

Dynamics of the Subnational Regional Effect: The Role of Institutions and Institutional Access*

Abstract

This study investigates the dynamics of subnational regional effects (SREs) over time using annual survey data of manufacturing firms in China from 1998 to 2007. SREs increase over time while China's economy grows rapidly and globalizes and its institutions develop. This trend is explained by institutional divergence across regions over time. Institutional accessibility converges over time and moderates SRE growth as predicted. Based on proxies for institutions and institutional access, we find evidence consistent with the institution-based theory as the cause of these dynamics. Our findings suggest that dynamics of institutions and institutional access are important in determining firm performance. Furthermore, the importance of local institutions can increase even as an economy develops due to institutional path-dependency.

Keywords: subnational regional effect; institution-based theory; institutional access; firm performance; dynamic profit components

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INTRODUCTION

Strategy scholars have a long history of studying the sources of firm performance (e.g., Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997). Debate initially focused primarily on whether performance derived from industrial structure (industry-based view)¹ or firm resources (resource-based view). Later, an institution-based view emerged which contends that a firm's institutional environment affects its performance. Consistent with this, previous studies find country (region) matters in determining profits for foreign affiliates of multinational corporations (MNCs) (Christmann *et al.*, 1999; Makino *et al.*, 2004) and European firms (Kattuman *et al.*, 2011).² Recent studies find evidence of subnational regional effects (SREs). That is, intra-country regions matter in explaining variation in firm performance. Chan *et al.* (2010) find that U.S. states and Chinese provinces explain the performance of Japanese MNC's foreign affiliates competing in each country. Ma *et al.* (2013) document interaction effects between subnational region and industry, corporate parent, and home country for foreign subsidiaries operating in China. While significantly advancing our understanding of firm performance, these recent studies also raise two questions that motivate our study.

First, how do SREs evolve over time with rapid development and globalization – a question posed by Makino *et al.* (2004: 1038) and Chan *et al.* (2010: 1237)? Several studies compare SREs in less- and more-developed regions cross-sectionally. Chan *et al.* (2008) find SREs are stronger with a low rather than high level of a country's institutional development. Chan *et al.* (2010) document that SREs among Japanese MNCs are stronger for affiliates in China than in the US, while Ma *et al.* (2013) find they are greater in less- versus more-developed regions of China. This has led to speculation that SRE strength is inversely related

¹ This is sometimes referred to as the industrial organization economics perspective.

² Foreign affiliates' regional effects are related to institutional development (Chan *et al.*, 2008) and exhibit significant industry interactions (Tong *et al.*, 2008). World regions also influence MNCs' location decisions (Arregle *et al.*, 2013).

to institutional development (Chan *et al.*, 2010). This prompts us to consider how SREs evolve over time as a country and its institutions develop.

To address this question we apply the institution-based theory and argue that intra-country differences can be amplified by development and globalization. Institutions, which can be economic, political or social, can diverge across subnational regions over time within a country even while its institutions are improving on average and its economy developing. Economic institutions such as capital and labor markets are uneven across regions in early stages of development and grow unevenly – a process that agglomeration effects can exacerbate (Fujita and Hu, 2011). Political institutions can diverge over time due to a policy preference for faster-growing regions (Yang, 1997: 16; Fujita and Hu, 2011). Heterogeneity in social institutions across regions amplifies these institutional differences as the efficacy of the latter relies on the former (North, 1990). For instance, trust among members of a society prevents people from engaging in inefficient non-cooperative traps (Chan *et al.*, 2008). Institutions can also diverge within a county in the midst of globalization. Globalization leads to information transmission across countries via trade (North, 1990). This information is absorbed at different rates by institutions in different regions according to the preponderance of international versus domestic institutions, absorption rates of local institutions, and uneven application of international mandates across regions (Ruef and Scott, 1998; He *et al.*, 2008; Wilson, 2009). These trends of diverging institutions resulting from both development and globalization are reinforced over time due to institutional path-dependency in the absence of large, negative shocks (North, 1990).

According to the institution-based theory, institutions influence organizational performance; therefore institutional divergence over time can result in widening firm performance across subnational regions over time. This is especially true for rapidly-developing economies in which social institutions often act as a substitute for formal political

and economic institutions that do not keep pace with growth (Xin and Pearce, 1996; London and Hart, 2004). Moreover, economic institutions are less interconnected in these economies further amplifying institutions' effect on firms. Institutions influence firm performance in the process of globalization according to how embedded firms are in institutions. Since this differs across regions, institutions affect firm performance to different degrees. This pattern is exacerbated by local protectionism – a common feature of globalizing economies (He *et al.*, 2008). Therefore, our theoretical framework predicts that absent large, negative institutional shocks SREs should increase over time when institutions are diverging within a country.

The second question raised by recent studies is how the dynamics of institutional access influence SREs over time? In applying the institution-based theory to SREs, previous work has focused on differences in institutional development across regions. Under this theory, differences in organizational performance depend on the interactions between institutions and organizations as moderated by formal and informal constraints. Institutional access refers to the degree to which organizations are actively and passively influenced by the formal and informal constraints that institutions impose (North, 1990).³ Institutions impose constraints on organizations and thereby affect their performance but the degree of influence is determined by the nature of the interaction between institutions and organizations (North, 1990). Differences in access across firms lead to differences in institutions' impact on firm performance and therefore magnify or diminish the effect of institutions on SREs. We are not aware of any empirical work that distinguishes between institutions and institutional accessibility in explaining SREs.

³ To make this more concrete consider an example. Firm performance is influenced by the availability of financing as determined by formal economic institutions such as the banking system and formal political institutions such as credit-risk requirements as well as informal cultural institutions such as norms about what types of firms are perceived as credit-worthy. Firms may be more or less affected by these institutions depending on the quality and extent of their institutional access. For example, politically-connected firms may be better able to influence lawmakers on setting credit requirements in their jurisdiction or those whose executives are in prominent social networks may benefit from positive public perception about their credit worthiness and contributions to society.

To test these two hypotheses, we use a comprehensive sample of manufacturing firms in China from 1998 to 2007 for several reasons. First, some of the previous literature that motivates our study uses the same dataset (e.g., Ma *et al.*, 2013; Xia and Walker, 2014). Therefore, our findings can be compared to them. Second, all three types of institutions were evolving quickly across regions in China over the sample period because of infrastructure expansion, market-oriented reforms, and migration, as explained later. Third, measuring institutional access is empirically challenging. The Chinese setting offers a unique proxy – ownership type – which is an important dimension of institutional access. Ownership type becomes more uniform across regions over time as illustrated later. We take advantage of the significant institutional change and unique measure of institutional access to examine the two hypotheses. Fourth, given China’s prominent role in global manufacturing and trade, understanding the sources of firms’ performance in China is particularly valuable.

To measure institutions we supplement previously-used institutional indices with new micro measures. We first establish that there is increasing institutional divergence over time across subnational regions (defined as city-level administrative regions). The standard deviation of the institutional measures across subnational regions increases 32% between 1998 and 2007. Given that there are no major negative shocks during the sample period, this is consistent with path dependence in institutional change; institutions that are diverging continue to diverge. Given this divergence in institutions, our first hypothesis predicts that SREs should increase over time. Consistent with this, we find that SREs increase dramatically over time – from 6.2% of total profit variance in 1998 to 22.6% in 2007. This occurs as China’s institutions develop and its economy expands and globalizes. Over the sample period, a commonly-used institutional index increased 20% for China, its economy

expanded on average by 9.9% annually, and its exports and imports grew by more than 23% annually.⁴

It is useful to compare this result to previous ones. Chan *et al.* (2008) find that institutional development decreases the variance of firm profits at the country level. Our result shows that institutions can diverge within a country even while improving and converging on average at the country level. That is, institutional development at the country level can decrease country regional effects over time, while simultaneously increasing SREs due to institutional divergence within the county.⁵ Chan *et al.* (2010) show that SREs are lower in a more-developed relative to a less-developed country. Our results show that SREs may increase within these countries over time even while SREs remain lower in the more developed country.⁶ SREs may be lower in a country with greater institutional development than in one with lower development, even while SREs are increasing over time within each country due to institutional divergence across subnational regions over time. Ma *et al.* (2013) show that SREs are lower in more- relative to less-developed regions within a country at a point in time. Our result demonstrates that the gap between less- and more-developed regions can widen over time even while institutions develop on average.⁷

⁴ Institutional index is from Gygli *et al.* (2018) and economic output and trade data is from *China Statistical Yearbook* (2009).

⁵ Consider a trivial, illustrative example. Suppose there are three regions in a country with 100 firms in each region. In year one, firm profits in Region 1 are distributed Normal (6,6), in Region 2 Normal (8,4), and in Region 3 Normal (10,2). At the country level, the mean profits are 8 and the standard deviation of firm profits is about 4.62. Across subnational regions the standard deviation of firm profits is 2. In year 2 suppose that profits in the three regions are distributed Normal (7,3), Normal (10,2), and Normal (13,1) respectively. At the country level, firm profits have a mean of 10 and a standard deviation of about 3.27. That is, institutional development overall has increased firm profits on average and reduced (country) regional effects. Across subnational regions the standard deviation of firm profits is 3 in year 2. That is, subnational regional effects have increased as institutions, and therefore firm profits, have diverged across subnational regions.

⁶ Again consider a trivial, illustrative example. Suppose Country A is less developed and firm profits are distributed Normal (5,3) across its subnational regions in year 1. Country B is more developed and firm profits are distributed Normal (8,2) across its subnational regions. In year 2, suppose both countries enjoy development so that SREs are distributed Normal (7,4) in Country A and Normal (10,3) in Country B across subnational regions. Note that as shown in Footnote 5 country (regional) effects may still be converging in year 2 consistent with Chan *et al.* (2008).

⁷ For a trivial illustrative example see Footnote 5.

To understand the underlying mechanism in our first hypothesis, we provide auxiliary evidence that the institution-based theory explains the increase in SREs over time. SREs could also operate through the industry- and resource-based views. If the institution-based theory is responsible for the diverging SREs, institutions should explain the SREs and continue to explain them even as they grow. Consistent with this, 48% of SREs are explained by a set of institutional proxies and this fraction is fairly constant over the sample period. As SREs rise, the explanatory power of these proxies grows commensurately. This fraction of 48% provides a lower bound on the importance of the institution-based theory vis-à-vis competing theories such as the resource- and industry-based views. Chan *et al.*, (2010) also call for work to identify key constituents of subnational institutions in explaining SREs. We find that dialect plays an important role, explaining roughly 50% of variance attributed to the institutional proxies.

To test our second hypothesis, we operationalize “institutional access” using ownership type. Ownership type is an important determinant of the extent and nature of a firm’s institutional access. Firms facing the same institutions but of different types will perform differently because their ownership form exposes them more or less to the formal and informal constraints that institutions impose.⁸ We focus on four ownership types (private domestic, private foreign, state-owned enterprise (SOE), and collective) and focus on three key determinants of the level of institutional access: government involvement in firm decisions, firm governance, and exposure to local institutions. We describe these in detail later.

We first establish that access, as measured by ownership type, is becoming more uniform over time. That is, the mixture of the four types becomes more similar across subnational

⁸ To make this more concrete return to the example of financing availability in Footnote 3. SOEs normally have easier access to credit on better terms than private firms because of their direct government connections while collectives can pool resources among members but may not have ready access to formal financing due to ownership discrimination for political ideology reasons (Chang and Wang, 1994). Private foreign firms are less connected to local credit institutions but have access to home-country financing.

regions over time. Given ownership type's importance in institutional access, this implies that access is becoming more uniform over time along this dimension. Given this increasing uniformity, our hypothesis predicts that institutional access should moderate SRE divergence over time. Since ownership type is the conduit through which a firm accesses local institutions we want to test whether this conduit magnifies or diminishes the effect of local institutions over time. To implement the test, we interact indicators for subnational region and indicators for ownership type. The interaction terms capture whether firm profits are differentially affected by institutions in its subnational region via ownership type.⁹ If these interaction terms explain less of the SREs over time then institutional access (via ownership type) plays a lesser role in SREs over time while if they explain more over time they play a larger role.

Consistent with our hypothesis, we find that ownership type moderates the increase in SREs that occurs over time: the portion of SREs explained by the ownership-location interaction terms decline from 50% in 1998 to 22% in 2007. SREs would have increased even more over time absent changes in access via ownership. We again provide corroborating evidence that the underlying mechanism is the institution-based theory by interacting ownership type with the institutional proxies and showing that these interactions explain a declining fraction of SREs over time (63% of SREs in 1999 compared to 35% in 2007). This is consistent with ownership type's interaction with institutions as the moderating influence of institutions on SREs.

We extend previous work in three primary ways. First, previous literature suggests that SREs should decrease with institutional development (Chan *et al.*, 2008; Chan *et al.*, 2010; Ma *et al.*, 2013).¹⁰ We distinguish SRE dynamics within versus at the country level.

⁹ Ownership type is also separately included to capture its direct effect on SREs as a dimension of institutions.

¹⁰ Economic papers examine convergence versus divergence in growth across countries (Baumol, 1986) and within (Barro and Sali-i-Martin, 1995). These papers differ in that they examine output rather than firm profits. Output differs from firm profits since it includes the total value of all goods produced by firms and governments.

