	2.706***	2.673***	-0.063	-0.023	-0.011	5.952***	5.803***	5.972***
in year 2000	(0.496)	(0.161)	(0.487)	(0.593)	(0.591)	(0.589)	(0.956)	(0.953)	(0.939)	(0.321)	(0.317)	(0.315)	(0.664)	(0.757)	(0.741)
Income in lagging		0.002	0.001		0.002	0.001		0.002	0.001		-0.002	-0.002		0.002	0.001
period 1		(0.005)	(0.005)		(0.005)	(0.005)		(0.005)	(0.005)		(0.005)	(0.005)		(0.005)	(0.005)
Income in lagging			0.000			0.000			0.000			-0.003			0.000
period 2			(0.007)			(0.007)			(0.007)			(0.006)			(0.007)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,292	1,257	1,245	1,292	1,257	1,245	1,292	1,257	1,245	1,292	1,257	1,245	1,292	1,257	1,245
Number of cities	263	262	262	263	262	262	263	262	262	263	262	262	263	262	262

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: In addition to control variables in Table B.3, time invariant variables, such as geographical factors, including region dummy, provincial dummy and distance to central cities, historical variables, proxies for economic policy as well as individual effect are also considered. Control variables of Table 7 and individual effect are controlled. In the regression of ER00, the individual effect is not controlled because of collinearity between ER00 and the individual effect.

Table B.18. The effect of the experience under CCP control by PS-match

Panel A. Income in lagging periods is not included as the covariate					
	Treated	Controls	Difference	S.E.	T-stat
ELF	9.508	9.432	0.075	0.148	0.51
GI	9.494	9.442	0.052	0.154	0.34
RQ	9.492	9.469	0.023	0.144	0.16
ER	9.503	9.457	0.046	0.142	0.32
PH	9.492	9.461	0.031	0.154	0.20
Panel B. Income in lagging period 1 is included as a covariate					
	Treated	Controls	Difference	S.E.	T-stat
ELF	9.556	9.469	0.087	0.152	0.58
GI	9.558	9.472	0.086	0.138	0.62
RQ	9.558	9.475	0.083	0.149	0.55
ER	9.559	9.468	0.091	0.145	0.63
PH	9.559	9.465	0.093	0.138	0.68
Panel C. Income in lagging period 1 and 2 is included as covariates					
	Treated	Controls	Difference	S.E.	T-stat
ELF	9.788	9.687	0.101	0.191	0.53
GI	9.786	9.680	0.106	0.171	0.62
RQ	9.782	9.620	0.163	0.162	0.90
ER	9.788	9.687	0.101	0.190	0.53
PH	9.790	9.614	0.177	0.177	1.00

Note: The results above are obtained by taking different indices of dialect diversity as one covariate. The significance of the difference between the treated group and the control group is decided by values of the T-statistic. Note: In addition to control variables in Table B.3, time invariant variables, such as geographical factors, including region dummy, provincial dummy and distance to central cities, and historical variables as well as economic policy are also considered.

Table B.19. The effect of dialectal diversity in Revolutionary area vs non-Revolutionary area

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variable	ELF	ELF	ELF	GI	GI	GI	RQ	RQ	RQ	ER	ER	ER	PH	PH	PH
Dialectal diversity	0.466	0.230	-0.270	-0.892*	-0.981	-0.798	1.007	0.533	-0.548	-0.157	-0.064	-0.211	-0.131	-0.718	-0.454
	(0.651)	(0.640)	(0.543)	(0.492)	(1.204)	(0.859)	(1.364)	(1.374)	(1.170)	(0.239)	(0.253)	(0.333)	(1.207)	(1.054)	(0.883)
Dialectal diversity*	0.120	0.056	1.247*	1.224	1.287	2.489**	-0.215	0.007	2.589	0.527	0.527	0.340	0.936	1.724	2.523**
Revolutionary area	(0.810)	(0.817)	(0.713)	(0.892)	(1.423)	(1.105)	(1.817)	(1.812)	(1.607)	(0.348)	(0.350)	(0.445)	(1.366)	(1.269)	(1.010)
Income in lagging		0.279***	0.186***		0.279***	0.187***		0.280***	0.187***		0.282***	0.205***		0.280***	0.180***
period 1		(0.053)	(0.062)		(0.054)	(0.063)		(0.053)	(0.062)		(0.054)	(0.063)		(0.054)	(0.064)
Income in lagging			0.011			0.019			0.012			0.003			0.023
period 2			(0.067)			(0.066)			(0.067)			(0.067)			(0.064)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	11.483***	7.852***	8.190***	12.088***	8.160***	8.211***	11.611***	7.823***	7.990***	11.975***	7.994***	9.540***	11.712***	7.736***	7.683***
	(3.410)	(2.894)	(2.518)	(3.350)	(2.906)	(2.518)	(3.377)	(2.908)	(2.510)	(3.437)	(3.043)	(2.327)	(3.407)	(2.965)	(2.486)
Observations	507	482	313	507	482	313	507	482	313	507	482	313	507	482	313
R-squared	0.977	0.980	0.971	0.977	0.980	0.972	0.977	0.980	0.971	0.977	0.980	0.971	0.977	0.980	0.972
Number of cities	175	175	172	175	175	172	175	175	172	175	175	172	175	175	172

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Note: Time variant control variables shown in column (7) Table B.3 are also included in the regression.

Table B.20: The effect of ER: revolutionary area vs. non-revolutionary area

	The East			Other regions		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ER	-0.937**	-1.181***	-2.826***	0.068	0.142	0.333
	(0.362)	(0.405)	(0.467)	(0.243)	(0.217)	(0.315)
ER* Revolutionary area	0.574	1.110**	3.259***	0.452	0.229	-0.725*
	(0.505)	(0.507)	(0.593)	(0.401)	(0.391)	(0.379)
Income in lagging period 1		0.353***	0.213*		0.277***	0.191*
		(0.064)	(0.127)		(0.074)	(0.103)
Income in lagging period 2			0.078			-0.003
			(0.143)			(0.075)
controls	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	15.918***	9.838**	11.409***	13.567***	7.432*	10.353***
	(4.381)	(4.320)	(3.846)	(4.812)	(4.421)	(3.775)
Observations	177	172	112	330	310	201
R-squared	0.986	0.989	0.991	0.979	0.982	0.980
Number of cities	60	60	59	115	115	113

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Note: Time variant control variables shown in column (7) Table B.3 are also included in the regression.

B.2 Indices of dialectal diversity

Taking dialect j and k as an example, the distance between j and k is defined by $\tau_{jk} = 1 - (\frac{l}{m})^{\delta}$, in which $\frac{l}{m}$ is the proportion of shared branches of j and m is the maximum number of branches between dialects at the lowest level and languages at the highest level. The dialectal distance is calculated at the cluster level, with $m = 5$ from Level 1 to Level 6 and the value of $\frac{l}{m}$ for a pair of different dialects ranging from 0.4 to 0.8. The parameter δ decides the declining speed of distance as the number of shared branches increase (Fearon, 2003). The lower the value of δ is, the larger the dialectal distance is. While Fearon (2003) takes 0.5 as the value of δ, Desmet et al. (2009) settle on a value of 0.05 and show that diversity indices perform better when $\delta \in [0.04, 0.10]$ than indices without distances. In this paper, the values 0.05, 0.1, 0.5, 0.8 and 1 are examined, showing that indices with δ equal to 1 or without distances perform better. Thus, in this paper, only the results of these diversity indices are shown in the following analysis.

