The Dynamic Role of Subnational Regions in Firm Performance*

Abstract

This study investigates dynamics of subnational regions in determining firm performance over time and by ownership type. We explain theoretically how subnational regions affect firm performance over time in the context of path dependence and the institution-based view and test these predictions using annual data of manufacturing firms in China from 2000 to 2014 – before and after a major negative institutional shock (2008 financial crisis). Consistent with path dependence, regional institutional quality diverges across regions before 2008, a pattern that is disrupted post-2008. Firm performance is increasing in institutional quality so that location effects are increasingly important before the financial crisis but less so post-crisis. These effects are greater for private- than state-owned enterprises consistent with differences in organizational objectives under the institution-based view.

Keywords: dynamic profit components; firm performance; global value chains; institutional environment; path dependence; subnational region

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INTRODUCTION

Strategy scholars have a long history of studying the sources of firm performance (e.g., McGahan and Porter, 1997; Rumelt, 1991; Schmalensee, 1985). Debate has focused primarily on whether performance derives from industrial structure (industry-based view), firm resources (resource-based view) or institutions (institution-based view). Consistent with the last, studies find country (region) matters in determining profitability for foreign affiliates of multinational corporations (MNCs) (Christmann *et al.*, 1999; Makino *et al.*, 2004) and European firms (Kattuman *et al.*, 2011).[1] Later studies introduced subnational regional effects (SREs): how much within-country regions explain variation in firm performance (Chan *et al.*, 2010; Ma *et al.*, 2013) from an institution-based view (Peng *et al.*, 2008). More recently, the "going subnational" literature examines how subnational regional differences influence MNCs' intra-country location choices, premised on within- often exceeding cross-country differences (Beugelsdijk and Mudambi, 2013). This literature primarily focuses on location and strategy choices (Hutzschenreuter *et al.*, 2020) but a few studies examine outcomes, including local institutions' impact on innovation, research and development, and interaction with market reforms (Chan and Du, 2021; Lebedev, 2023; Sun and Zeng, 2020). In contrast, SREs quantify the overall influence of subnational institutions in determining firm profits.

The global value chain (GVC) literature considers the role of location in MNCs' value chains. While the analysis has been primarily at the national and supra-national level, subnational regions are important in upstream innovation activities (De Marchi and Alford, 2022; Hutzschenreuter and Harhoff, 2020; Mudambi *et al.*, 2018). This literature also documents a dramatic vertical disintegration in GVCs over time (Kano *et al.*, 2020). This implies that MNCs increasingly interact with outside firms upstream and downstream,

[1] 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).

including those of other ownership types such as private-owned enterprises (POEs) and state-owned enterprises (SOEs). This vertical disintegration also indicates that these interactions change dramatically over time impacting both MNCs and their non-MNC partners (Yang and Singh, 2014).

This raises two crucial questions vis-a-vis previous studies. First, how do SREs evolve over time? Firms must understand this to form a prediction of how important SREs will be in the future. Previous studies involving cross-sectional comparisons of MNCs have led to speculation that SREs are inversely related to institutional and economic development (Chan *et al.*, 2010). Chan *et al.* (2008) find that the variance of firm profitability is negatively related to country institutional development. Two studies find greater SREs in less- versus more-developed regions in cross-section: SREs among MNCs are stronger for affiliates in China than in the US (Chan *et al.*, 2010) and in less- versus more-developed regions of China (Ma *et al.*, 2013).

Value chain disaggregation over time means that MNCs increasingly collaborate with firms of other ownership types and that these relationships evolve over time, prompting our second question: how do SRE dynamics compare across ownership types over time?[2] MNCs must understand how location affects firms of other ownership types over time to plan the evolution of their value chains. The previous literature establishes SREs' importance for MNCs and that ownership type matters in explaining variation in firm performance (Fitza and Tihanyi, 2017; Xia and Walker, 2014); however, it does not examine SREs and their dynamics by ownership type. The GVC literature also examines how institutions influence upgrading vis-a-vis supplier ownership type (Morris and Staritz, 2013), and institutional path dependency in subnational location choice (Hutzschenreuter and Harhoff, 2020; Stallkamp *et*

[2] Examining non-MNCs is also important because MNCs comprised only 10% of world output in 2014 (World Bank Group, 2015).

al., 2016) but not the overall importance of subnational institutions to firm profits by ownership type.