Theoretically, we show that SREs diverge over time as institutions develop at the country level and an economy expands if subnational regional institutions are diverging within the country and there are no negative shocks. That is, institutions are improving on average at the country level but diverging across regions within the country. We provide empirical support for this using data on firms in China. Institutions, as measured by commonly-used institutional indices, are developing over time but also diverging across subnational regions. Moreover, path-dependency (due to the absence of any significant negative shocks) during this time period reinforces this institutional divergence.

Second, we demonstrate that it is important to distinguish between the level of institutional development and the level of institutional access, the nature of interactions between organizations and institutions, in explaining SRE dynamics. In rapidly developing and globalizing countries, institutional development and institutional access both typically change rapidly. Theoretically, we show that convergence in institutional access across regions over time mitigates the increase in SREs that derives from a divergence in institutional development across regions over that same time period. Consistent with this prediction, we find that the increase in SREs in China over time is partially moderated by a convergence in institutional access across subnational regions. As far as we are aware, this is the first empirical study to distinguish these two effects on SREs.

Third, we provide support that institutions explain why SREs increase with institutional development. To do so we supplement institutional indices used in the previous literature with micro measures that proxy for social, economic, and political institutions. Collectively, these explain 48% of the SREs over the sample period providing a lower bound on the role of the institution-based theory in explaining SREs. As SREs increase over time, these proxies explain a roughly constant fraction of them consistent with institutions causing SRE dynamics. We perform an analogous test for whether the institutional proxies explain the

moderating effects of institutional access on SREs over time and find evidence that they do. As far as we are aware, this is the first paper that quantifies institutions' importance in explaining SREs.

As a subsidiary contribution we extend the previous literature, which mostly focuses on MNCs, to examine all ownership types. MNCs are not the predominant organizational form: domestic firms comprised 90% of the world's output in 2014 (World Bank Group, 2015). Examining other ownership types is also useful because MNC headquarters have incentives to alter subsidiaries' reported performance from actual operating performance for tax reasons (Slemrod, 1995). They may also alter actual operating performance in one region for better performance in another (e.g., choosing a less-profitable production location to lower transport costs to selling locations). More broadly, firm effects and SREs may be conflated for MNCs because they set their strategies across countries as well as within. In our sample 95.7% of the observations are single-location firms, obviating these problems.

In the next section we develop our hypotheses and relate them to the extant literature. We then present our methodology followed by our results and some auxiliary evidence. We conclude by discussing the implications and limitations of our study.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Institutional dynamics over time in rapidly developing and globalizing economies

Institutions can, although do not necessarily, diverge over time across subnational regions within a country whose institutions and economy are developing rapidly. Whether they do so or not depends in part on the country's stage of development. Due to underlying institutional change, regional inequality grows during the early stages of a county's economic development reaching a maximum level during intermediate stages before declining as it matures (Williamson, 1965). In the early growth stages, moving costs are disproportionately overcome in more-developed regions leading to greater labor mobility and better labor

resource allocation relative to less-developed regions. Agglomeration effects accumulate faster in more developed regions (Fujita and Hu, 2001) attracting greater capital flows and exacerbating the institutional gap. In the early growth stages, political institutions also diverge as national governments tend to implement policies favoring faster-growing regions (Yang, 1997: 16; Fujita and Hu, 2001).

Technology, a primitive in determining growth (North, 1990), also plays a role in institutional dynamics in the midst of fast economic development. Technological development accompanies economic growth and drives institutional change either with (Nelson, 2005) or without (Ayres, 1944) institutional feedback. Regions with conditions conducive to accumulated knowledge have greater potential to absorb fast-moving institutional change (Roland, 2004: 120) so that areas with a “head start” outpace and diverge from those with a lower initial knowledge stock.

Empirical results support these arguments. Italy’s regions diverged from 1976 to 1993 in the midst of fast growth due to industrial policy (Terrasi, 1999). Changes in political institutions manifested via property rights led to cross-county divergence in growth and, at the same time, encouraged Europe’s rapid growth after 1500 (Acemoglu *et al.*, 2005).

Institutions can also diverge over time due to globalization. Globalization stimulates learning from sources outside the country via interactions such as trade, a channel for institutional change (North, 1990). This generally leads to institutional convergence across countries but this does not necessarily imply the same within countries. Globalization leads to different learning rates for international and domestic institutions (Wilson, 2009) and an uneven distribution of them within a country leads to a widening institutional gap across regions (He *et al.*, 2008). As a country globalizes, international mandates (such as those made by the World Trade Organization (WTO)) may force a country to adjust its institutions; however, these adjustments may be unevenly implemented at the subnational level (Wilson,

2009: 31) leading to diverging institutions. Different subnational regions also change policies at different speeds (Ruef and Scott, 1998).

If institutions are diverging because of either development or globalization, they are likely to continue to do so in the absence of large, negative shocks. In their absence, institutional change is incremental and path dependent (North, 1990). Since our sample period contains no major negative shocks we develop the remaining hypotheses assuming this positive feedback (we discuss how the presence of negative shocks affects our hypothesis in footnote 12).

Role of institutions in SRE dynamics over time

According to the institution-based theory, underlying institutions influence firm performance. As a result, greater institutional differences across regions cause greater variation in firm profitability across those regions (Chan *et al.*, 2010). An extension of this argument is that if institutions are diverging across subnational regions even while institutions are developing on average at the country level then SREs can increase over time even as a country develops.¹¹ That is, average institutional quality is increasing over time at the country level while the variance of institutional quality across regions is increasing. This can be due to widening economic performance between urban and rural areas over time (Williamson, 1965; Fujita and Hu, 2001) as occurred in Mexico post-NAFTA (Sánchez-Reaza and Rodríguez-Pose, 2002) and in Italy from 1976 to 1993 (Terrasi, 1999).

Different institutional types also evolve and interact in specific ways as economies develop to increase SREs. Substitutability of social, economic, and political institutions can lead to increasing SREs over time. In rapidly growing countries, formal legal and financial institutions are often under-developed and firms instead rely on informal contracts enforced via social networks (Xin and Pearce, 1996; London and Hart, 2004). The strength of these

¹¹ We say “can” instead of “does” because the effect of institutions on SREs also depends on an absence of negative shocks and how institutional access might vary over time. In our empirical specification we use a period with no negative shocks and investigate institutional access separately.

networks differs across subnational regions due to varying norms of reciprocity, trust, and risk taking while their reach differs due to heterogeneity in culture or language (Emirbayer and Goodwin, 1994; Bertrand *et al.*, 2000) and span of connecting technology (Coscia *et al.*, 2017). An increasing reliance on these social institutions as development proceeds results in increasing variation in firm performance across regions.

Although these arguments apply to any rapidly growing economy, the process of institutional change within emerging economies leads to larger regional variation in performance compared to developed economies (Chan *et al.*, 2010: 1231). Regional markets in emerging economies are less interconnected due to poor infrastructure and lack of intermediaries such as banks (Prahalad and Lieberthal, 1998). In emerging economies, economic institutions develop unevenly due to differences in natural endowments and infrastructure (Démurger, 2001; He *et al.*, 2008). Also, economic growth in emerging economies may outpace the development of formal institutions increasing reliance on informal social mechanisms over time (Allen *et al.*, 2005) and further exacerbating regional variation.

Globalization can also lead to increasing SREs as institutions diverge. Firms that are less embedded in their home country's institutions are more affected by global ones (Wilson, 2009: 15) so that regional differences in firm embeddedness will exacerbate regional differences in firm performance over time. Local political protectionism affects globalization of local industries (He *et al.*, 2008) so that as globalization proceeds, jurisdictions with different levels of protectionism are influenced differentially.

Institutional path dependency will tend to perpetuate institutions' effect on SREs. Once the direction of their impact is set, institutions continue to influence SREs in the same way until a dramatic negative shock to institutions occurs (North, 1990). This has been shown in a variety of empirical contexts and for dramatically-long durations. Income differences can

persist for centuries (Maloney and Caicedo, 2012) even after severe shocks such as wars (Davis and Weinstein, 2002; Brakman *et al.*, 2004; Miguel and Roland, 2011). Political institutional changes due to colonization can affect performances of societies centuries later (Acemoglu *et al.*, 2002) and the impact of historical conflicts can result in differences in firm performance decades later (Gao, *et al.*, 2018). Arguments in this and the previous subsection imply:

*Hypothesis 1: In the absence of major negative shocks, SREs increase over time when institutions are diverging across regions over time.*¹²

Role of institutional access in SRE dynamics over time

According to the institution-based theory, institutions' effect on firm performance is moderated by firms' institutional access. In answering the question of why differences in performance exist across organizations, North argues that, "The answer hinges on the difference between institutions and organizations and the interaction between them that shapes the direction of institutional change." (North, 1990: 7). North distinguishes between institutions and organizations and emphasizes "interaction" – the channel from institutions to organizations. We refer to the nature of these interactions, which ultimately influence organizational performance, as "institutional access." North defines institutions as constraints (both formal and informal) that influence interactions. These interactions moderate the degree to which the constraints affect the organizations and therefore determine the degree of "institutional access," or ability to derive benefit from resources within these constraints (Ribot and Peluso, 2003: 154). Peng and Heath (1996) examine these interactions for firms in

¹² In the absence of major negative shocks, SREs decrease over time when institutions are converging. In the presence of a major negative shock, the predictions are indeterminate because it depends on whether the negative shock is large enough to cause converging institutions to diverge or diverging institutions to converge. The presence of a positive shock would reinforce path dependency so SREs would continue on the same path but even more strongly. We discuss this below in the context of China joining the WTO.

countries transitioning from planned to market economies and argue that a firm's strategies are constrained by these interactions.

There has been a small amount of work on the idea of institutional access for organizations other than firms which we use to inform our definition. Minkoff (1997) applies the term to the women's political movement in post-1950s America and contrasts how white women and women of color have organized themselves to change their access to interest groups and social movement politics. Women of color chose less traditional methods, such as community work and decentralized decision-making, which isolated them from accessing power centers which favor established organizations. Alam, *et al.* (2016) examine how institutional access, as measured by social networks linking households with agriculture extension services and weather information, affects the adaptation of poor Bangladeshi households to flooding. Kriesi (2004) examines how two dimensions of access to political institutions (e.g., the legislature) affect the efficacy of political protests: the degree of territorial centralization and openness in the policy-making phase. Lee and Ousey (2005) show that the level of institutional access to non-economic institutions, as measured by per-capita civic and church organizations, has a significant effect on Black urban homicide rates.

There has been some work outside the context of firms documenting the empirical effect of institutional access. The degree of an entity's access influences its ability to benefit from trade resources (Ehrlich, 2007) and lack of access to local political and social institutions reduces resources and benefits for immigrant children (Yoshikawa *et al.*, 2008). A group's ability to access and control resources affects agricultural performance in African countries and access depends on participation in social institutions (Berry, 1989).

We are interested in the dynamics of institutional access. Peng (2002: 253) describes the importance of the relationship between organizations and institutions: "an institution-based view on business strategy, therefore, focuses on the dynamic interaction between institutions

and organizations, and considers strategic choices as the outcome of such an interaction,” Access can vary geographically and shift over time (Ribot and Peluso, 2003: 154) and can be formal (e.g., property rights) or informal (Ribot and Peluso, 2003: 157). Since institutional access is the conduit through which firms access organizations, institutional access magnifies the effect of institutions on SREs over time if it is diverging across regions over time. If, on the other hand, access is converging across regions over time, it diminishes the effect of institutions on SREs. Thus:

*Hypothesis 2: Dynamically, if institutional access becomes more uniform across subnational regions over time, institutional access will moderate an increase in SREs over time.*¹³

It is important to distinguish between what is being tested in Hypotheses 1 and 2. Hypothesis 1 concerns the dynamics of institutions, while Hypothesis 2 concerns the dynamics of institutional access. Although economic development and globalization are commonly thought to lead to converging institutional access, this does not necessarily imply that SREs will also converge. Institutions themselves may be diverging over time leading to increased SREs (Hypothesis 1). That is, the economic integration that normally accompanies development and globalization can lead to fewer barriers to accessing institutional resources even if it does not necessarily lead to converging institutions and the latter effect can overwhelm the former.

METHODOLOGY

Data

Besides being the world’s largest developing country, China as a setting offers two main advantages in examining SRE dynamics. China has developed rapidly, allowing the

¹³ If SREs were decreasing the increasing uniformity in access would accelerate this decrease. On the other hand if institutional access is becoming less uniform across subnational regions over time, institutional access will accelerate an increase or moderate a decrease in SREs over time.

relationship between SREs and development to be examined while holding constant subnational regions' macro-environment. Also, China has interesting variation in institutions (Démurger, 2001) which help identify institutional effects over time.

Our data is the annual Survey of Manufacturers in China compiled by the National Bureau of Statistics (NBS) of the People's Republic of China (PRC) from 1998 to 2007. The survey includes all SOEs engaged in manufacturing regardless of size and all private, foreign, collective and Hong Kong/Macau/Taiwan (HMT) firms engaged in manufacturing with annual revenues above RMB five million. For consistency across ownership types, we drop any SOE firm-year observation with less than RMB five million in annual revenues. The firm panel is unbalanced because firms "enter" and "exit" from the data as their revenues fall above or below this cutoff. Following McGahan and Porter (1997) and Cai and Liu (2009) we also drop any firm-year observation with less than RMB five million in assets.