Then, given the population share of each dialect group in each city and dialectal distances, five indices of dialect diversity can be calculated in the following way[47]:

$$ELF = 1 - \sum_{k=1}^{K} s_k^2, GI = \sum_{k=1}^{K} \sum_{j=1}^{K} s_j s_k \tau_{jk};$$

$$RQ = \sum_{k=1}^{K} s_k^2 (1 - s_k), ER = \sum_{k=1}^{K} \sum_{j=1}^{K} s_j s_k^2 \tau_{jk};$$

$$PH = 2 \sum_{k=1}^{K} s_c s_k \tau_{ck}.$$

s_k, s_j and s_c are population share dialect group, k, j and the largest group c. τ_{jk} and τ_{ck} are corresponding dialectal distances of each pair of dialects.

47. Desmet et al., 2009, Linguistic diversity and redistribution, Journal of European Economics Association, p. 1294-1297.

B.3 Additional figures

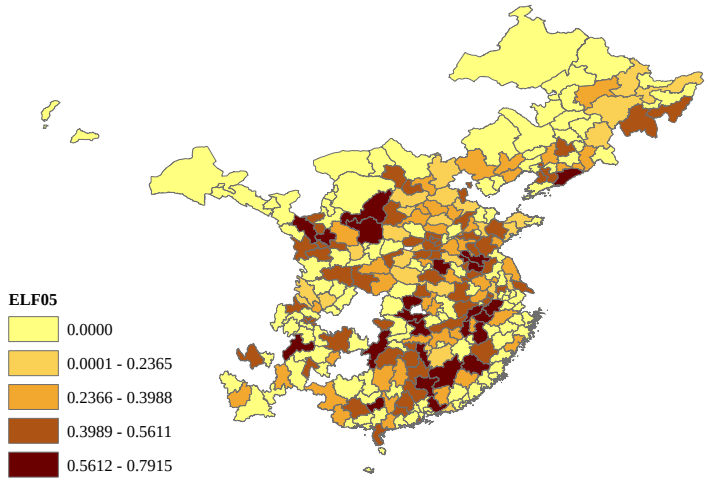

Figure B.1a. ELF in 2005

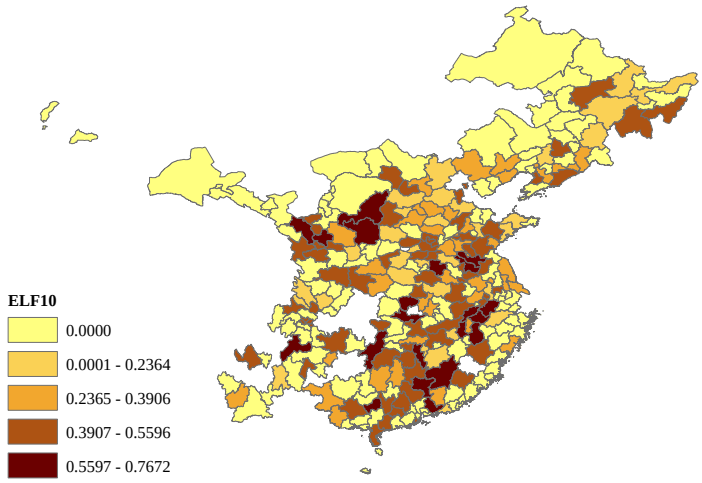

Figure B.1b. ELF in 2010

Figure B.1. Distribution of linguistic fractionalization (ELF)

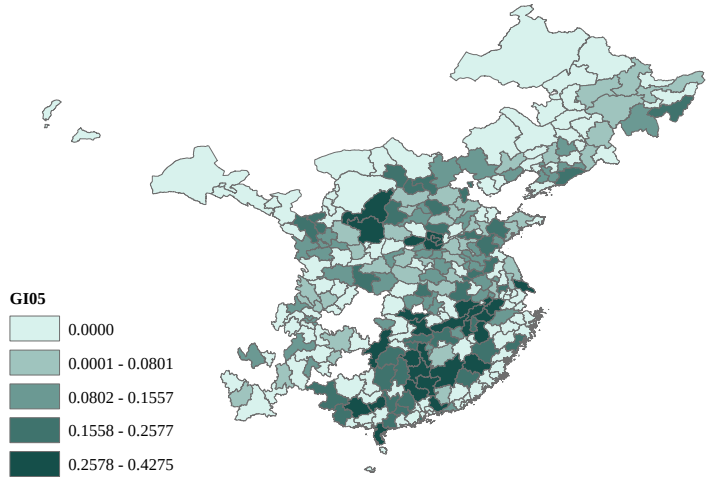

Figure B.2a. GI in 2005

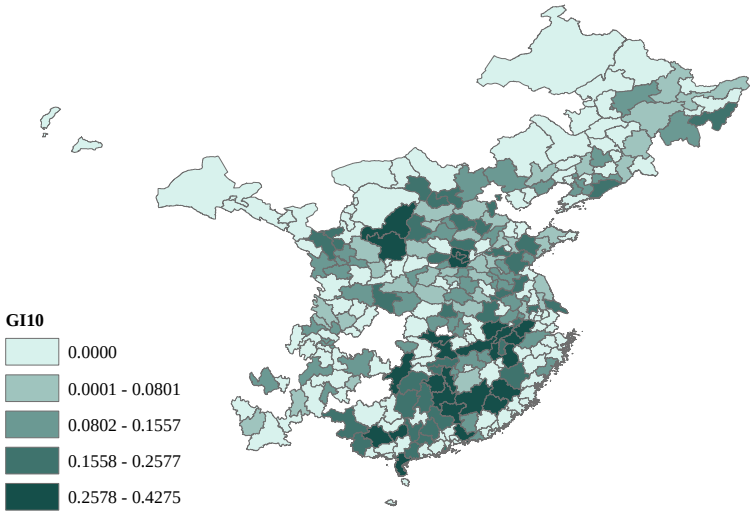

Figure B.2b. GI in 2010

Figure B.2. Distribution of adjusted dialect fractionalization (GI)

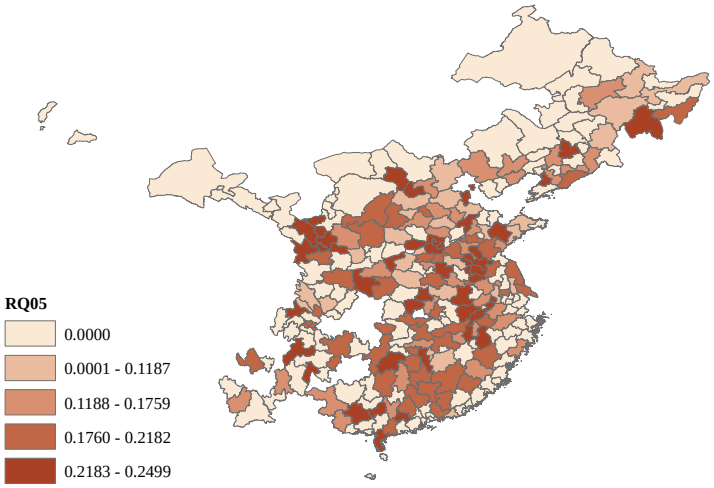

Figure B.3a. RQ in 2005

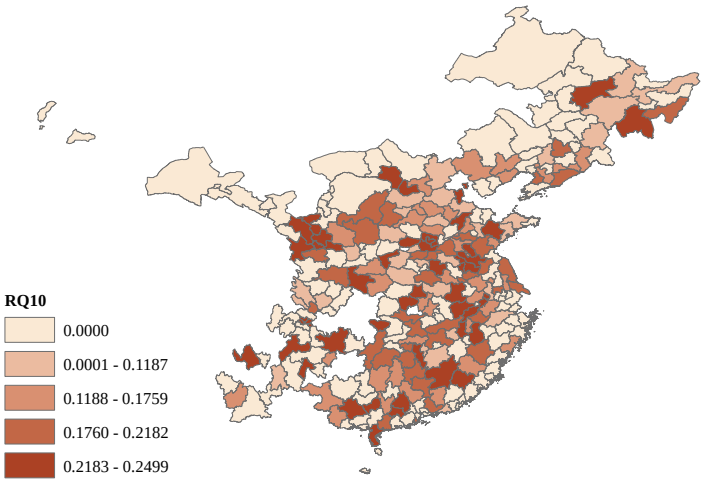

Figure B.3b. RQ in 2010

Figure B.3. Distribution of dialect polarization (RQ)