To address these two questions, we apply path-dependence theory (Dobusch and Kapeller, 2013; Micelotta *et al.*, 2017; Sydow *et al.*, 2009, 2020; Vergne and Durand, 2010), in the context of the institution-based view (Peng *et al.*, 2008), to develop hypotheses. For the first question, path dependence predicts that institutions follow a stochastic process that is contingent and self-reinforcing in the absence of major negative shocks. This implies that institutions in regions with above-average institutional quality will become even better over time relative to those in below-average. Organizational actions exacerbate this trend (Garud and Karnøe, 2001) as successful organizations invest in preserving the status quo to their ongoing benefit (North, 1990).

The institution-based view predicts a positive relationship between institutional quality, as it relates to profitability, and firm performance as has been shown empirically (Chang, 2023; Cuervo-Cazurra and Dau, 2009; Murphy *et al.*, 1991; Park *et al.*, 2006). Chan *et al.* (2008) predict a positive, concave relationship, but find a negative relationship using cross-country data. We confirm that their hypothesis holds within a single country over time and offer reasons why the two settings might differ. Combining this with the widening gap in institutional quality across regions due to path dependence implies that firm profitability diverges across subnational regions and SREs increase over time at least until a major negative shock occurs.

A negative shock disrupts pre-existing institutions to the detriment of successful incumbents (Dobusch and Kapeller, 2013; North, 1990; Sydow *et al.*, 2009, 2020; Vergne and Durand, 2010). Under path-dependence theory, this reduces or even eliminates the self-reinforcing nature of institutional quality over time. Given the link between institutional quality and firm profitability, this implies that subsequent to a major negative shock, SREs

increase more slowly or even decrease if there is a reversal in which high- and low-quality regions trade places. This is temporary as the dominant organizations post-realignment (even if not previously dominant) exert efforts to optimize institutions to their benefit (North, 1990), eventually reverting back to the self-reinforcement of institutional quality and increasing SREs.

For the second question, the key aspect of the institution-based view is the interaction of organizational objectives with institutions. Organizations have varying objectives that mediate how institutions affect their payoffs. Firms with profitability as their primary objective are highly responsive to institutional aspects affecting profitability while those with alternative or more diffuse objectives are less so. Under the path-dependence theory and in the absence of a major negative shock, firm types that are highly responsive will experience greater profitability divergence across regions than will types that are less sensitive. To examine this, we focus on two ownership types: POEs and SOEs. POEs' primary objective is profits while SOEs' objectives include profits but also others that are possibly more important.[3] High SOE profits are disproportionately diverted to efforts such as supporting employment, while low profits are often subsidized. SOEs have other objectives, such as political advancement, that benefit them organizationally. This has implications both in the cross section and over time. At a point in time, institutional differences across subnational regions should result in more extreme outcomes and greater SREs for POEs than for SOEs. Over time, in the absence of a major negative shock, it implies that the gap in SREs between the two types of organizations should widen. Analogously, after a major negative shock the disruption of the institutional environment against the status quo should have a greater effect on firms highly focused on profits and the SRE gap decline.

[3] SOEs comprise an estimated 10% of global GDP (Stan *et al.*, 2014) and share many aspects worldwide, such as government involvement in their operations and the pursuit of non-profit objectives.

To test these hypotheses, we apply a hierarchical linear model (HLM), also known as longitudinal multilevel modeling, to a survey of manufacturing firms in China from 2000 to 2014. This setting is ideal for several reasons. First, the time period encompasses a major negative institutional shock (the 2008 financial crisis) dividing the institutional environment into two regimes. This allows a test of whether SREs follow a trend consistent with path dependence pre-crisis and how a major negative shock affects the trend post-crisis. Second, the setting offers a large SOE sample alongside POEs because China transitioned from an historical command-and-control economy. Third, as the second-largest economy, China plays a prominent role in global manufacturing and trade so that understanding firm performance there is particularly valuable.

Following previous studies, we define firm performance as return on assets. We define the subnational region as the four-digit level (equivalent to prefectures) of the Administrative Division Codes of the PRC published by the National Bureau of Statistics (NBS). Prefectures are a natural unit of analysis because a higher-level grouping (two-digit or province) would aggregate significant variation in political institutions that occur at the prefecture level and a lower-level grouping (six-digit or county) would force us to drop many observations due to collinearity of factors within such small regions. This choice is also consistent with studies on the impact of political turnover on firm outcomes (Zhong *et al.*, 2019). Empirically, we define SREs as the variance in the distribution of firm profitability across all manufacturing firms attributable to the prefecture in a variance decomposition controlling for variance attributable to year, firm, ownership type, and industry.