Although the survey data is at the firm level, 95.7% of the observations are also at the establishment level because the firm has a single plant. For these, the firm's address is the production location. The other 4.3% have more than one plant but we observe only one plant's address and do not know whether all plants are located at that address or not. We apply several filters to the data to ensure its accuracy and suitability for estimation. We drop any firm with a single year of data because we cannot identify a year effect and any regions that have fewer than eleven observations to avoid collinearities among the firm, year and region effects. We also drop any firm-year observations for which the constituent elements of operating profit or total assets do not equal their totals because these are essential for our profitability measure. Finally, we lose a few observations due to missing values. This leaves 1,116,722 observations.

We use operating income as a fraction of total assets as the primary profitability measure where operating income is gross income less cost of goods sold, operating expenses, and

depreciation and amortization. This measure does not have interest subtracted because we wish to measure operating profitability exclusive of financing decisions. Whether to include taxes is a more complicated issue. In our baseline results we subtract sales and administrative taxes as these are determined at the subnational level in China and therefore represent the outcome of regional political institutions. We do not subtract income taxes as they are determined at the national level. Another issue which arises in China is how to treat government subsidies. Because the objective is to isolate operating performance from financing decisions we do not add them in calculating operating income in our baseline estimates. Our measure of operating income may still include the effect of implicit subsidies (e.g., below-cost inputs or favorable asset prices) because these are not distinguishable in the data. We show below that our results are robust to adding explicit subsidies, sales taxes, and administrative taxes to the measure of operating income.¹⁴

To define the subnational region we use the four-digit level of the Administrative Division Codes of the PRC published by the NBS. The first two digits identify one of the 31 provinces and the third and fourth digits identify the prefecture or major city. There are 360 different four-digit regions in the data.¹⁵ We comment in our results on how the number of regions affects the estimates. In China, these local political boundaries correspond well to local economic boundaries because China's political system evaluates promotion of bureaucrats in large part based on economic performance within these regions.

In addition to using ownership type as a proxy for institutional access we also include it as a control variable because it is at the firm not the regional level. Since the official registration status in the data often does not reflect de facto ownership, we follow previous studies (Dougherty *et al.*, 2007) in assigning ownership. Many registration types (there are 23 in total) are not meaningfully distinct (OECD, 2000; ADB, 2003). Basing ownership type on the

¹⁴ It is important to test this robustness because subsidies and taxes are outcomes of political institutions.

¹⁵ For 19 observations only the provincial-level area code is disclosed. For these we use provincial averages of the data.

controlling shareholder is more meaningful in understanding firm performance. Specifically, we define ownership based on the type of paid-in capital that exceeds 50% of the total. If no single type exceeds 50% we rely on the registration type. We use six categories of paid-in capital: SOE, collective, legal person, private, foreign, and HMT. For the legal person type, we use information on the firm's registration type to classify it in one of the other five categories following Brandt *et al.* (2012).

Industry classifications are based on the four-digit classifications assigned by the NBS (525 in total). This level roughly corresponds to the four-digit code in the Compustat database used in studies of US firms such as McGahan and Porter (1997).

Table 1 shows summary statistics for the data.¹⁶ Firm performance has a mean of 9.2% with significant variation. Profits increase over time (although not monotonically) consistent with China's reform and opening-up. Over the entire sample period private domestic firms are the most common (49.7% of observations), followed by collectives (15.2%), SOEs (12.4%), HMT (11.4%), and private foreign (11.2%).

[Insert Table 1 about here.]

Measure of institutional access

To operationalize the idea of institutional access we focus on firm ownership type. While there are other determinants of access, ownership type is an important one as it is a major determinant of how firms interact with institutions. Ownership type is a major conduit through which institutions influence firms and therefore the degree to which firms are affected by the constraints that institutions impose. This choice is also motivated by Peng and Heath (1996) which describes how SOEs face different constraints than private firms and how this differential access affects their strategies and performance. In addition to SOEs we

¹⁶ Brandt *et al.* (2012) compare this dataset with aggregate firm data from the *China Statistical Yearbook* and find that it is similar. We made a similar comparison and found it is representative.

examine collective firms and distinguish private domestic from private foreign firms. Even if faced with the same institutions, each ownership type has unique features in accessing them. The three key dimensions along which institutional access differs for ownership types are extent of government involvement, agency issues, and cumulative exposure to local institutions.

Governments are key determinants of the “rules of the game” for firms. The degree of government involvement in firm activities determines these firms’ exposure to institutional constraints. Involvement is the greatest for SOEs and least for private firms with collectives in between. Being owned and controlled by the government, SOEs have direct government ties and enjoy preferential access to political institutions relative to private firms including access to financing (Brandt and Li, 2003; Lu *et al.*, 2012), avoidance of arbitrary government fees (Li *et al.*, 2006), and preferential treatment in government contracts (Chen *et al.*, 2014). On the other hand, governments impose other objectives on SOEs besides profits such as social stability, employment, employee welfare, community development, output, and enrichment of bureaucrats (Lin *et al.*, 1998; Mi and Wang, 2000; Bai *et al.*, 2006). Governments subsidize under-performing SOEs due to their “soft budget constraint.” Unable to determine whether an SOE’s poor performance is due to market forces, policy burdens, or managerial incompetence, the government subsidizes the loss (Groves *et al.*, 1995; Lin *et al.*, 1998). Private domestic and foreign firms, in contrast, face a “hard budget constraint” and are more subject to market forces.

Owned and managed by residents of local communities but under the purview of a local urban or rural government, collectives experience an intermediate level of interaction with governmental institutions. Government involvement in collective ownership leads them to pursue other goals (e.g., supporting local political projects and providing local jobs) in addition to profits but because of the mixed government-private ownership less so than for

SOEs. In contrast to SOEs and collectives, private foreign and domestic firms primarily pursue profits (Peng and Luo, 2000) and because of less government involvement their interactions are least influenced by government institutions.

Agency issues also lead to differences in how ownership types access institutions because they influence the incentives for firm managers. SOE managers are not residual claimants of firm profits (Mi and Wang, 2000). Their compensation is instead regulated by government bureaucracy reducing the possibility of performance-based incentives (Mi and Wang, 2000) as shown empirically (Firth *et al.*, 2006). As a result, SOE firms have blunter incentives to access institutions to maximize profits. In contrast, managers of private domestic and foreign firms are usually residual claimants of profits and more typically face incentives tied to performance. As a result, they focus more intensely on accessing institutions for profit maximization (Hart, 1983).

Differences in flexibility across ownership types in locating geographically also lead to differences in cumulative exposure to local institutions. Private foreign firms have no extant ties to local institutions and great flexibility in choosing their location. In contrast, private domestic firms usually grow organically from a particular location and are intimately tied to local institutions because they rely on the founder's social network. This difference in accumulated exposure to local institutions is borne out empirically in firm migration studies: MNC corporate headquarters are more likely to relocate than those of domestic firms (Brouwer *et al.*, 2004; Strauss-Kahn and Vives, 2009). A collective firm is explicitly tied to a location because the residents provide land so that production and ownership are co-located. Moreover, its goals, governance procedures, and network ties are determined by a management committee appointed by and composed of local residents. Similarly, SOEs are tied to a particular bureaucracy within a particular governmental administrative region and

therefore explicitly tied to this locale. Therefore, both SOEs and collectives generally have deep exposure to local institutions.

Since institutional access varies across ownership types, profits will vary across firms of those types even conditional on institutional quality. Therefore, the more disparate are firm types across subnational regions (e.g., predominantly SOEs in some regions but predominately private domestic firms in others) the greater will be SREs. On the other hand, the more uniform are these types across subnational regions (i.e., a similar fraction of all four types across regions) the lower will be SREs. Thus, institutional access, as proxied by ownership type, either enhances or diminishes SREs over time depending on whether access becomes more or less similar across regions.

Analysis

We measure subnational region's importance through a variance components analysis of operating profitability (e.g., McGahan and Porter, 1997) which assesses the amount of profit variation associated with different categories (factors) describing the firms (Searle, 1971). We include factors previously used in the literature (year of operation, industry, ownership type, and firm strategy) and supplement this with the firm's production location.¹⁷ We use a random effects model (Searle, 1971: Chapter 9) to explain the operating performance of the i^{th} firm in the j^{th} industry in the k^{th} region with ownership type l in year t :

$$r_{ijklt} = \mu + \alpha_i + \beta_j + \lambda_k + \rho_l + \gamma_t + \epsilon_{ijklt}, \quad (1)$$

where μ is the grand mean of the operating margins over all firms in all years, α_i is the firm-specific effect (the profit increment associated with firm i), β_j is the industry effect (the profit increment associated with participation in industry j), λ_k is the subnational regional effect (the

¹⁷ Factors examined in the previous literature include year, industry, business segment, corporate-parent, business group (Khanna and Rivkin, 2001; Chang and Hong, 2002), and strategic group (Short *et al.*, 2007). We are unable to examine the role of conglomerates. For the few multi-plant firms, we do not know all of the products the firm produces because the firm may not report them.

profit increment associated with firms in region k), ρ_l is the ownership effect (the profit increment associated with ownership type l), γ_t is the year effect (the profit increment associated with firms operating in year t), and an error term ϵ_{ijkl} .

The variance of the operating performance is decomposed as:

$$\sigma_r^2 = \sigma_\alpha^2 + \sigma_\beta^2 + \sigma_\lambda^2 + \sigma_\rho^2 + \sigma_\gamma^2 + \sigma_\epsilon^2. \quad (2)$$

This model assumes that different factors are independent unless interaction effects are included. This is our baseline model and we implement it using the SAS COV command. One issue with the procedure is that aggregating a factor at a higher level can obscure its importance in explaining variance (McGahan and Porter, 2005). On the other hand, using more finely-defined categories risks sparse matrices which can create collinearities among factors. Since the SAS COV command implements a variance rather than a sum-of-squares method it is relatively insensitive to category dimensions (Vanneste, 2017). Nonetheless, we comment more on how aggregation affects the results when we present them and offer evidence that this does not account for subnational region's importance vis-à-vis other factors.

Sampling procedure

Because the data set is prohibitively large, we use bootstrap sampling to allow feasible estimation times. Bootstrapping allows population inference based on estimates from random samples from the population (Efron, 1979). The average of a statistic based on multiple random samples (with replacement) is arbitrarily close to the true statistic as the sample size or the number of bootstrap iterations increases. The deviation of the bootstrap statistic from the true statistic is given by the bootstrap error.

Formally, we take $r=1,2,\dots,R$ samples of n with replacement from the full data. We choose n to be as large as possible to reduce simulation error while allowing for a reasonable

convergence time. Our estimate for a variance parameter in the COV procedure is then:

$\bar{\sigma}^2 = \sum_{r=1}^R \sigma_r^2 / R$ where σ_r^2 is the r^{th} bootstrap estimate. The associated error of the estimate is:

$$\sqrt{\frac{\sum_{r=1}^R (\bar{\sigma}^2 - \sigma_r^2)^2}{(R-1)}} \sqrt{\frac{n}{n-1}}. \quad (3)$$

We use a block bootstrap by firm to allow for correlation within firm across years.¹⁸ Because of this, the average sample sizes for different models are not the same. We draw blocks until we are close to 10,000 observations (i.e., $n \approx 10,000$)¹⁹ and perform 50 bootstrap iterations for each model ($R=50$).

RESULTS

SREs across all firm types

Before testing our hypotheses, we examine whether SREs' importance for MNCs previously found in the literature extends to other ownership types. We do so for two reasons. First, we wish to examine SRE dynamics across the whole economy not just one ownership type. Second, we later use ownership type as a proxy for institutional access. If SREs are unimportant when all ownership types are included then assessing the importance of institutional access via ownership type is meaningless.

Most arguments in the extant literature for why SREs are important for MNCs extend to other ownership types. The mechanism identified is that region-specific institutions affect firm performance in that region, a feature which is not unique to MNCs. Differences of firm embeddedness in regional institutions, such as local inter-firm networks (Saxenian, 1991), yield differences in competitive advantage for private firms (McEvily and Zaheer, 1999) which are also relevant for other ownership types. Chan *et al.* (2010: 1228-1229) provides a

¹⁸ Stratified sampling might reduce sampling error in the estimates; however it is infeasible because there are insufficient observations in industry-location-ownership cells.

¹⁹ To make the sampling procedure faster we group more than one firm together in a block (although they are still randomly sampled within the block). Therefore the number of observations in different samples will not be within 10 of each other.

comprehensive discussion of these arguments which apply to all ownership types. This implies our first validation test:

Validation Test 1: SREs are a significant determinant of firm profits irrespective of ownership type.

Column 2 of Table 2 shows the COV estimation of Equations (1) and (2) using Equation (3) to calculate standard errors. The five factors in the base model explain 56.0% of the total variance (6.2%) in profits over the ten years. The error contains 44.0% of the total variance and captures idiosyncratic shocks unrelated to the included factors. Year effects, representing annual macroeconomic shocks affecting all firms, capture only 0.7% of variance. Stable industry effects account for 1.9% of variance and are similar to those for Indian manufacturing firms (Majumdar and Bhattacharjee, 2014) but much less than those for US firms (McGahan and Porter, 1997).²⁰ Column 1 displays the average across bootstrap iterations of the number of levels for each factor.

[Insert Table 2 about here.]

Ownership type explains only 1.1% of total variance compared to 6.8% in Xia and Walker (2014) using the same data. The difference is methodological. Xia and Walker (2014) estimate ownership's effect province-by-province (31 in total) and calculate its overall influence based on an equal-weighted average across provinces with significant ownership effects. This gives greater weight to smaller regions.²¹ Our results complement these and imply that ownership matters more in small (based on firm population) provinces than large. Stable firm effects play a large role (38.7%) in explaining total variance. This is of similar magnitude as for all US firms using somewhat different methods and from an earlier period (McGahan and Porter, 1997).