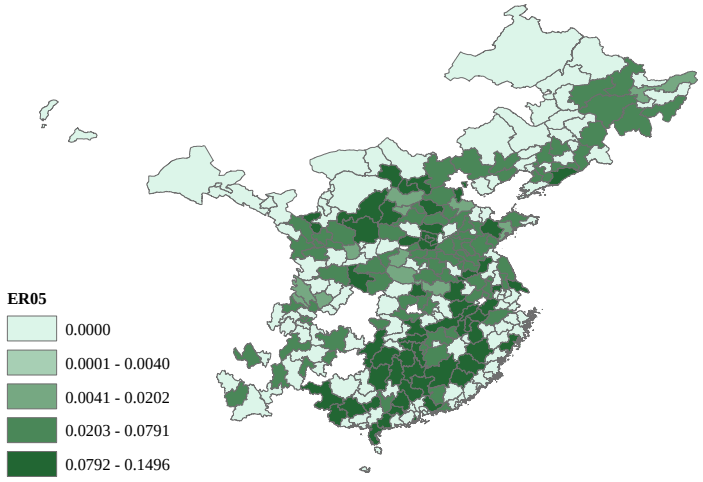

Figure B.4a. ER in 2005

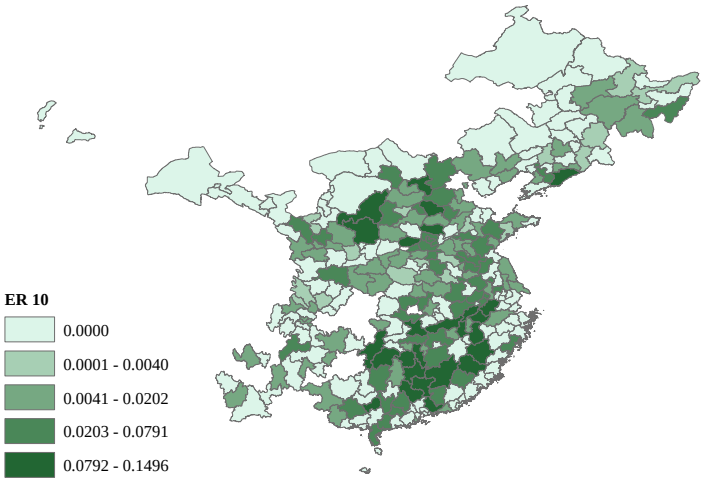

Figure B.4b. ER in 2010

Figure B.4. Distribution of adjusted dialect polarization (ER)

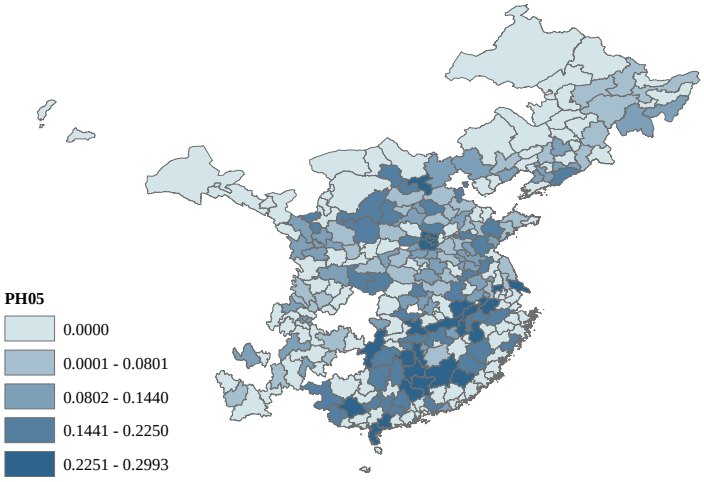

Figure B.5a. PH in 2005

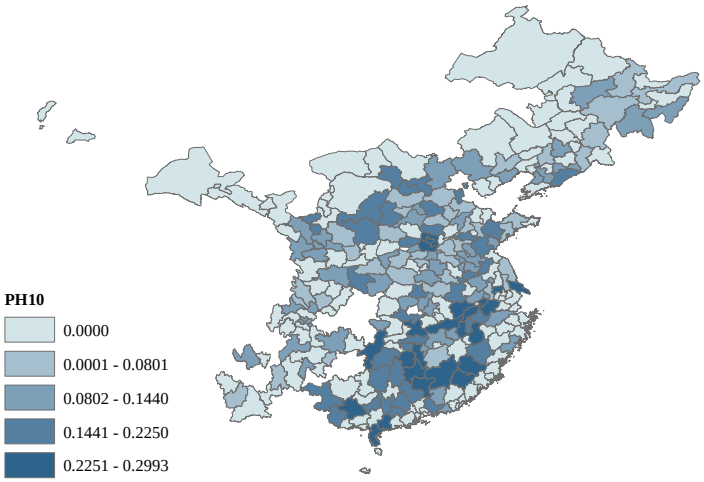

Figure B.5b. PH in 2010

Figure B.5. Distribution of periphery heterogeneity (PH)

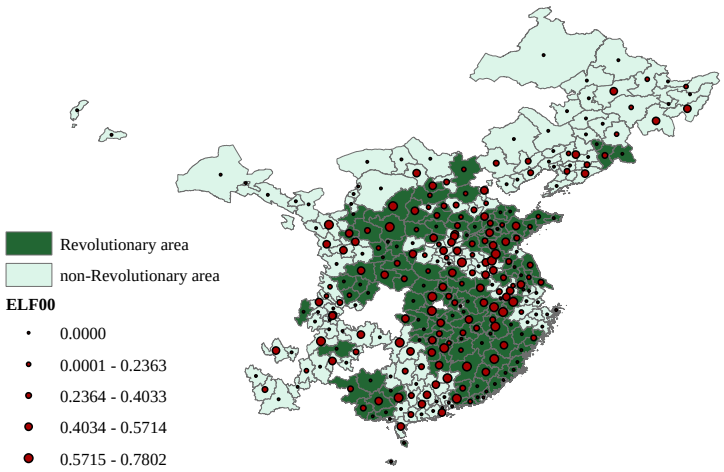

Figure B.6a. The distribution of ELF in the revolutionary area vs. non-revolutionary area

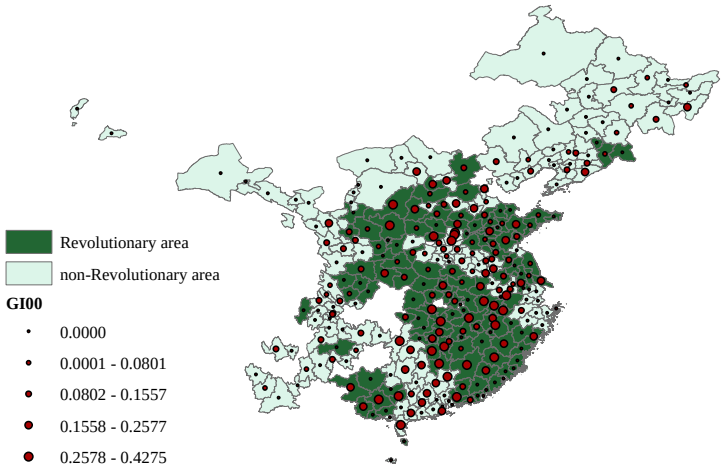

Figure B.6b. The distribution of GI in the revolutionary area vs. non-revolutionary area