²⁰ The US sample differs in that it is from an earlier time period and includes all firms not just manufacturers. Industry's small influence relative to the US is not likely due to using more aggregated industry classifications – there are an average of 443 industry categories versus 625 in McGahan and Porter (1997).

²¹ Xia and Walker (2014) do not provide a standard error to judge the statistical significance of the nationwide effect. The paper also classifies collective firms as SOEs.

After firm, subnational region is the most important factor (13.6%) validating that SREs are important across all ownership types. This is not because it is measured more finely than other factors. While the few levels for ownership and year may explain their small contribution and the large number of firms its large contribution; it does not explain region's large role vis-à-vis industry. The number of industry levels exceeds that of region (Column 1).

Column 3 checks robustness to our definition of operating income. It contains estimates adding subsidies and sales and administrative taxes to our baseline measure of operating income. The results are very similar to the baseline results in Column 2 and SREs explain 13.5% of the overall variance. For the remainder of the paper, our measure of operating income is net of sales and administrative taxes and subsidies but the results are robust to including them.

Firm profits are highly persistent – 41.3% of this year's profits depend on last – as shown in Column 4 which controls for serial correlation. However, virtually all of this persistence is at the firm level (stable firm effects drop to 22.9% while other effects remain similar). In particular, SREs remain the same as in the baseline results. Although the samples and models are not directly comparable, profits are somewhat more persistent than for US firms for which 37.8% of variance persists (McGahan and Porter, 1997). Because controlling for serial correlation primarily separates the stable and persistent firm effects but does not materially affect the other factors we estimate all other models without controlling for it because doing so requires prohibitively long computational times. Supplementary Information A provides evidence that the baseline results are also robust to sorting by firm age, firm size, and industry.²²

²² Throughout the paper, for continuous variables such as firm age and size we create 50 levels by splitting the variable's distribution into 50 subgroups so that the number of observations in each subgroup is as equal as possible.

Macro evidence of diverging SREs

Having validated that SREs are important in the overall sample we now provide macro-level evidence of their dynamics over time – our second validation exercise:

Validation Test 2: Economic performance diverges across China's subnational regions from 1998 to 2007, a time of rapid economic/institutional development and globalization.

The black, solid line in Graph 1 plots the standard deviation of deflated gross domestic product (GDP) per capita across China's prefectures (close to our measure of subnational region) over time. It diverges suggesting that overall economic performance diverges across China's regions over time. This is a time in which China is globalizing and its economy and institutions developing rapidly. The red, large-dashed line in Graph 1 shows China's aggregate GDP from 1998 to 2007 while the green, small-dashed line shows the sum of China's imports and exports in each year. Graph 2 shows two measures of China's institutional development over time. The black, solid line shows the index constructed in Gygli *et al.* (2018). The index ranges from 1 to 100 and is based on economic, social, and political dimensions that are weighted based on a principal components analysis. One hundred represents the most globalized country-year over the entire sample period for which the index was constructed (1970 to 2015 for 209 countries). The index for China increases from 50.2 to 60.3 over the sample period. The red, dashed line shows the average value of the index constructed in Fan *et al.* (2007) across all of China's provinces normalized to 100 in 1998. The average increases to 163 in 2007.

This validation test provides macro-level evidence that firm performance is diverging across regions over time even with development and globalization at the national level. We now turn to micro-level evidence in the context of institutions.

[Insert Graphs 1 and 2 about here.]

Dynamics of subnational institutions over time

Even though China's institutions are improving over time they are doing so unevenly across subnational regions:

Validation Test 3: Dynamically, institutions diverge across China's subnational regions from 1998 to 2007, a time of rapid economic/institutional development and globalization.

Institutions can affect firm profits at different levels (e.g., region, firm, and industry) and therefore can be measured at different levels. We measure them at the subnational region level because we are interested in explaining SREs, which are driven by subnational region-level institutions.

Previous work substantiates institutions' role in generating SREs. Chan *et al.* (2008) develop an institutional development index at the country level and show that it is negatively correlated with foreign-affiliate SREs. We instead focus on whether institutions are diverging within a country even while the country's institutions are developing on average. Ma *et al.* (2013) use an institutional development index based on Wan and Hoskisson (2003) and show that foreign-affiliate SREs are greater in subnational regions with less-developed institutions. While this confirms institutions' role in SREs cross sectionally, it does not capture the dynamics of institutional contributions over time.

To measure institutional evolution in China we rely primarily on the annual marketization index developed by Fan *et al.* (2007). It is designed to be a comprehensive proxy for each province's institutional development (Fan *et al.*, 2007) and has been used extensively in the management literature (Chang and Wu, 2014). The marketization index is composed of five dimensions (sub-indices) and each sub-index is composed of indicators. We use four of the five sub-indices: government-market relationship, product-market development, factor-market development, and market/legal intermediary development. We do not include the private-firm development sub-index because it is highly collinear with and less precise than

our ownership measure included as a firm-level control variable. Supplementary Information B explains how the marketization index is constructed.

While the marketization index captures much of institutions' impact on firms, we supplement it with new institutional proxies for three reasons. First, for previous papers institutional indices were sufficient because the goal was to measure particular dimensions of institutions. In contrast, we wish to be as exhaustive as possible as our goal is to see to what extent institutional proxies can explain SREs. Second, the marketization index is measured at the provincial level and we wish to introduce variation in the institutional measures at the prefectural level which closely corresponds to our definition of subnational regions.²³ Third, the marketization index includes proxies for economic and political but not social institutions and also does not include proxies for physical and human capital. We therefore add additional proxies for these. Supplementary Information C provides a description and justification of our additional proxy measures along with sources and summary statistics.

Comments on proxies. An issue with some of our added proxies as well as the marketization index developed by Fan *et al.* (2007) is that they measure outcomes rather than underlying "rules of the game." This is an issue also faced by previous work in this literature. As we discuss below, developing proxies which better capture "rules of the game" would be useful.

Validation test. We use these institutional proxies to perform the validation test. Because we use proxies, we cannot ensure that they capture institutions' full effect on firm profits or that they may not capture one institutional type better than others. Nonetheless, as we show later, our proxies explain a significant fraction of SREs. The blue, solid line in Graph 3 shows an equal-weighted average of the standard deviation of all of the proxies across subnational regions in each year from 1998 to 2007 normalized to 100 in 1998. Except for a small dip in

²³ We are unable to construct the marketization index at the prefectural level following the procedure in Fan *et al.* (2007) because we do not have access to the raw data.

1999, this measure increases over time confirming Validation Test 3. Although China's institutions are developing at the national level during this time they develop unevenly across subnational regions.

[Insert Graph 3 about here.]

SRE dynamics over time

Given that underlying institutions are diverging over time and there are no major negative shocks during the sample period, Hypothesis 1 predicts that SREs should increase over time. Our single-country data is ideally suited to test this because subnational regions face the same national conditions (e.g., legal system, monetary policy, trade policy, and immigration policy), so that subnational and national differences are not conflated.

To test this hypothesis, we produce year-by-year COV estimates of Equations (1) and (2) omitting the unidentified year factor. The solid line in Graph 4 plots these year-by-year estimates along with the 90% confidence interval (dashed lines) using standard errors produced by Equation (3).²⁴ SREs hold steady at about 6.0% of total variance from 1998 to 2002 and then increase rapidly to reach about 23% in 2007 confirming Hypothesis 1. This upward trend is not due to an increase in the number of regions across years: the footnote of Graph 4 shows no systematic increase in their number over time. This upward trend is consistent with path dependency. Underlying institutions lead to a divergence in firm profits over time and this path continues consistently with no reversal. Why do SREs begin to increase most dramatically in 2002? The theory of institutional change can help explain this. The acceleration coincides with China joining the WTO in December 2001 – a positive institutional shock. WTO accession can be viewed as China's central government using a foreign entity as a commitment device to push domestic reforms at lower levels of

²⁴ The pooled data is robust to serial correlation (see Column 4 of Table 2) so that year-by-year estimation should be relatively unaffected by correlation of errors across years.

government (Jefferson, 2002) because non-compliance would be prohibitively costly (Wilson, 2009: 63; Zweig, 2002: 29). This positive shock reinforces the divergence of SREs.

[Insert Graph 4 about here.]

Institutional access dynamics over time

Having established SRE dynamics over time, we turn now to the role of institutional access. It is empirically challenging to measure institutional accessibility. We examine firm ownership type as a proxy for one dimension of institutional access because it is precisely measured and is an important contributor. While an aspect of institutions themselves, a firm's ownership type also affects a firm's institutional access and therefore its performance. We focus on the five ownership types present in our data: private domestic, private foreign, SOE, collective, and HMT.²⁵ This is a precise measure since it is based on paid-in capital and registration form. Before using this to test Hypothesis 2 we validate the dynamics of ownership types over time. Access could become more or less uniform across regions over time either because types themselves become more or less uniform or the degree of access across types becomes more or less uniform over time. In our setting we validate that:

Validation Test 4: Dynamically, 1) ownership types, and 2) degree of institutional access via ownership types converge across China's subnational regions from 1998 to 2007.

Dynamics of ownership types. The mix of ownership types are converging across regions over the sample period (part 1) of the validation test). The red, dashed line in Graph 3 displays the standard deviation of an ownership index²⁶ across subnational regions over the sample period. The standard deviation declines slightly through 2003 after which it begins

²⁵ HMT enterprises do not fall neatly into our four canonical categories. These firms are geographically located in mainland China but are owned by a Hong Kong, Macau, or Taiwan based entity. As with private foreign firms, these entities have great discretion in where to locate but their owners may have unique social and political connections due to the historical connections between their locations and mainland China.

²⁶ The ownership index is constructed by taking the average of five sub-indices. The sub-indices are the standard deviation across all prefectures of the fraction of firms of each type (SOEs, private domestic, collective, private foreign, and HMT) in each prefecture. Once these sub-indices are averaged the index is normalized to 100 in 1998.

dropping more dramatically. The distribution of ownership types are becoming more uniform across subnational regions over time contributing to a convergence of institutional access across these regions.

Dynamics of institutional access by ownership type. Since we cannot directly measure the degree of institutional access within each ownership type, we rely on the previous literature to argue that the degree of access is converging across ownership types over time as China globalizes and develops rapidly (part 2) of the validation test).

In China, economic development has led to changes to ownership types that make them more similar in accessing economic institutions. Discrimination between SOEs and private firms in credit allocation has diminished over time due to increased competition as the economy has expanded (Gou *et al.*, 2016). Firms' endogenous responses have hastened this convergence. Private domestic and foreign firms have compensated for their disadvantage relative to SOEs in accessing financial institutions by investing in banks (Lu *et al.*, 2012). SOEs have an historical advantage in hiring because their employees were virtually guaranteed lifetime employment. However, SOE privatization and restructuring have increased their exposure to market forces making their access to labor markets more similar to that of private domestic and foreign firms in terms of opportunity, wages, and status (Démurge *et al.*, 2012).

Economic development has also narrowed access to political institutions across ownership types over time. Market reforms have increased the autonomy of SOE management and subjected them to market forces by rewarding them based on profit performance (Li *et al.*, 2015) moving them closer to private firms. Reductions in SOE subsidies have also narrowed this gap (Brandt *et al.*, 2008). Development has led to formalization of political and legal institutions allowing private firms to migrate toward the formal political institutions accessed by SOEs (Li *et al.*, 2006). These include access to government resources, regulatory

protection from competition, social status (Chen *et al.*, 2014), better access to financing, preferential tax treatment, and better access to regulated industries (Feng *et al.*, 2015). With economic development, private firms have also hired more people with political connections (Feng and Johansson, 2017), moving them closer to SOEs' level of political access.

Globalization has also led to equalization of institutional access across ownership types in China through the diffusion of business practices from foreign firms (Brandt *et al.*, 2008). Globalization leads to greater access to financing mechanisms (Biles, 2004) allowing more uniform access across ownership types. Globalization increases the flow of ideas across boundaries (Rivera-Batiz and Romer, 1991) which equalizes access to “ways of doing things” across ownership types. SOEs frequently monopolize primary, upstream industries while private domestic and foreign firms dominate more competitive, downstream industries. As globalization increases demand for downstream goods this induces greater demand for upstream inputs increasing SOE profits (Li *et al.*, 2015) and moving them closer to higher-profit private firms.

Role of institutional access in SREs over time

Since ownership types and their degree of institutional access both converge across subnational regions over time, Hypothesis 2 predicts that ownership type should moderate the increase in SREs that occurs over time. To test this we use ownership type as a proxy for access and interact it with subnational region and see how these interactions explain the variance in firm profits over time. We modify Equations (1) and (2) to allow for these interactions:

$$r_{ijkt} = \mu + \alpha_i + \beta_j + \lambda_k + \rho_l + (\lambda_k \times \rho_l) + \gamma_t + \epsilon_{ijkt}, \quad (1a)$$

$$\sigma_r^2 = \sigma_\alpha^2 + \sigma_\beta^2 + \sigma_\lambda^2 + \sigma_\rho^2 + \sigma_{\lambda\rho}^2 + \sigma_\gamma^2 + \sigma_\epsilon^2, \quad (2a)$$

where $\sigma_{\lambda\rho}^2$ is the variance explained by the interaction term. Since ownership is a firm-level variable, the non-interacted ownership type captures how this firm-level factor affects firm

profits. We continue to estimate standard errors using Equation (3). Before proceeding to a year-by-year analysis we check whether we need to control for serial correlation. Column 5 of Table 2 shows the results using the full panel. Together, the interaction terms and the standalone regional effect ($\sigma_{\lambda\rho}^2 + \sigma_{\lambda}^2$) explain roughly the same amount of variance as subnational region does in the model without interactions (Column 2). Serial correlation does affect both the interaction term and the SREs (Column 6) so we control for serial correlation in our year-by-year analysis.²⁷ This requires dropping the first year of data.