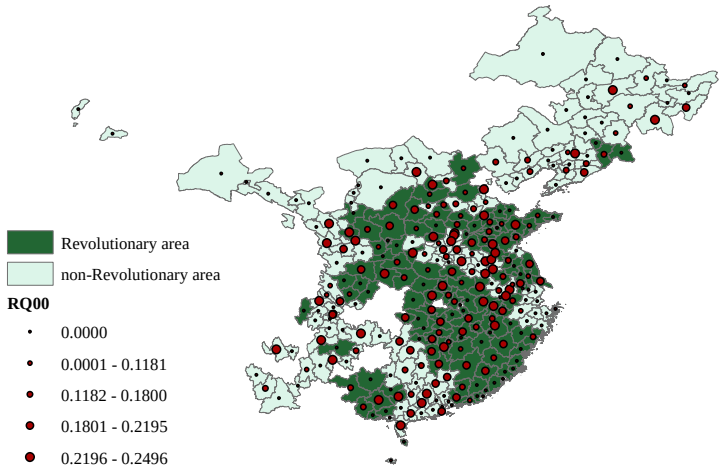

Figure B.6c. The distribution of RQ in the revolutionary area vs. non-revolutionary area

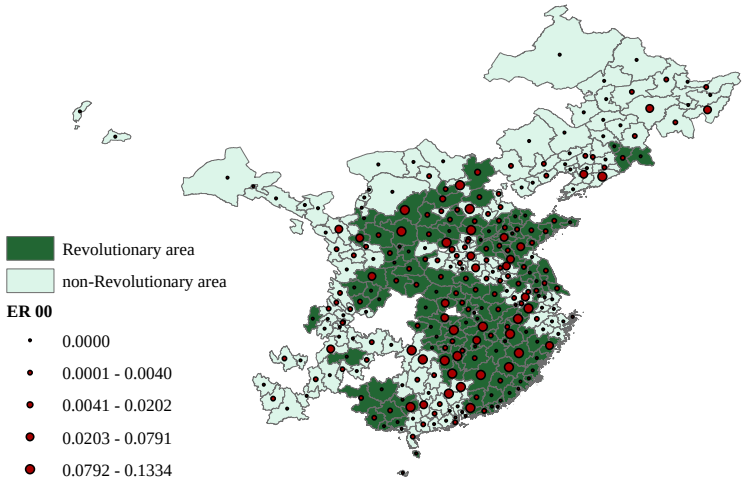

Figure B.6d. The distribution of ER in the revolutionary area vs. non-revolutionary area

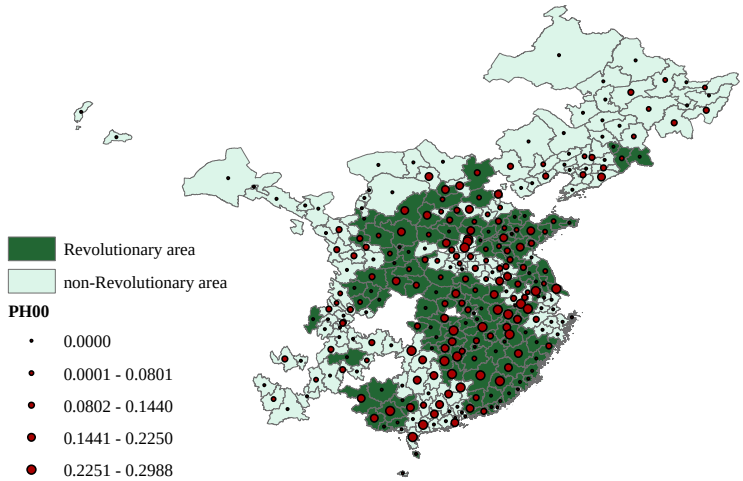

Figure B.6e. The distribution of PH in the revolutionary area vs. non-revolutionary area

Figure B.6.The distribution of dialect diversity in the revolutionary area vs. non-revolutionary area

B.4 Mandarin vs. Non-Mandarin Dialects

According to the language tree of Chinese dialects, dialects belong to either the Mandarin supergroup or non-Mandarin supergroup. Correspondingly, based on the category of dialects used by people, prefecture-level cities belong to either the Mandarin area or non-Mandarin area. It should be noted that there is no city where both Mandarin dialects and non-Mandarin dialects are used. Hence, a dummy, Mandarin, is constructed indicating whether a city belongs to the Mandarin area. The estimated result is obtained by the regression of the fixed-effects model introducing the interaction term between the Mandarin dummy and diversity indices. The reason why some dialects in China are called Mandarin dialects is that they have Putonghua as their foundation. Putonghua was formed in the 1920s and promoted in China from 1956 on. Compared with non-Mandarin dialects, Mandarin dialects are closer to the Chinese Putonghua and therefore people speaking Mandarin dialects have advantages in communicating with people in neighborhoods and master Putonghua. Thus, it is generally assumed that it is easier for people speaking Mandarin dialects to engage in market economic activities. Xu et al. (2015) propose that dialectal diversity should have a less negative effect in the Mandarin area. In addition, the distance between non-Mandarin dialects is larger than that between Mandarin dialects. According to our hypothesis that the positive role of diversity increases with the dialectal distance, however, the positive effect in the Mandarin area should also be smaller because of the smaller distance between Mandarin dialects. The opposite will happen in the non-Mandarin area. Therefore, we are not certain about the difference in the effect of diversity between the Mandarin area and the non-Mandarin area.

After introducing an interaction term between dialectal diversity indices and Mandarin in the baseline fixed-effects model, we obtain the estimated results shown in Table D1. The difference in the effect of Mandarin dialect diversity and non-Mandarin dialectal diversity is described by the coefficient of the interaction terms. We can observe that interaction terms based on ELF, RQ and PH are not significant and their effects on economic growth are the same in the Mandarin area and non-Mandarin area. Furthermore, their main effects are consistent with the results of the baseline estimation. For GI, the corresponding interaction term is not significant, but the main effect on income is significant, which is inconsistent with the baseline analysis. We also

notice that the coefficient of the interaction term of Mandarin and GI is negative. Although it is not significant, the effect of GI in the whole sample may be disturbed and it is thus not significant in the baseline estimation. In addition, in the estimation of the effect of ER, the main effect is significant and positive, while the coefficients of its interaction term with Mandarin are significant and negative with larger absolute values. Thus, the effects of ER on economic growth are positive in the non-Mandarin area and negative in the Mandarin area. This is also consistent with the insignificant result of ER in the baseline regression. Above all, we do not observe the larger positive role of dialectal diversity in the Mandarin area, and the difference in the effect of ER between the Mandarin area and the non-Mandarin area also implies that larger dialectal distance results in a larger positive role of diversity, which is different from the conclusion of Xu et al. (2015). Hence, we state that there is no significant effect of difficulty in communication due to dialectal diversity.

Table B.4.1. The effect of Mandarin dialectal diversity and non-Mandarin dialectal diversity

Indep. Variable	ELF	ELF	ELF	GI	GI	GI	RQ	RQ	RQ	ER	ER	ER	PH	PH	PH
Dialect diversity	1.455***	0.855**	0.815**	1.126*	0.696	1.102**	3.531***	1.985**	1.603*	0.277*	0.284*	-0.181	0.780	1.338***	1.399**
	(0.407)	(0.400)	(0.408)	(0.585)	(0.497)	(0.547)	(1.057)	(0.904)	(0.928)	(0.148)	(0.145)	(0.216)	(0.967)	(0.393)	(0.551)
Mandarin* Dialect diversity	-0.704	-0.584	-0.567	-1.404	0.523	0.077	-2.084	-1.481	-1.108	-0.662**	-0.692*	-0.186	1.430	-0.597	-0.718
	(0.630)	(0.683)	(0.670)	(1.102)	(2.055)	(1.995)	(1.445)	(1.482)	(1.477)	(0.270)	(0.352)	(0.476)	(1.825)	(1.423)	(1.411)
Income in lagging		0.285***	0.069		0.288***	0.068		0.284***	0.068		0.293***	0.076		0.281***	0.064
period 1		(0.039)	(0.060)		(0.039)	(0.060)		(0.039)	(0.061)		(0.039)	(0.059)		(0.039)	(0.061)
Income in lagging			0.019			0.021			0.020			0.034			0.024
period 2			(0.068)			(0.068)			(0.068)			(0.071)			(0.069)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.344***	5.641***	10.341***	7.603***	5.691***	10.336***	7.322***	5.646***	10.352***	7.815***	5.858***	10.407***	7.551***	5.677***	10.267***
	(1.206)	(1.309)	(1.594)	(1.223)	(1.327)	(1.599)	(1.219)	(1.308)	(1.599)	(1.192)	(1.314)	(1.573)	(1.164)	(1.308)	(1.619)
Observations	712	656	412	712	656	412	712	656	412	712	656	412	712	656	412
R-squared	0.964	0.972	0.954	0.964	0.972	0.954	0.964	0.972	0.954	0.964	0.972	0.954	0.964	0.972	0.954
Number of cities	252	250	229	252	250	229	252	250	229	252	250	229	252	250	229

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, p<0.1.

Note: In addition, to control variables in column (7) of Table B.3 and individual effects, time invariant variables, such as geographical factors, including region dummy, provincial dummy and distance to central cities, and historical variables as well as economic policy are also considered.

Appendix C.

Appendix to Chapter 3

C.1 Additional tables

Table C.1. The list of countries

Baseline set of countries				Additional 23 countries included in sensitivity checks S6#
Algeria	Dominican Rep.	Korea, Rep.	Saudi Arabia	Albania
Argentina	Ecuador	Madagascar	Senegal	Armenia
Australia	Egypt	Malawi	Sierra Leone	Benin
Austria	El Salvador	Malaysia	Singapore	Cambodia
Bangladesh	Fiji	Mali	South Africa	Croatia
Belgium	Finland	Mauritius	Spain	Czech Republic
Bolivia	France	Mexico	Sri Lanka	Estonia
Botswana	Gabon	Morocco	Sudan (former)	Germany
Brazil	Gambia	Mozambique	Swaziland	Haiti
Bulgaria	Ghana	Nepal	Sweden	Kazakhstan
Burkina Faso	Greece	Netherlands	Switzerland	Kyrgyzstan
Burundi	Guatemala	New Zealand	Syrian Arab Rep.	Latvia
Cameroon	Honduras	Nicaragua	Tanzania	Lithuania
Canada	Hungary	Niger	Thailand	Moldova
Central African Rep.	India	Nigeria	Togo	Mongolia
Chile	Indonesia	Norway	Trinidad & Tobago	Romania
China	Iran, Islamic Rep.	Pakistan	Tunisia	Russia
Colombia	Ireland	Panama	Turkey	Slovakia
Congo, Dem. Rep.	Israel	Paraguay	Uganda	Slovenia
Congo, Rep.	Italy	Peru	United Kingdom	Ukraine
Costa Rica	Jamaica	Philippines	United States	Vietnam
Cote d'Ivoire	Japan	Poland	Uruguay	Yemen
Cyprus	Jordan	Portugal	Venezuela	Zimbabwe
Denmark	Kenya	Rwanda		

Notes: In the case of private credit, the baseline country sample does not include Bangladesh and the Democratic Republic of the Congo.

Table C.2. Data description and sources

Variable	Notation	Unit	Data source	Notes
GDP per capita	y	USD (PPP, 2011 prices)	PWT9.0	Own calculation based on population data and real GDP at PPP using national accounts growth rates (rgdpna) – both series are taken from PWT 9.0.
Private credit	PCB	% of GDP	GFDD	Private credit by deposit money banks (code: GFDD.DI.01)
Domestic credit	DC	% of GDP	GFDD	Domestic credit to the private sector (code: GFDD.DI.14)
Gross fixed capital formation	GFCF	% of GDP	WDI	(code: NE.GDI.FTOT.ZS)
Human capital index	HC	index	PWT9.0	Index of human capital per person, based on years of schooling and returns to education. The level of human capital increases with the index.
Inflation (price index)	INFL		WDI	100 + annual average change of consumer prices (code: FP.CPI.TOTL.ZG)
General government final consumption expenditure	GovCons	% of GDP	WDI	code: NE.CON.GOVT.ZS
Balance of foreign trade	BoT	% of GDP	WDI	Code: NE.RSB.GNFS.ZS
Volume of foreign trade	Trade	% of GDP	WDI	import + export of goods and services (code: NE.TRD.GNFS.ZS)
Banking crisis	Banking crisis	[0, 5]	Laeven and Valencia (2018)	The original data is a dummy variable taking on value 1 if there was a systemic banking crisis in the given year, 0 otherwise. In the 5-year panel, the sum of the underlying years is used.
The level of democracy/autocracy	Polity2	[-10, 10]	Polity IV database Center for Systemic Peace	Combined measure of democracy and autocracy. The level of democracy (autocracy) increases (decreases) with the index.

Social violence	Violence	[0, 300]	Major Episodes of Political Violance (1946-2018) Center for Systemic Peace	The total measure of international, civil and ethnic warfare and violence (code: actotal). The magnitude of violence increases with the index. In the 5-year panel, the sum of the underlying years is used, scaling up the original index range [0 ; 60] accordingly.
State history index	SH#	[0, 1]	Borcan et al. (2018)	The length of established statehood on the present territory of a country increases with the index # = 1950 / 1950adj / 1500 / 1500adj 1950: period included: 3500BCE-1950CE 1500: period included: 3500BCE-1500CE adj: adjustment for ancestry based on the World Migration Matrix (1500-2000, version 1.1) of Putterman and Weil (2010). For further details, see Section 3.
Agricultural years	AgrY#		Putterman and Trainor (2018)	The number of years since the Neolithic Revolution # = none / adj adj: adjustment for ancestry based on the World Migration Matrix (1500-2000, version 1.1) of Putterman and Weil (2010). For further details, see Section 3.
Legal origin dummies	-		La Porta et al. (2008)	German, French, English, and Scandinavian legal origins are distinguished
Continent dummies	-		own categorization	Constructed dummies: Asia, Sub-Saharan Africa, Middle East & North Africa, Europe, Latin America & the Caribbean (North America and Oceania constiute the reference group.)
Latitude			Spolaore and Wacziarg (2013)	Latitude for the centroid (center point) of a country

Notes: PWT 9.0 – Penn World Table (version 9.0) (Feenstra at el., 2015); WDI – World Development Indicators database (World Bank); GFDD – Global Financial Development Database (World Bank)