Graph 5 shows the fraction of SREs explained by the interaction term (i.e., $\sigma_{\lambda\rho}^2 / (\sigma_{\lambda\rho}^2 + \sigma_{\lambda}^2)$) in each year along with a 90% confidence interval based on the bootstrap standard errors. These are based on year-by-year estimates of Equations (1a) and (2a) allowing for serial correlation. The percentage explained shows a fairly consistent decline. The 1999 and 2007 estimates differ by 34.5 percentage points ($p = 0.000$).

These results confirm Hypothesis 2. The increasing similarity of ownership types and their degree of institutional access over time leads to more uniformity in firm profits across subnational regions. That is, the increase in SREs would have been even greater had it not been for the moderating influence of converging institutional access via ownership type.

[Insert Graph 5 about here.]

AUXILLIARY EVIDENCE

Thus far we have shown that SREs diverge over time along with a divergence in institutions and that a convergence in institutional access moderates the divergence in SREs. Both of these results are consistent with the institution-based theory. In this section, we provide supporting quantitative evidence that it is the institution-based theory at play.

²⁷ The year-by-year results are very similar if serial correlation is not controlled for.

Institution-based theory and SRE dynamics

We showed that SREs diverge over time consistent with Hypothesis 1. However, Hypothesis 1 has a maintained assumption that the institution-based theory is the underlying mechanism. We now perform an auxiliary test to provide evidence for this assumption. If institutions are responsible, then the institutional proxies should explain a relatively constant portion of the SREs over time even as they grow. That is, as the variance of firm profits across regions increases over time, the portion of this variance explained by region-specific institutions should increase commensurately.

If our proxies were comprehensive and the institution-based theory was solely at play, then the proxies should explain 100% of SREs. However, SREs may also operate through the industry- and resource-based views. A firm's political connections are an example of firm-specific institutions that would be attributable to the resource-based view.²⁸ Similarly, an industry association is an example of an industry-specific institution that would be attributable to the industry-based view. If the associations are unique to particular regions this would contribute to SREs.²⁹ To the extent that these firm- and industry-specific contributions to SREs are at play then our institutional proxies will not fully explain the SREs and this auxiliary test is crucial to quantify the relative importance of institutions. If our proxies are not comprehensive, other theories are also at play, or both; the fraction explained should still remain constant if the institution-based theory is at play:

Auxiliary Test 1: Institutional proxies explain a constant portion of SREs over time consistent with institutions as the underlying reason for increasing SREs over time.

This is only an auxiliary test because our proxies do not explain 100% of the SREs. We cannot be certain that the same pattern exists for any non-captured institutional effects. To

²⁸ The contribution of these firm-specific institutions could be measured by interacting firm and location but are only identified if firms move across locations over time.

²⁹ These could be measured by interactions between industry and location but are only identified if the mix of industries varies across regions over time.

execute this auxiliary test, we modify Equations (1) and (2) to decompose the SREs into the portion explained by the institutional proxies and the portion unexplained.

$$r_{ijkl} = \mu + \alpha_i + \beta_j + \left(\sum_{m=1}^M \lambda_{km} + \lambda_{kU}\right) + \rho_l + \gamma_t + \epsilon_{ijkl}, \quad (1b)$$

$$\sigma_r^2 = \sigma_a^2 + \sigma_\beta^2 + \left(\sum_{m=1}^M \sigma_{\lambda m}^2 + \sigma_{\lambda U}^2\right) + \sigma_\rho^2 + \sigma_{\lambda \rho}^2 + \sigma_\gamma^2 + \sigma_\epsilon^2, \quad (2b)$$

where λ_{km} is institutional proxy m in region k and λ_{kU} is the portion of SREs unexplained by the M institutional factors in region k . Their respective variances are given by $\sigma_{\lambda m}^2$ and $\sigma_{\lambda U}^2$. The unexplained portion is implemented by including an indicator for each subnational region k .

We first estimate Equations (1b) and (2b) using the full panel.³⁰ Column 7 of Table 2 shows the results.³¹ The institutional proxies ($\sum_{m=1}^M \sigma_{\lambda m}^2$) explain 6.8% of the overall variance in firm profits and the unexplained portion of the SREs drops to 7.4%. Together, they explain roughly the same amount of regional variation as in the model without interactions (Column 2). The institutional proxies are jointly highly significant with the F-value greatly exceeding the critical value. Dialect plays a particularly important role as an institution. It explains 3.0% of the overall variance or almost half the 6.8% of variance explained by the institutional proxies. This is important because Kingston and Caballero (2009) suggest that more work distinguishing formal and informal institutions would be useful and dialect is a precisely measured proxy for informal social institutions.

The institutional proxies collectively explain 48% (i.e., $(\sum_{m=1}^M \sigma_{\lambda m}^2) / (\sum_{m=1}^M \sigma_{\lambda m}^2 + \sigma_{\lambda U}^2)$) of the SREs. That we do not explain all of the SREs is in part due to the incompleteness of our proxies. It could also be due to the role of competing theories. The portion of variance explained by our proxies places a lower bound on the importance of the institution-based

³⁰ We are unable to check the robustness of these estimates to controlling for serial correlation because the convergence time with so many factors was infeasible.

³¹ SAS's COV procedure automatically drops observations which create collinearities but does not report the number of observations it drops. Thus, although the sample in Column 7 appears to be the same as that of the model in Column 5 it is not. That is why the overall variance of the two differs.

theory in explaining regional firm performance. It would be useful to compare its importance relative to the resource- (firm effects) and industry-based (industry effects) views. We are unable to address this because the dimensionality of doing so prevents it. It would require interacting each industry with each of the regions to capture the contribution of the industry-based view and each firm with each of the regions to capture the contribution of the resource-based view.

Graph 6 shows year-by-year estimates of the portion of the SREs explained by institutional proxies using Equations (1b) and (2b) along with 90% confidence intervals. Although the error bands are somewhat wide, the portion of SREs explained by the institutional proxies is roughly constant over time lying between 38% and 63% in all years. This provides support that institutions explain the rise in SREs over time – their influence rises over time commensurately. Put differently, even though SREs are increasing over time the portion of them unexplained by the institutional proxies is not. While we cannot rule out other explanations for the SRE dynamics such as the resource- or industry-based views, this provides evidence that the institution-based theory plays a role and gives a lower bound on its importance (at least 38% in all years).

Chan *et al.* (2008) demonstrate that institutional development across countries is correlated with the variance of firm profits across countries consistent with the institution-based theory. Our results extend this to subnational regions and provide a lower bound on the magnitude of the variance explained by the institution-based theory. Supplementary Information D provides qualitative evidence for the role of institutions in the dynamics of SREs.

[Insert Graph 6 about here.]

Institution-based theory and institutional access dynamics

We showed that ownership-region interactions moderate SREs over time consistent with Hypothesis 2. However, Hypothesis 2 has a maintained assumption that the institution-based

theory is the underlying mechanism. We now perform an auxiliary test to provide evidence for this assumption. If institutional access is the conduit, then interactions between ownership type and the institutional proxies should explain a declining portion of the SREs over time. That is, as the variance of firm profits across regions increases over time, the portion of this variance explained by region-specific institutional access (as measured by ownership) should decline:

Auxiliary Test 2: Interactions between ownership type and institutional proxies constitute a declining portion of SREs over time consistent with institutional access as the underlying reason for ownership types' declining influence on SREs over time.

As before, this is only an auxiliary test because our proxies do not explain 100% of the SREs. To execute this auxiliary test, we decompose the SRE into the portion explained by the interactions between ownership type and the institutional proxies, the institutional proxies themselves, and the portion unexplained. We modify Equation (1b) to add interactions between ownership types and the institutional proxies ($\sum_{m=1}^M \sum_{l=1}^L (\lambda_{km} \times \rho_l)$). We also add to Equation (2b) the variance explained by these interactions terms ($\sum_{m=1}^M \sum_{l=1}^L \sigma_{\lambda lm}^2$).³²

Graph 7 shows year-by-year estimates of the portion of the SREs explained by the interaction terms ($(\sum_{m=1}^M \sum_{l=1}^L \sigma_{\lambda lm}^2) / [\sum_{m=1}^M \sum_{l=1}^L (\sigma_{\lambda m}^2 + \sigma_{\lambda lm}^2) + \sigma_{\lambda U}^2]$) along with 90% confidence intervals estimated using Equation (3). The portion of SREs explained by the interaction effects declines from 50% in 1998 to 22% in 2007. This drop of 28% is significant ($p = 0.000$). The decline in this fraction is consistent with institutions as the underlying reason for ownership types playing a moderating role on SREs over time.

[Insert Graph 7 about here.]

³² We are unable to check the robustness of these estimates to controlling for serial correlation because the convergence time with so many factors was infeasible. As we showed earlier, controlling for serial correlation primarily separates the stable and persistent firm effects but does not materially affect the other factors including ownership type so the effect of controlling for serial correlation is likely to be small.

DISCUSSION

Theoretical and practical implications

Our results have three main theoretical and practical implications for firm strategies during periods of incremental, not sudden, change. In the sample period, China's economy experienced no major negative shocks that would lead to a re-evaluation of institutions (Wilson, 2009: 23-24). In such a regime, institutions tend to self-perpetuate because organizations have adapted to and benefit from the status quo. Barring a major negative shock one would anticipate a continuation into the future of the divergence in profits across China's subnational regions.

First, the institutional dynamics that we identify suggest that firms deciding where to locate must not only understand current institutions but also forecast their future path. If no major negative shocks are expected then institutions will exhibit a high degree of path dependence making a forecast feasible – a continuation of the existing trend. The firm can use the historical antecedents of local institutions to predict this direction.

Second, we find that institutional access plays a critical role in shaping SRE dynamics. This implies that it is important to consider not just how underlying institutions evolve as an economy develops and globalizes but also how institutional access evolves. A firm and its competitors may face the same institutions but their competitive positions can differ due to differences in institutional access. A firm can potentially alter its access to improve its competitive position without changing local institutions in ways that might benefit its competitors.

Empirically, we identify the effect of institutional access on SREs through interactions between subnational regions and ownership types. From a practical standpoint, the importance of ownership implies that a firm's performance will be heavily influenced by its competitors' types. A firm must consider the ownership and governance structures of

competitors when assessing how local institutions will affect its profits. Given institutional path dependence this also means that analysts predicting future industry profitability should consider current ownership mix. Relatedly, most previous work examines SREs only for MNCs. We show that location choice is a crucial decision not just for MNCs. While MNCs must develop cross-country strategies, local firms are primarily concerned with home-country institutions.

Third, we find that informal institutions play an important role in explaining SREs. In particular, dialect constitutes almost half of the effect of all institutional proxies. This implies that even if firms face the same formal institutions they may be at a significant advantage or disadvantage relative to firms with access to different informal institutions. This is especially true if economic growth outpaces the development of formal mechanisms for facilitating transactions, such as legal and financial systems. In this case, firms must rely more on connections to social networks. Also, firms facing the same formal institutions may benefit from mergers or joint ventures with firms that access different social institutions although such tie-ups may pose difficulties in integration.

Limitations and future research

There are five main areas of potential future research suggested by our study. The first is the sample and generalizability of the results. We find that SREs increase over time even as China develops and globalizes rapidly. This raises the question of whether these results would apply to other economies – particularly those that are smaller and less diverse. It would be useful to also investigate the relationship between development and SREs in more developed countries although they may not offer sufficient empirical variation.

Second, our sample does not include a major negative shock that would trigger dramatic institutional change. It would be useful to examine such a sample (e.g., the 2008 global financial crisis) to examine the SRE dynamics before and after. Major negative shocks may

interrupt the path dependence of institutions. The question is whether this would accelerate or reverse SREs' pre-existing trend.

Third, although we explicitly link changing SREs to institutions in support of the institution-based view, our institutional measures explain only about one-half of the SREs. It would be useful to develop more proxies to further determine how much variation in firm profits is due to the institution-based theory relative to the resource- and industry-based views. Relatedly, distinguishing formal rules and informal constraints would quantify how much more persistent the latter are in determining firm performance. Most extant work has focused on formal institutions (Coscia *et al.* (2017) is an exception). This would require identifying finer levels of proxies that distinguish these two types of constraints. It would also be useful to develop more proxies for "rules of the game" rather than outcomes.

Fourth, we are able to test the effect of institutions on SREs only under a regime of diverging institutions across regions. It would be useful to test the converse of Hypothesis 1: do converging institutions across regions lead to declining SREs over time? Places to look for converging institutions would be developed countries or right after a major negative shock such as the 2008 financial crisis.

Fifth, we use ownership type as a proxy for firms' institutional access because it is a precise and important dimension. However, it is only one dimension. It would be useful to examine other dimensions such as senior management's or directors' social networks, especially political connections. This could be measured through identifying relatives, fellow school alumni, clans, ethnicity, or dialects of executives.