213

Table C.3. Correlation matrix of the baseline sample: 95 countries & 1970-2014 (5-year periods)

	ln(y)	lnPCB	lnDC	SH1950 (d=1%)	SH1950 (d=0%)	SH1950 (d=2%)	SH1950 (d=5%)	SH1950 adj	SH1500	SH1500 adj
lnPCB	0.702*	1								
lnDC	0.715*	0.976*	1							
SH1950 (d=1%)	0.240*	0.272*	0.240*	1						
SH1950 (d=0%)	0.210*	0.234*	0.206*	0.989*	1					
SH1950 (d=2%)	0.259*	0.298*	0.264*	0.993*	0.964*	1				
SH1950 (d=5%)	0.285*	0.334*	0.295*	0.934*	0.874*	0.970*	1			
SH1950adj	0.406*	0.399*	0.390*	0.874*	0.878*	0.856*	0.784*	1		
SH1500	0.229*	0.250*	0.225*	0.990*	0.992*	0.970*	0.884*	0.874*	1	
SH1500adj	0.400*	0.377*	0.376*	0.823*	0.843*	0.790*	0.686*	0.983*	0.847*	1
AgrY	0.275*	0.272*	0.240*	0.813*	0.816*	0.797*	0.734*	0.715*	0.808*	0.677*
AgrYadj	0.482*	0.418*	0.410*	0.611*	0.630*	0.585*	0.509*	0.804*	0.620*	0.811*
lnGFCF	0.488*	0.450*	0.458*	0.258*	0.235*	0.271*	0.281*	0.316*	0.251*	0.305*
lag(lnHC)	0.840*	0.649*	0.672*	0.125*	0.094*	0.148*	0.183*	0.273*	0.114*	0.269*
lnINFL	-0.125*	-0.264*	-0.197*	-0.048	-0.042	-0.052	-0.053	-0.014	-0.051	-0.014
lnGovCons	0.385*	0.348*	0.342*	0.08	0.079	0.079	0.074	0.038	0.088	0.042
Violence	-0.233*	-0.196*	-0.180*	0.203*	0.218*	0.185*	0.138*	0.136*	0.208*	0.130*
Polity2	0.510*	0.465*	0.473*	-0.016	-0.047	0.009	0.057	0.099*	-0.036	0.086
lnTrade	0.279*	0.304*	0.262*	-0.131*	-0.134*	-0.127*	-0.122*	-0.098*	-0.112*	-0.07
BoT	0.504*	0.179*	0.187*	0.022	-0.013	0.051	0.104*	0.101*	0.007	0.09
Banking crisis	-0.008	0.021	0.022	-0.067	-0.075	-0.058	-0.033	-0.068	-0.079	-0.08

	AgrY	AgrYadj	lnGFCF	lag(lnHC)	lnINFL	lnGovC	Violence	Polity2	lnTrade	BoT
AgrYadj	0.801*	1								
lnGFCF	0.218*	0.297*	1							
lag(lnHC)	0.182*	0.386*	0.344*	1						
lnINFL	-0.031	0.003	-0.187*	-0.089	1					
lnGovCons	0.152*	0.102*	0.234*	0.323*	-0.113*	1				
Violence	0.176*	0.082	-0.131*	-0.187*	0.116*	-0.217*	1			
Polity2	-0.006	0.187*	0.148*	0.655*	-0.043	0.190*	-0.113*	1		
lnTrade	-0.076	-0.023	0.289*	0.253*	-0.218*	0.291*	-0.299*	0.120*	1	
BoT	0.03	0.117*	0.076	0.376*	-0.037	-0.015	-0.063	0.127*	0.088	1
Banking crisis	-0.019	-0.037	-0.125*	0.033	0.234*	0.018	0.04	0.013	-0.064	0.036

Notes: Pairwise correlations. The asterisk denotes significance at the 1-percent level.

Table C.4. Summary statistics of the baseline sample: 95 countries & 1970-2014 (5-year periods)

Variables	ln(y)	lnPCB	lnDC	SH1950 (d=1%)	SH1950 (d=0%)	SH1950 (d=2%)	SH1950 (d=5%)
Obs	852	819	819	95	95	95	95
Mean	8.859	3.255	3.355	0.227	0.174	0.28	0.405
Std.Dev.	1.214	0.934	0.942	0.181	0.16	0.201	0.233
Min	5.841	-0.709	-0.468	0.007	0.005	0.011	0.024
Max	11.456	5.505	5.509	0.739	0.746	0.729	0.86
Variables	SH1950adj	SH1500	SH1500adj	AgrY	AgrYadj	lnGFCF	lag(lnHC)
Obs	95	95	95	95	95	800	842
Mean	0.276	0.168	0.224	4457	5216	3.027	0.658
Std.Dev.	0.155	0.19	0.165	2381	2055	0.331	0.349
Min	0.022	0	0	362	1400	1.376	0.007
Max	0.727	0.76	0.747	10500	10375	4.187	1.305
Variables	lnINFL	lnGovCons	Violence	Polity2	lnTrade	BoT	Banking crisis
Obs	813	816	849	849	824	824	739
Mean	4.752	2.651	3.79	2.58	4.047	-3.2	0.39
Std.Dev.	0.347	0.355	8.32	7.07	0.56	9.6	0.97
Min	4.575	1.406	0	-10	1.916	-48.9	0
Max	8.783	3.704	65	10	6.018	47.4	5

Table C.5. Sensitivity to the GMM settings (FD = domestic credit)

Sens. check	S1B	S2B	S3B	S4B
Weighting matrix	default	default	default	cross-country & -time heteroskedasticity
Internal IV	default	default	1st order lags	default
External IV	legal origin	none	default	defaut
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2				
ln(DC_bottom)	0.0864	0.1272	0.1421	0.0542
	(0.019)	(0.002)	(0.001)	(0.121)
ln(DC_upper)	-0.0805	-0.0548	-0.0346	-0.0934
	(0.024)	(0.163)	(0.406)	(0.004)
Wald test (pv)	0.087	0.163	0.040	0.067
γ	0.216	0.108	0.204	0.216
SH quartile	Q3	Q2	Q3	Q3
N	544	544	614	544
no. of countries	95	95	95	95
Jstat (pv)	0.054	0.030	0.644	0.003
no. of IVs	26	23	25	32

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Table C.6. Sensitivity to the sample (FD = domestic credit)

Sens. check	S5B	S6B	S7B	S8B	S9B	S10B	S11B	S12B	S13B	S14B	S15B
Complete obs. (min.)	6	3	default	default	default	default	default	default	default	default	default
Period	default	default	1970-2004	1980-2009	default	default	default	default	default	default	default
Countries	default	default	default	default	Developed	Developing	w/o LAC	w/o Asia	w/o MENA	w/o SSA	w/o West
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2											
ln(DC_bottom)	0.0752	0.0553	0.0693	0.0569	0.0158	0.0511	0.0278	0.0749	0.0632	0.0163	-0.1663
	(0.011)	(0.055)	(0.026)	(0.099)	(0.497)	(0.157)	(0.313)	(0.004)	(0.027)	(0.558)	(0.003)
ln(DC_upper)	-0.0690	-0.0898	-0.0795	-0.1035	-0.0579	-0.0386	-0.1009	-0.0987	-0.1134	-0.0734	0.0378
	(0.04)	(0.004)	(0.019)	(0.001)	(0.008)	(0.384)	(0)	(0.003)	(0.001)	(0.001)	(0.231)
Wald test (pv)	0.127	0.063	0.060	0.055	0.235	0.045	0.015	0.050	0.080	0.040	0.000
γ	0.216	0.216	0.204	0.216	0.104	0.216	0.388	0.228	0.216	0.228	0.039
SH quartile	Q3	Q3	Q3	Q3	Q2	Q3	Q3	Q3	Q3	Q2	Q1
N	512	570	448	471	336	208	407	462	488	413	424
no. of countries	81	118	87	95	54	41	75	82	85	67	74
Jstat (pv)	0.077	0.085	0.051	0.049	0.092	0.404	0.082	0.198	0.117	0.009	0.219
no. of IVs	32	32	31	30	32	28	31	31	31	31	30

Notes: Robust p-values are in brackets. Developed countries: high income & upper-middle income countries, Developing countries: low income & lower-middle income countries. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Notations: LAC – Latin America & the Caribbean, MENA – Middle East & North Africa, SSA – Sub-Saharan Africa, West – Europe & North America

Table C.7. Sensitivity to the threshold effect (FD = domestic credit)

Sens. check	S16B	S17B	S18B	S19B	S20B	S21B
X with.threshold effect	lag(lny)	lnGFCF	lag(lnHC)	ln(INFL)	ln(GovCons)	Polity2
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2						
ln(DC_bottom)	0.0338	0.0414	0.0533	0.0658	0.0543	0.0611
	(0.221)	(0.132)	(0.021)	(0.012)	(0.084)	(0.032)
ln(DC_upper)	-0.0540	-0.0843	-0.0693	-0.0782	-0.0279	-0.0634
	(0.127)	(0.025)	(0.059)	(0.021)	(0.363)	(0.05)
ln(X_bottom)	0.9046	0.0098	0.2982	-0.0628	0.2303	0.0075
	(0)	(0.875)	(0.023)	(0.004)	(0)	(0.002)
ln(X_upper)	0.8188	0.3068	0.2525	-0.1318	-0.1640	0.0055
	(0)	(0.002)	(0.043)	(0.005)	(0.028)	(0.087)
γ	0.216	0.216	0.216	0.226	0.216	0.204
SH quartile	Q3	Q3	Q3	Q3	Q3	Q3
Jstat (pv)	0.044	0.035	0.064	0.069	0.099	0.062

Notes: Robust p-values are in brackets. In each case, N= 544, no. of countries = 95, no. of IVs = 32. For the individual tests, only the p-values (pv) are presented. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Table C.8. Sensitivity to the control variables (FD = domestic credit)

Sens. scenario	S22B	S23B	S24B	S25B
Add. control	lnTrade	BoT	Banking crisis	lnPCB*Polity2
Control variables: lag(lny), ln(GFCF), lag(ln(HC)), ln(INFL), ln(GovCons), Violence, Polity2				
Add. control	-0.0814	0.0010	-0.0262	-0.0043
	(0.116)	(0.722)	(-0.004)	(0.017)
ln(DC_bottom)	0.0680	0.0674	0.0341	0.0732
	(0.024)	(0.035)	(0.013)	(0.012)
ln(DC_upper)	-0.0808	-0.0938	-0.0546	-0.1162
	(0.014)	(0.003)	(0.073)	(0)
Wald test (pv)	0.000	0.080	0.010	0.000
γ	0.216	0.216	0.202	0.228
SH quartile	Q3	Q3	Q3	Q3
N	544	544	439	544
no. of countries	95	95	85	95
Jstat (pv)	0.153	0.091	0.146	0.089
no. of IVs	34	34	32	34

Notes: Robust p-values are in brackets. The H0 of the Wald test is $\alpha_1 = \alpha_2$. For the individual tests, only the p-values (pv) are presented. The p-value of the Wald test is based on bootstrapping. SH quartile shows the quartile to which γ falls. External IVs: legal origin dummies, continent dummies, latitude. Internal IVs: 1st & 2nd order lags of untransformed variables with the exception of Violence.

Appendix D.

Appendix to Chapter 4

D.1 Additional tables

Table D.1. The direct effect of instruments for the whole sample.

Variable	(1)	(2)	(3)	(4)
Number of product categories	0.008**	-0.002		
	(0.003)	(0.004)		
Dummy of the massacre			-0.324***	-0.167**
			(0.069)	(0.069)
Chinese share		0.010***		0.006***
		(0.002)		(0.002)
GDP per capita in the lagged period	0.781***	0.762***	0.843***	0.775***
	(0.059)	(0.047)	(0.040)	(0.042)
Gross fixed capital formation.	0.187***	0.253***	0.259***	0.245***
	(0.065)	(0.053)	(0.046)	(0.042)
Trade	0.047	0.029	0.001	0.005
	(0.061)	(0.057)	(0.057)	(0.058)
Financial development	0.041	-0.007	-0.016	-0.010
	(0.040)	(0.031)	(0.032)	(0.029)
Natural resources rents	-0.012	-0.074***	-0.071***	-0.081***
	(0.022)	(0.018)	(0.024)	(0.019)
Ethnic diversity	0.158	0.178**	0.218**	0.185***
	(0.104)	(0.066)	(0.082)	(0.066)
Population	-0.086**	-0.000	0.046**	0.009
	(0.040)	(0.045)	(0.018)	(0.021)
Human capital	0.267	0.206	-0.165	0.129
	(0.241)	(0.202)	(0.127)	(0.146)
Polity	0.001	-0.006***	-0.004**	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Island	-0.027	0.006	0.269***	0.137**
	(0.037)	(0.028)	(0.059)	(0.060)
Total area	0.114*	0.041	-0.010	0.042*
	(0.066)	(0.054)	(0.019)	(0.023)
Time effect	Yes	Yes	Yes	Yes
Constant	-0.299	0.632	0.904	0.720
	(0.851)	(0.703)	(0.621)	(0.606)
Observations	53	53	53	53
R-squared	0.998	0.999	0.998	0.999

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D.2. The direct effect of instruments in different economic environments

	Economic environment=0				Economic environment=1			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of product categories	-0.025	0.017			-0.037*	0.013		
	(0.023)	(0.045)			(0.016)	(0.016)		
Dummy of the massacre			0.238*	0.143			-0.399**	-0.179
			(0.120)	(0.280)			(0.141)	(0.135)
Chinese share		-0.011		-0.004		0.035***		0.021**
		(0.011)		(0.013)		(0.007)		(0.009)
GDP per capita in the lagged period	0.637***	0.624***	0.590***	0.597***	0.284	0.763***	0.727***	0.669***
	(0.089)	(0.104)	(0.091)	(0.109)	(0.283)	(0.184)	(0.109)	(0.087)
Gross fixed capital formation	0.448**	0.505**	0.426***	0.469*	0.113	0.100**	0.118	0.105**
	(0.132)	(0.172)	(0.112)	(0.196)	(0.126)	(0.038)	(0.071)	(0.040)
Trade	0.075	0.056	0.120	0.098	0.086	-0.395***	-0.111	-0.286***
	(0.117)	(0.115)	(0.085)	(0.110)	(0.072)	(0.103)	(0.071)	(0.076)
Financial development	0.004	0.027	0.019	0.026	0.129	-0.029	-0.005	-0.004
	(0.040)	(0.048)	(0.041)	(0.053)	(0.092)	(0.062)	(0.051)	(0.044)
Natural resources rents	0.077	0.066	0.080	0.089	0.066	-0.145**	-0.083	-0.120**
	(0.072)	(0.071)	(0.055)	(0.064)	(0.049)	(0.055)	(0.048)	(0.038)
Ethnic diversity	-0.031	-0.053	-0.059	-0.071	2.987**	-1.423	0.431	-0.222
	(0.095)	(0.098)	(0.090)	(0.115)	(1.203)	(1.192)	(0.261)	(0.387)
Population	-0.101	-0.316	-0.246**	-0.259**	0.342*	-0.208	0.050	-0.030
	(0.061)	(0.212)	(0.071)	(0.084)	(0.165)	(0.165)	(0.028)	(0.036)
Human capital	1.370	1.302	1.681*	1.578	0.354	1.274***	0.356	0.891**
	(0.737)	(0.796)	(0.696)	(0.923)	(0.437)	(0.340)	(0.213)	(0.267)
Polity	0.002	0.007	0.003	0.005	-0.004	-0.006	-0.002	-0.007
	(0.004)	(0.007)	(0.004)	(0.007)	(0.007)	(0.006)	(0.003)	(0.004)
Island	-0.166	-0.154	-0.403**	-0.309	0.312*	-0.360*	0.245**	-0.046
	(0.086)	(0.100)	(0.162)	(0.331)	(0.162)	(0.182)	(0.094)	(0.151)
Total area	0.185**	0.404	0.342***	0.348**	-0.888**	0.558	-0.053*	0.155
	(0.070)	(0.213)	(0.078)	(0.090)	(0.376)	(0.395)	(0.028)	(0.096)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-1.546**	-3.569	-3.049***	-3.125***	13.464**	-2.837	2.871***	1.663
	(0.456)	(1.828)	(0.667)	(0.737)	(5.496)	(4.873)	(0.792)	(1.080)
Observations	24	24	24	24	29	29	29	29
R-squared	0.999	0.999	0.999	0.999	0.999	0.9998	0.9998	0.9998