Besides these five areas, our results raise some miscellaneous questions. Our sample includes only manufacturing firms. This raises the question of whether SREs would be greater or lesser in service industries. Since services tend to be more local in scope we might expect greater effects for them. Industry effects play a minor role in explaining firm

performance as it also does in Indian manufacturing industries (Majumdar and Bhattacharjee, 2014) but in contrast to US manufacturing and services firms (McGahan and Porter, 1997). It would be useful to determine whether this is a difference between developing and developed countries. They could differ because private markets are not yet mature enough in developing countries for industry structure to matter or because government intervention in these countries nullifies industry's importance.

Previous papers have found that industry sorting is important in explaining SREs (Ma *et al.*, 2013) unlike what we find in China. It would be useful to investigate what this says about the development of China's manufacturing industries. In particular, are there barriers to firms' location choices that prevent industry-related agglomeration efficiencies from being realized? Like previous papers, we find yearly effects explain very little of firm performance. This suggests examining higher-frequency data to see if this is due to data aggregation.

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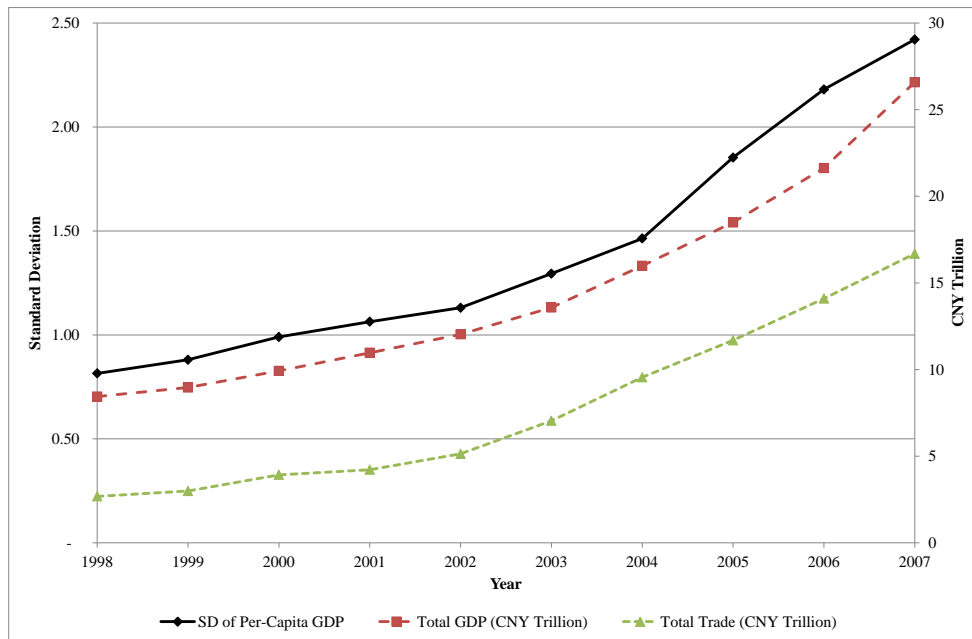
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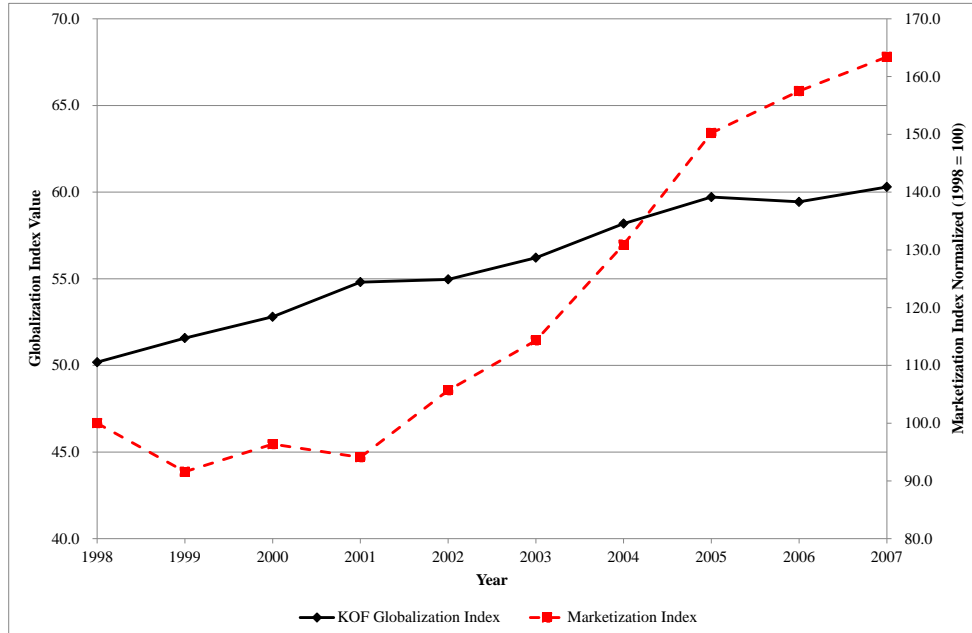
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Graph 1 Standard deviation of deflated per-capita GDP across China's prefectures, total GDP, and total trade 1998 to 2007



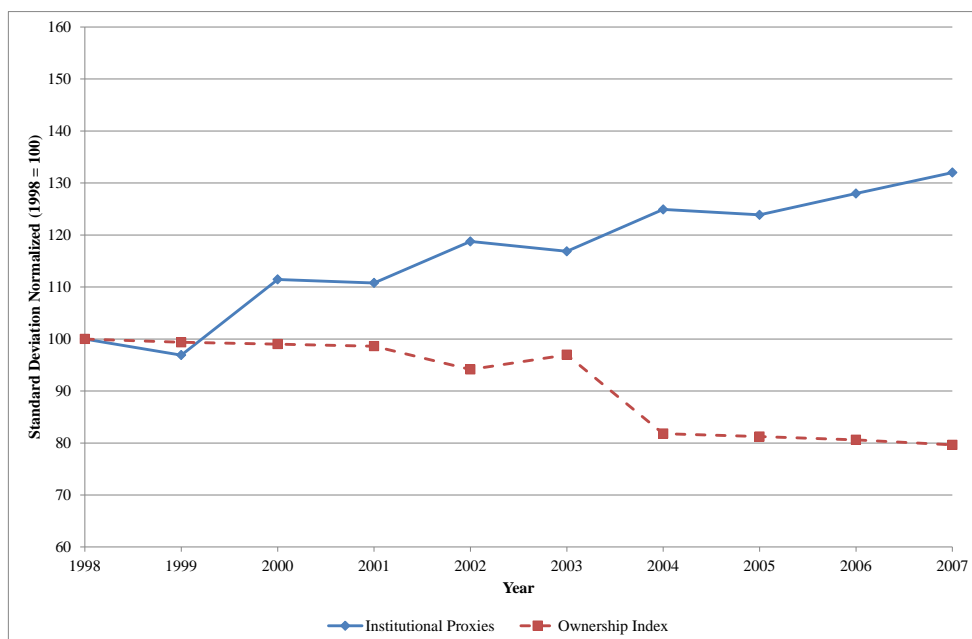
Standard deviation of deflated per-capita GDP across China's prefectures in each year measured on left axis. China's GDP and total trade (imports plus exports) in CNY trillion measured on right axis. Data from *China Statistical Yearbook* (2009).

Graph 2 KOF institutional index and marketization institutional index for China 1998 to 2007



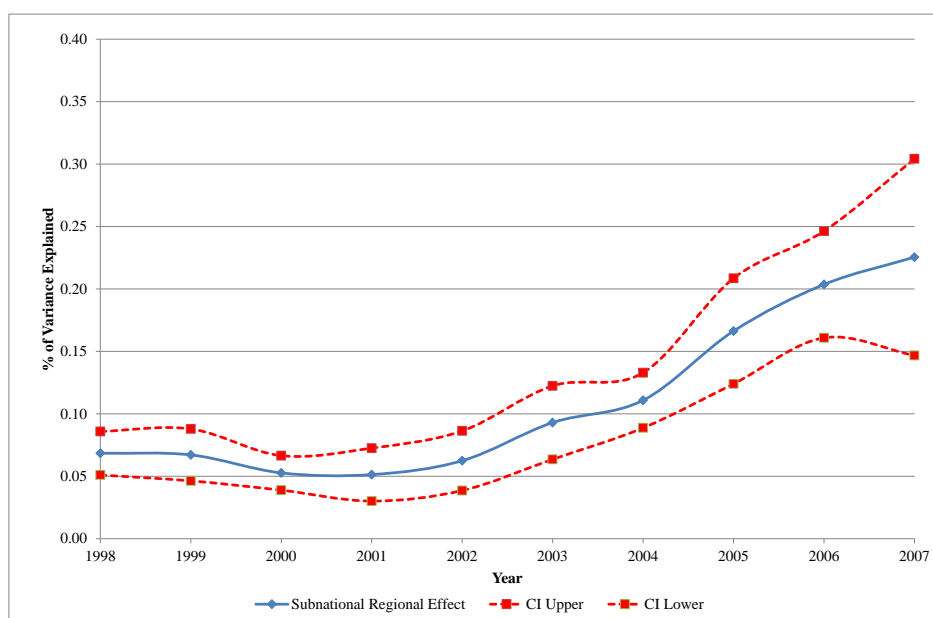
KOF Globalization Index (left axis) for China based on Gygli, *et al.* (2018). The index ranges from 1 to 100 and is based on economic, social, and political dimensions that are weighted based on a principal components analysis with 100 representing the most globalized country over the entire sample period for which the index was constructed (1970 to 2015 for 209 countries). Standard deviation of sub-indices of the Marketization Index (right axis) based on Fan, *et al.* (2007) across provinces of China normalized to 100 in 1998.

Graph 3 Standard deviation of institutional proxies and ownership index (both normalized to 1998 = 100) across China's prefectures 1998 to 2007



“Institutional proxies” is the equal-weighted average of the standard deviation across subnational regions of all institutional proxies (including the Marketization Index) described in the text in each year and normalized to 100 in 1998. The ownership index is constructed by taking the average of five sub-indices. The sub-indices are the standard deviation of the fraction of firms in each prefecture that are SOEs, private domestic, collective, private foreign, and HMT. Once these sub-indices are averaged the index is normalized to 100 in 1998.

Graph 4 COV estimates of subnational regional effects on operating margins for manufacturing firms in China estimated year-by-year from 1998 to 2007

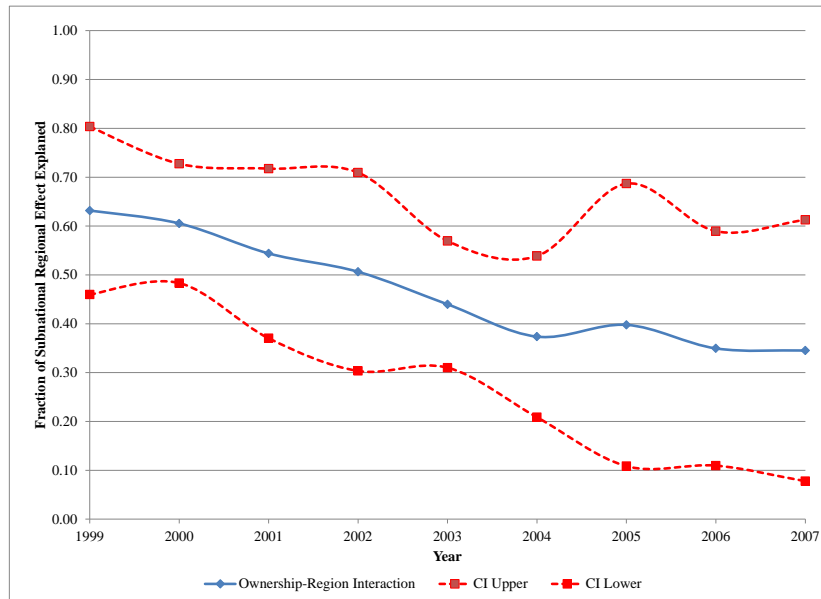


Number of Subnational Regions									
1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
333.5	333.5	332.1	330.8	329.9	311.2	315.9	323.3	320.9	317.6

Percentage variance explained by subnational region factor in COV estimates of operating margin for manufacturing firms in China based on year-by-year estimates of Equations (1) and (2) in the text omitting the unidentified year factor. Dashed lines are 90% confidence intervals based on bootstrap standard errors estimated according to Equation (3) in the text using 50 iterations. The table shows average number of levels for subnational region factor across all bootstrap iterations in each year.