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D.3. The direct effect of instruments for the sample without Singapore.

Variable	(1)	(2)	(3)	(4)
Number of product categories	0.043**	0.014		
	(0.017)	(0.018)		
Dummy of the massacre			-0.273***	-0.079
			(0.071)	(0.097)
Chinese share		0.013***		0.011*
		(0.004)		(0.005)
GDP per capita in the lagged period	0.782***	0.752***	0.779***	0.750***
	(0.090)	(0.059)	(0.065)	(0.062)
Gross fixed capital formation.	0.206***	0.221***	0.253***	0.238***
	(0.066)	(0.057)	(0.053)	(0.056)
Trade	0.090	-0.005	0.025	-0.010
	(0.078)	(0.090)	(0.079)	(0.088)
Financial development	0.021	-0.014	0.003	-0.012
	(0.043)	(0.027)	(0.035)	(0.028)
Natural resources rents	-0.086**	-0.108***	-0.070***	-0.093***
	(0.038)	(0.030)	(0.023)	(0.020)
Ethnic diversity	0.198*	0.214**	0.152*	0.188*
	(0.109)	(0.097)	(0.088)	(0.094)
Population	-0.126**	-0.009	-0.014	0.011
	(0.048)	(0.060)	(0.050)	(0.051)
Human capital	-0.038	0.175	0.115	0.241
	(0.420)	(0.280)	(0.305)	(0.290)
Polity	0.001	-0.008***	-0.003	-0.008***
	(0.002)	(0.003)	(0.002)	(0.003)
Island	0.011	0.005	0.224***	0.065
	(0.035)	(0.027)	(0.065)	(0.078)
Total area	0.199**	0.065	0.075	0.039
	(0.082)	(0.088)	(0.066)	(0.071)
Time effect	Yes	Yes	Yes	Yes
Constant	-1.145	0.765	0.223	0.957
	(1.034)	(1.235)	(0.943)	(1.119)
Observations	44	44	44	44
R-squared	0.996	0.997	0.997	0.997

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table D.4. The direct effect of the instrument – the dummy of the port.

	Whole sample		Economic environment=0		Economic environment=1		Singapore=0	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			lnypc1	lnypc1	lnypc1	lnypc1	lnypc1	lnypc1
Dummy of the port	0.135***	-0.005	-0.283	-0.129	0.249**	0.050	0.105**	-0.016
	-0.043	-0.058	(0.160)	(0.321)	(0.100)	(0.065)	(0.048)	(0.058)
Chinese share		0.010***		-0.006		0.026**		0.015***
		-0.003		(0.011)		(0.008)		(0.005)
GDP per capita in the lagged period	0.837***	0.748***	0.598***	0.603***	0.938***	0.692***	0.743***	0.739***
	-0.045	-0.048	(0.093)	(0.108)	(0.169)	(0.124)	(0.088)	(0.063)
Gross fixed capital formation	0.292***	0.235***	0.428***	0.486**	0.163	0.112**	0.274***	0.230***
	-0.058	-0.048	(0.112)	(0.188)	(0.098)	(0.045)	(0.068)	(0.060)
Trade	-0.001	0.028	0.113	0.086	-0.230*	-0.335***	0.021	-0.006
	-0.062	-0.053	(0.093)	(0.111)	(0.122)	(0.066)	(0.088)	(0.083)
Financial development	0.000	0.002	0.009	0.024	-0.037	-0.005	0.022	-0.013
	-0.041	-0.032	(0.039)	(0.055)	(0.069)	(0.052)	(0.046)	(0.029)
Natural resources rents	-0.038	-0.070***	0.087	0.095	-0.075	-0.114*	-0.039	-0.094***
	-0.025	-0.019	(0.063)	(0.067)	(0.053)	(0.050)	(0.027)	(0.021)
Ethnic diversity	0.15	0.169**	-0.050	-0.072	-0.331	-0.511	0.104	0.199*
	-0.105	-0.064	(0.086)	(0.112)	(0.473)	(0.358)	(0.095)	(0.097)
Population	-0.054**	-0.02	-0.268**	-0.273**	-0.123*	-0.091**	-0.112*	0.016
	-0.024	-0.022	(0.089)	(0.096)	(0.055)	(0.027)	(0.058)	(0.061)
Human capital	0.204	0.276*	1.505*	1.461	0.754*	1.111***	0.560	0.271
	-0.18	-0.159	(0.681)	(0.812)	(0.363)	(0.278)	(0.401)	(0.307)
Polity	-0.002	-0.005***	0.001	0.005	-0.006	-0.008	-0.001	-0.009***
	-0.002	-0.002	(0.003)	(0.008)	(0.005)	(0.006)	(0.002)	(0.003)
Island	0.057**	-0.004	-0.362*	-0.256	-0.019	-0.197**	0.035	-0.005
	-0.027	-0.031	(0.161)	(0.279)	(0.070)	(0.076)	(0.039)	(0.036)
Total area	0.003	0.069***	0.476**	0.412	0.046	0.222**	0.105	0.038
	-0.027	-0.021	(0.153)	(0.209)	(0.059)	(0.087)	(0.086)	(0.070)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.562	0.456	-4.308**	-3.728	0.767	0.918	-0.099	1.037
	-0.734	-0.574	(1.373)	(1.854)	(1.368)	(1.250)	(1.020)	(1.025)
Observations	53	53	24	24	29	29	44	44
R-squared	0.998	0.999	0.999	0.999	0.9998	0.9998	0.996	0.997

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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Erklärung

Ort, Datum:……..

Erklärung gem. § 4 Abs. 2

Hiermit erkläre ich, dass ich mich noch keinem Promotionsverfahren unterzogen oder um Zulassung zu einem solchen beworben habe, und die Dissertation in der gleichen oder einer anderen Fassung bzw. Überarbeitung einer anderen Fakultät, einem Prüfungsausschuss oder einem Fachvertreter an einer anderen Hochschule nicht bereits zur Überprüfung vorgelegen hat.

Unterschrift: …….

Ort, Datum:……..

Erklärung gem. § 10 Abs. 3

Hiermit erkläre ich, dass ich für die Dissertation folgende Hilfsmittel und Hilfen verwendet habe:

- Stata
- Microsoft Office
- Mathtype
- ArcGIS
- R studio

Auf dieser Grundlage habe ich die Arbeit selbstständig verfasst.

Unterschrift: …….