Graph 5

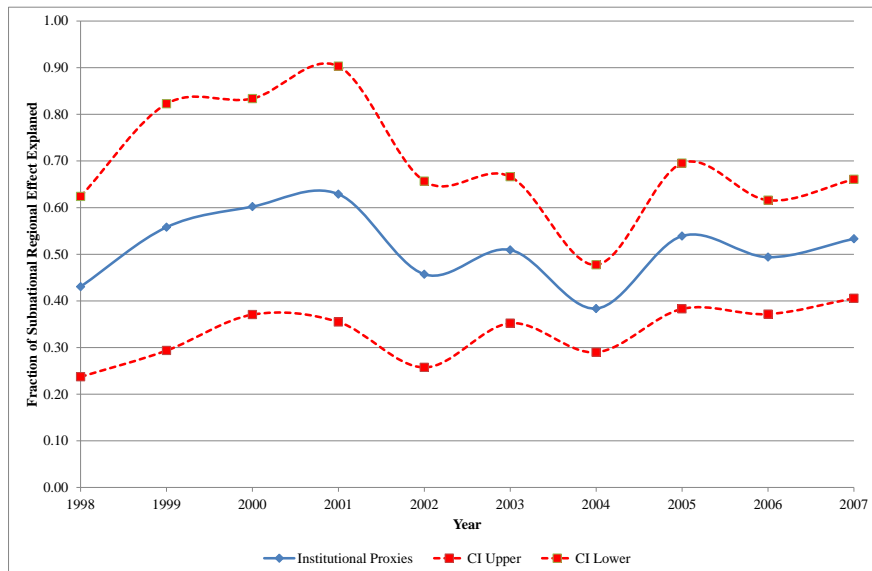
Fraction of SREs explained by interaction between ownership type and subnational region in COV estimates of operating margins for manufacturing firms in China estimated year-by-year from 1999 to 2007



Fraction of SREs in each year explained by interactions between ownership type and subnational regions in year-by-year estimations of Equations (1a) and (2a) in the text and controlling for serial correlation. Dashed lines are 90% confidence intervals based on bootstrap standard errors estimated according to Equation (3) in the text using 50 iterations.

Graph 6

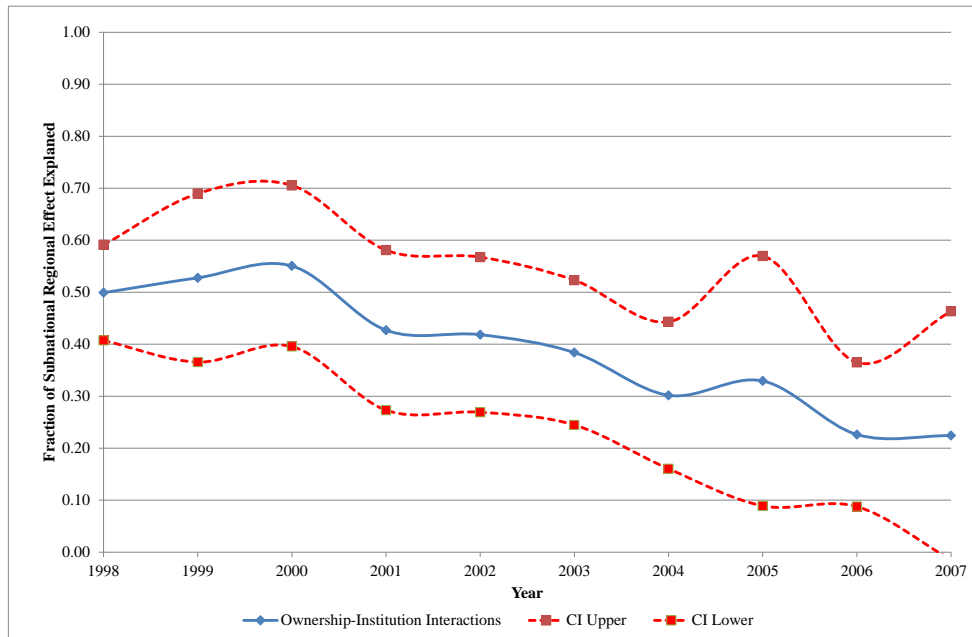
Fraction of SREs explained by institutional proxies in COV estimates of operating margins for manufacturing firms in China estimated year-by-year from 1998 to 2007



Fraction of SREs in each year explained by the institutional proxies in year-by-year estimations of Equations (1b) and (2b) in the text. Dashed lines are 90% confidence intervals based on bootstrap standard errors estimated according to Equation (3) in the text using 50 iterations.

Graph 7

Fraction of SREs explained by interactions between ownership type and institutional proxies in COV estimates of operating margins for manufacturing firms in China estimated year-by-year from 1998 to 2007



Fraction of SREs in each year explained by interactions between ownership type and institutional proxies in year-by-year estimations of Equations (1b) and (2b) modified to add interactions between ownership type and institutional proxies as described in the text. Dashed lines are 90% confidence intervals based on bootstrap standard errors estimated according to Equation (3) in the text using 50 iterations. The confidence interval drops below the lower bound of zero in 2007.

Table 1 Descriptive Statistics for Sample of Chinese Manufacturing Firms 1998 to 2007

	N	Mean	Standard Deviation	Min	Max
<i>Variable:</i>					
Operating Income/Assets	1,116,722	0.092	0.234	-8.114	44.119
Operating Income (RMB millions)	1,116,722	5.544	54.445	-2,130.490	14,530.790
Total Assets (RMB millions)	1,116,722	89.843	604.592	5.000	90,250.780
<i>Operating Income/Assets by Year:</i>					
Year 1998	66,590	0.053	0.172	-1.803	30.464
Year 1999	70,726	0.055	0.209	-2.119	44.119
Year 2000	70,244	0.059	0.138	-4.690	7.097
Year 2001	86,292	0.057	0.134	-2.629	6.396
Year 2002	94,549	0.065	0.196	-8.114	37.974
Year 2003	71,784	0.089	0.169	-2.789	11.532
Year 2004	138,715	0.079	0.182	-5.317	9.876
Year 2005	169,635	0.103	0.252	-4.399	19.944
Year 2006	179,152	0.117	0.268	-3.126	18.197
Year 2007	169,035	0.141	0.330	-5.153	26.687
Firm Age (Years)	1,104,119	10.342	10.684	0.000	108.000
Firm Size (Total Assets RMB 100,000)	1,116,722	89.843	604.592	5.000	90,250.780
<i>Number Observations:</i>					
State-Owned Enterprises	138,223				
Collectives	169,870				
Private Domestic	555,486				
Hong Kong/Macau/Taiwan	127,530				
Private Foreign	125,613				
<hr/> Summary statistics for all firms in the sample. <hr/>					

Table 2 COV Estimates of Operating Margins for Manufacturing Firms in China between 1998 and 2007

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	<u>Base Model</u>		Taxes/ Subsidies	Serial Correlation	Ownership Interactions	Ownership Interactions Serial Corr.	Institutions
	Avg. # Categ.	%	%	%	%	%	%
Var(Year)	10.0	0.74% *** (0.16%)	0.73% *** (0.16%)	0.88% *** (0.26%)	0.74% *** (0.17%)	0.89% *** (0.25%)	1.05% *** (0.34%)
Var(Subnational Region)	301.7	13.64% *** (4.72%)	13.50% *** (5.14%)	13.64% *** (4.47%)	11.53% *** (4.95%)	11.95% *** (4.62%)	7.35% *** (3.12%)
Var(Industry)	442.3	1.88% ** (1.10%)	1.77% * (1.19%)	2.01% * (1.45%)	1.87% ** (1.07%)	2.80% (5.58%)	1.89% * (1.23%)
Var(Firm)	3316.0	38.65% *** (6.37%)	39.10% *** (6.41%)	22.85% * (14.61%)	37.42% *** (6.80%)	20.75% * (13.71%)	37.66% *** (7.17%)
Var(Ownership)	5.0	1.07% *** (0.30%)	1.01% *** (0.33%)	1.25% *** (0.47%)	1.25% *** (0.38%)	1.37% *** (0.48%)	0.93% *** (0.30%)
Var(Subnational Region x Ownership)					2.83% (3.43%)	1.44% (1.84%)	
Var(Error)		44.02% *** (8.28%)	43.89% *** (8.06%)	59.37% *** (14.79%)	44.36% *** (9.29%)	60.80% *** (14.60%)	47.23% *** (14.42%)
Var(Total)		6.15% (1.23%)	5.29% (1.16%)	5.63% (1.28%)	6.02% (1.12%)	5.58% (1.14%)	6.35% (1.31%)
AR(1)				0.413 ** (0.212)		43.17% *** (17.75%)	
Var(Institutional Proxies F-Value Critical Value)							6.78% 158.56 1.79
Average Sample Size	11,210		11,204	5,637	11,229	5,638	11,229
Bootstrap Iterations	50		50	50	50	50	50

Percentage variance explained by factors in COV estimates of operating margin for Chinese manufacturing firms. COV estimates based on bootstrap estimation from the full sample in years 1999 through 2007 in Columns 4 and 6 and from 1998 to 2007 in all other columns. Bootstrap standard errors in parentheses. * = 10% significance, ** = 5% significance, *** = 1% significance for a one-sided t-test. Total variance in Column 5 differs from that in Column 7 because SAS COV procedure drops observations with collinear interaction terms without reporting the reduced number of observations.

Online Supplement
for
Dynamics of the Subnational Regional Effect:
The Role of Institutions and Institutional Access

Supplementary Information A
Robustness of COV Estimates of Operating Margins for
Manufacturing Firms in China between 1998 and 2007

Subnational region's importance could result from systematic sorting of firms by age across regions. If moving an established firm is costly and because some areas of China developed or were privatized before others (Démurger, 2001; He *et al.*, 2008), survivorship bias could explain the SREs. Older, surviving firms will have higher profits on average because poor-performing firms will have previously exited and areas which developed earlier will have a higher proportion of older firms. Similarly, firms in some areas may be systematically larger or smaller than those in others and profitability may differ due to scale economies. To see if these occur, Column 2 of the table below controls for firm age and size.¹ Firm size plays a significant but small role in explaining variance but does not detract from subnational region's importance compared to the baseline results replicated in Column 1. Firm age is insignificant.

If operating in particular industries is more profitable in some locations, this will lead to systematic sorting of industries by region and be revealed as location rather than industry effects. To allow for this possibility, Column 3 introduces an interaction term between subnational region and industry. The interaction term is statistically insignificant and the point estimate of the SREs is diminished only slightly.

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¹ Throughout the paper, for continuous variables such as firm age and size we create 50 levels by splitting the variable's distribution into 50 subgroups so that the number of observations in each subgroup is as equal as possible. SAS's COV procedure automatically drops observations which create collinearities but does not report the number of observations it drops. Thus, although the samples in Columns 1 through 3 appear to be the same they are not. That is why the overall variances of them differ.

	(1) Base Model %	(2) Firm Age/Size %	(3) Industry Interactions %
Var(Year)	0.74% *** (0.16%)	0.91% *** (0.18%)	0.75% *** (0.16%)
Var(Subnational Region)	13.64% *** (4.72%)	13.60% *** (4.83%)	13.42% *** (4.89%)
Var(Industry)	1.88% ** (1.10%)	1.78% * (1.11%)	1.43% ** (0.83%)
Var(Firm)	38.65% *** (6.37%)	38.12% *** (6.34%)	34.14% *** (8.70%)
Var(Ownership)	1.07% *** (0.30%)	0.70% *** (0.23%)	1.07% *** (0.30%)
Var(Firm Size)		0.88% *** (0.33%)	
Var(Firm Age)		0.22% (0.18%)	
Var(Subnational Region x Industry)			5.63% (6.99%)
Var(Error)	44.02% *** (8.28%)	43.79% *** (8.39%)	43.55% *** (8.58%)
Var(Total)	6.15% (1.23%)	6.15% (1.23%)	6.12% (1.21%)
Average Sample Size	11,210	11,210	11,210
Bootstrap Iterations	50	50	50

Percentage variance explained by factors in COV estimates of operating margin for Chinese manufacturing firms. COV estimates based on bootstrap estimation from the full sample in years 1998 to 2007. Bootstrap standard errors in parentheses. * = 10% significance, ** = 5% significance, *** = 1% significance for a one-sided t-test. Total variance in Column 3 differs from that in Columns 1 and 2 because SAS COV procedure drops observations with collinear interaction terms without reporting the reduced number of observations. Firm age and firm size variables are discretized into 50 levels by splitting their distributions into 50 subgroups so that the number of observations in each subgroup is as equal as possible.

Supplementary Information B Description of Marketization Index

Sub-Index	Description
Indicators	
Sub-Indicator	
1. Government-market relationship	
1a. Proportion of resources allocated by market	Fiscal expenditures of local governments (budgetary and extra budgetary)/local GDP
1b. Tax deduction on farmers	Average of (tax/household income of farmers)
1c. Reduction in government interventions upon firms	Time spent by the chief managers of the enterprises in dealing with government departments and personnel/total working hours
1d. Reduction in cost (excluding tax) of firms	Enterprise burden of fees and apportionment/sales revenue
1e. Government size	The number of workers in state organizations, party organizations, and social organizations/total population of the province
2. Development of private firms	
2a. Proportion of non-state-owned economy in the sales income of industrial enterprises	Industrial enterprise product sales revenue/total sales revenue
2b. Proportion of non-state-owned economy to whole society in the total investment in fixed assets	Non-state-owned economy portion of total investment in fixed assets/total investment in fixed assets
2c. Proportion of the employment for non-state-owned economy to total employment in urban areas	Employment in non-state-owned economy/total employment in urban areas
3. Development of product market	
3a. Power of market on product pricing	
(3a1) Power of market on retail product pricing	The proportion of prices of retail goods that is determined by market
(3a2) Power of market on production materials pricing	The proportion of prices of production materials that is determined by market
(3a3) Power of market on agricultural products pricing	The proportion of prices of agricultural products that is determined by market
3b. Reduction in local protection in commodity markets	Number of events that trade protection measures were taken for products sale/local GDP
4. Development of factor market	
4a. Marketization of financial sectors	
(4a1) Competition in the financial sectors	Deposits that are absorbed by non-state-owned financial institutions/those absorbed by all financial institutions
(4a2) Marketization of credit funds allocation	(Total Loans issued by financial institutions-Total loans of state-owned enterprises)/Total Loans issued by financial institutions
4b. Introduction of foreign capital	Local investment by foreign investors from Hong Kong, Macao and Taiwan/local GDP
4c. Labor mobility	Number of rural labor migrants/number of total local urban employees
4d. Marketization of technological achievements	Transaction volume of local technology market/the number of local technological personnel
5. Development of market and legal intermediaries	
5a. Developmental of market Intermediaries	
(5a1) The number of lawyers/total population	The number of lawyers/total local population
(5a2) The number of accountants/total population	The number of accountants/total local population
5b. Protection of the legitimate rights and interests of producers	The number of cases received in economic cases/GDP (prior to 2003)
5c. Protection of intellectual property rights	
(5c1) The number of received patent applications/technological personnel	The number of received patent applications/technological personnel
(5c2) The number of approved patent applications/technological personnel	The number of approved patent applications/technological personnel
5d. Consumer protection	The number of consumer complaints received by the consumer association

Based on Fan G, Wang XL, Zhu HP. (2007). *Marketization index in China: The regional process report of 2006*. Beijing: Economic Science Press (in Chinese).

Supplementary Information C

Description and Justification of Additional Institutional Proxies

Economic institution proxies. We use the number of universities in each subnational region as a proxy for human capital as educational entities are latent functions that support economic institutions (Korgen and Atkinson, 2017:19).² As proxies for physical infrastructure we use road capacity as measured by highway kilometers per capita (Korgen and Atkinson, 2017:19), railway capacity as measured by rail kilometers per capita (Salomon, 2016: 77), and port capacity as measured by the number of shipping berths (Salomon, 2016: 77). For communications infrastructure we use the number of mobile and landline phones per household. Internet penetration measures by subnational region are unavailable but likely highly correlated with phone penetration.

Social institution proxies. Unified only recently, China's regions developed different social practices due to historical isolation and limited infrastructure (Ralston *et al.*, 1996). China's terrain is expansive with many geographic barriers such as mountains and rivers which led to different independent cultures and languages developing before unification (*Ethnologue: Languages of the World*, 2009). The Communist government policy restricting freedom of movement perpetuated many of these differences even since the rise of modern China (Ralston *et al.*, 1996). Social networks are particularly important in China given the reliance on *guanxi* (Park and Luo, 2001). Underlying measures of attitudes toward work, trust, hierarchy, and risk are unavailable by regions within China so we rely on two proxies for social institutions.³

The first is the predominant dialect (out of 51) spoken in each subnational region. Dialects originated due to geographic and social isolation and therefore provide a good proxy for social practices, attitudes, and networks that firm managers might access. Language is a communal institution that provides a set of conventions to coordinate activity (Port, 2010) and provides economic, social and emotional support (Kuah-Pearce, 2011: 33). Dialect can also form an impenetrable network to outsiders (Kuah-Pearce, 2011: 33). The second proxy is the percentage of the region's population that belongs to one of 55 officially-recognized minority groups (other than the majority Han population). Minority groups emerged historically

² For prefectures within China's four municipalities (Beijing, Shanghai, Tianjin and Chongqing) the education variable is defined at the municipal level. Chan *et al.* (2008) use GDP per capita and national ratings of economic systems, distribution infrastructure, and financial resources in their cross-country analysis. We do not have similar ratings available and use proxies for the underlying determinants of output rather than the output measure itself.

³ Chan *et al.* (2008) use justice, harassment and violence, corruption, and civil freedom for their cross-country analysis. These measures are unavailable for regions within China.

due to geographic isolation and have different cultural practices affecting interactions. Pepinsky (2017) defines ethnicity as a “collective of individuals who recognize shared attributes of heritage in specific recurrent situations” and argues that it constitutes a social institution.

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The following table shows the source for the additional institutional proxies:

Variable	Source
Minority (% of Population)	The Fifth Population Census of China
Number of Colleges	China City Statistical Yearbook 1999-2008 China Statistical Yearbook 1999-2008 CEInet Database
Highway Kilometers	China City Statistical Yearbook 1999-2008 China Statistical Yearbook for Regional Economy 2000-2008 Provincial and Prefectural Level Statistical Yearbooks 1999-2008
Railway Kilometers	China City Statistical Yearbook 1999-2008 China Statistical Yearbook for Regional Economy 2000-2008 Provincial and Prefectural Level Statistical Yearbooks 1999-2008
Number of Shipping Berths	China City Statistical Yearbook 1999-2008 China Statistical Yearbook for Regional Economy 2000-2008 Provincial and Prefectural Level Statistical Yearbooks 1999-2008
Mobile Phones Registered Per Household	China City Statistical Yearbook 1999-2008 China Statistical Yearbook 1999-2008 China Statistical Yearbook for Regional Economy 2000-2008
Landline Phones Registered Per Household	China City Statistical Yearbook 1999-2008 China Statistical Yearbook 1999-2008 China Statistical Yearbook for Regional Economy 2000-2008
Dominant Dialect	Language Atlas of China

Continuous Proxies: The following table shows the summary statistics for the continuous additional institutional proxies (the two discrete proxies are described below):

Variable	N	Mean	Standard Deviation	Min	Max
Minority (% of Population)	1,116,481	3.44	9.24	0.04	98.03
Number of Colleges	1,116,722	0.026	0.048	0.000	1.171
Highways (Kilometers Per Capita)	1,116,481	14.8	13.7	0.8	1,054.1
Railways (Kilometers Per Capita)	1,116,722	5.6	7.8	0.1	344.6
Number of Shipping Berths	1,116,722	0.3	0.5	0.0	5.5
Mobile Phones Registered Per Household	1,116,481	1.1	1.8	0.0	25.5
Landline Phones Registered Per Household	1,116,481	0.5	0.7	0.0	15.9

Summary statistics for additional institutional proxies by region used in estimation. Mobile phones per household in some regions greatly exceed one because phones can be used in regions in which they are not registered (especially by households that have moved and do not want to relinquish their phone number which is non-portable across regions). Landline phones per household greatly exceed one in some regions because this includes business phones.

Dominant Dialect: Data on dialects is taken from the *Language Atlas of China* as described in Lively (2000).⁴ The data is based on a 1987 survey and classifies dialects by a four-digit code: phylum, stock, group, and subgroup. We have simplified this somewhat. The atlas actually uses a six-digit code for Mandarin because it is divided into finer subgroups. According to Lively (2000) it is not clear how different these finer delineations are linguistically and culturally so we do not use them. Most of the dialects in China concern the Han ethnic group and are contained within the Sino-Tibetan phylum (first digit equals “1”) and within that the Sinitic stock (second digit equals “1”) although a few are within the Tibeto-Burman stock (first digit equals “1” and second digit “2”). A few other locations have a dominant dialect within the Altaic phylum (first digit equals “3”). The following table shows the frequency distribution of the major dialects across the subnational regions in the data:

4-Digit Dialect	N	%	Cumulative
			%
1111	49,383	5.0	5.0
1112	12,995	1.3	6.3
1113	77,200	7.8	14.0
1114	69,344	7.0	21.0
1115	85,540	8.6	29.6
1116	8,428	0.9	30.5
1117	76,015	7.6	38.1
1118	89,740	9.0	47.1
1121	3,734	0.4	47.5
1122	1,470	0.2	47.7
1123	1,723	0.2	47.8
1124	2,316	0.2	48.1
1125	7,331	0.7	48.8
1126	2,438	0.3	49.0
1127	15,534	1.6	50.6
1131	202,877	20.4	71.0
1132	17,831	1.8	72.8
1133	20,580	2.1	74.9
1134	10,686	1.1	75.9
1135	4,476	0.5	76.4
1136	2,797	0.3	76.7
1141	3,301	0.3	77.0
1142	3,053	0.3	77.3
1143	3,031	0.3	77.6
1144	886	0.1	77.7
1145	1,967	0.2	77.9
1146	2,128	0.2	78.1
1149	1,922	0.2	78.3
1151	9,335	0.9	79.2
1152	2,057	0.2	79.5
1153	644	0.1	79.5
1161	37,355	3.8	83.3
1162	1,786	0.2	83.5
1163	9,235	0.9	84.4
1164	1,797	0.2	84.6
1166	1,789	0.2	84.7
1167	2,465	0.3	85.0
1171	105,518	10.6	95.6
1172	10,393	1.1	96.6
1173	4,136	0.4	97.1
1174	5,975	0.6	97.7
1176	454	0.1	97.7
1177	1,006	0.1	97.8
1181	8,143	0.8	98.6
1182	950	0.1	98.7
1184	1,624	0.2	98.9
1185	4,566	0.5	99.3
1186	1,939	0.2	99.5
1193	723	0.1	99.6
1200	2,107	0.2	99.8
3000	1,787	0.2	100.0
Total	994,510		

⁴ Lively W. 2000. Coding scheme for the language atlas of China, University of Washington, mimeo.

Supplementary Information D

Qualitative Evidence of Dynamic Role of institutions in SREs

While the main text provides quantitative evidence that institutions accounted for increasing SREs over time in China, we provide here qualitative examples for social, economic, and political institutions. Why would social institutions play a larger role over time in explaining SREs? China's economy grew rapidly during this time but formal business methods did not keep pace leading firms to increasingly rely on informal mechanisms (Peng and Heath, 1996; Xin and Pearce, 1996). China's formal legal institutions have improved over time but economic activity has outpaced this so that firms increasingly rely on informal contracts (Allen, *et al.*, 2005). The effectiveness of these informal contracts depends on the strength of social ties. If networks are local and differ in effectiveness, variation in firm profits increases across subnational regions over time. A similar logic applies to China's capital markets. Formal financing in China is government-controlled and preferential to SOEs. Private domestic firms must rely primarily on private financing enforced through informal contracts. As China's private economy has expanded over time, social networks have become increasingly important in such enforcement over time.

A specific example that illustrates these points is that of the "Wenzhou Businessmen" (Cao, 2010). Business people in Wenzhou city are connected by a strong social network based on Christianity that helps their businesses: explicitly through identifying business partners, customers, suppliers, and financing and implicitly by enforcing strong norms of trust and reciprocity within the group. Initially the group built many churches in Wenzhou but has since expanded outside the city consistent with the increased influence of social institutions over time. The group has unique linguistic and geographic characteristics captured by the proxies: they speak the Wu dialect and are concentrated in Wenzhou.

Another specific example is the Hakka people who left Northern China due to food scarcity. They formed a cohesive identity while migrating southward in response to stigmatization that they encountered from pre-existing residents who were concerned about the strain placed on local resources. "Hakka" means "guests" – a hostile reference implying that they would eventually "go home" (Erbaugh, 1996). The Hakka people emerged highly successful in commerce attributed at least in part to their resilience and resourcefulness (Constable, 1996: 10). Although the Hakka people have spread out across China they share a common dialect and identity (Constable, 1994: 20-38). As China has developed, social networks like those of the Hakka and "Wenzhou Businessmen" may have increased in importance as a substitute for

formal mechanisms leading to a widening gap between these groups' profits and those of business people without access to such networks.

A more general example is the massive migration from China's rural areas to cities to work in manufacturing. An estimated 67 million rural workers moved to cities in 1999 increasing to 140 million in 2008 (Chen, *et al.*, 2010: 2). Migrants frequently follow others from their rural village to the same city because connections help them locate jobs and integrate into new surroundings (Chen et al., 2010). If some villages' workers are more productive than those from others this leads to a divergence in firm profits across regions as emigration increases over time.

Why might economic institutions lead to a divergence in firm profits across subnational regions over time as China develops? Path dependencies lead to a self-reinforcing divergence. School availability and quality vary significantly across China (Min, 2004). As China has developed, access to education has expanded enormously (undergraduate enrollment increased from 2.0 million in 1998 to 8.7 million in 2010)⁵ but several factors have led to uneven expansion across subnational regions. In an effort to build world-class schools, the government disproportionately funds schools that are already the best (Li and Wu, 2012). Since the best colleges are not uniformly distributed across subnational regions (Li and Wu, 2012) this results in the "rich getting richer and the poor getting poorer" (Rong and Shi, 2001).

China's university enrollment process exacerbates this divergence. Placement in a particular college is determined by an applicant's performance on the *gaokao* (a uniform nationwide exam) but applicants whose *hukou* (official residence) shares the same province as a college are admitted with lower scores. Since university quality is uneven across subnational regions this "home bias" leads to a self-reinforcing cycle in which inequality increases over time (Li and Wu, 2012). These regional differences in human capital persist due to agglomeration effects and labor market frictions (under the *hukou* system migrant workers can only obtain government services in their place of registration). A similar path dependency in physical capital creates a self-reinforcing cycle – regions with better infrastructure produce greater output which in turn allows greater infrastructure investments in those regions (Démurger, 2001).

Why might political institutions lead to a divergence in firm profits across regions over time? Government officials have discretion to provide implicit subsidies such as selling land at below-market

⁵ According to Ministry of Education data available at <http://www.moe.gov.cn/>.

value and selectively issuing business licenses to reduce local competition. On the incentive side, local political institutions may provide economic stimulus such as high-tech parks, infrastructure directed at local firms, and incentives for foreign direct investment (Head and Ries, 1996). Although regional differences primarily arise due to local policy variation, China's central government also creates regional disparities through policies favoring urban areas and SEZs (Fujita and Hu, 2001).

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