We argue qualitatively that our sample lies in the self-reinforcement (second) phase of path dependence (Dobusch and Kapeller, 2013; Sydow, *et al.*, 2009) in which outcomes are neither a pure random walk nor completely deterministic. We then provide qualitative and quantitative evidence that regional institutional quality as it relates to firm profitability fulfills

the two criteria for this stage of path dependence: it is contingent and self-reinforcing (Vergne and Durand, 2010). Before the financial crisis, regions with above-average institutional quality are 14.5% more likely to experience an above-average increase in quality relative to those with below. After the negative shock of the financial crisis, this pattern changes. Regions with above-average institutional quality are as likely to experience a below as an above-average improvement in quality.

The underlying institutional path dependence in the absence of major negative shocks is reflected in regional profit heterogeneity. Pre-crisis, SREs for all firms increase from 6.4% of total profit variance in 2000 to 21.1% in 2007. The 14.7 percentage point increase is significant at better than the 0.01% level. This effect is not due to a large jump in a minority of years but rather a higher propensity to increase across all years. SREs have a 58.3% probability of increasing year-on-year with a 95% confidence interval of (54.1%, 62.5%). These results support the institution-based view, which posits that institutions change to the benefit of previously-successful organizations. Post crisis, the disruption of institutional path dependence due to the major negative shock is reflected in SREs, which decrease from 17.4% of total profit variance in 2008 to 12.0% in 2014. The 5.4 percentage point drop is significant at the 0.4% level. This is consistent with the institution-based view which argues that major negative shocks alter institutions to the detriment of previously-successful organizations slowing SREs' increase or even reversing it.

Consistent with path dependence having a greater influence on organizations that are more sensitive to institutional aspects affecting profitability, SREs for POEs significantly exceed those for SOEs in all years pre- and post-crisis (14.0 percentage points on average). Pre-crisis, the POE-SOE gap in SREs increases from 9.4 percentage points in 2000 to 22.4 percentage points in 2007 consistent with stronger institutional path dependence for firms focused primarily on profitability. The 13.0 percentage point increase is significant at the 2.1% level.

The negative shock of the financial crisis is more disruptive to path dependence for ownership types with more profit-driven objectives. Post-crisis, the POE-SOE gap narrows, falling from 16.6 percentage points in 2008 to 12.1 percentage points in 2014. However, the 4.5 percentage point decline is not statistically significant (25.1% level).

We extend previous work in two primary ways. First, we develop a theory of SRE dynamics over time that combines path dependence theory and the institution-based view. The self-reinforcing property of path dependence predicts the evolution of underlying regional institutions, as they relate to firm profitability, over time. The institution-based view links these institutional changes to firm profitability across regions with different institutional quality. This extends the previous literature that develops and tests theories of cross-sectional comparisons of SREs (Chan *et al.*, 2010; Ma *et al.*, 2013) under the institution-based view.[4] Empirically, we examine SRE dynamics inter-temporally within a country. We provide empirical evidence consistent with path dependence under the institution-based view both in the absence of a major negative shock and subsequent to one. In the "going subnational" literature, understanding SREs over time is important for MNCs in choosing their locations: Hutzschenreuter *et al.* (2020, p. 11) call for longitudinal studies of how regional characteristics affect firm performance. Our work is complementary in that it provides conditions under which aggregate regional institutions will be an increasing or decreasing determinant of future performance. Our framework can be easily extended to test whether a specific institutional characteristic will be an increasing or decreasing determinant of profits over time.

Second, by relating organizational objectives under the institution-based view to the theory of path dependence, we develop theoretical predictions for SRE dynamics over time by ownership type. Variation in different ownership types' objectives under the institution-based

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

view determines their responsiveness to regional institutions as they relate to firm profitability. We provide empirical evidence consistent with this by comparing firms with differing emphases on profitability. The results show that, in the absence of major negative shocks, organizational objectives interact with institutions to increase SREs faster over time for more profit-focused organizations. Analogously, a major negative shock disrupts the path of SREs more for more profit-focused organizations. This is consistent with Chang and Wu (2014) which finds that institutional barriers drive a wedge between firm efficiency and survival.

In the next section we discuss reasons why SREs would increase over time and how these dynamics might differ by ownership type. We then present our methodology followed by our results. We conclude by discussing the implications and limitations of our study.

SRE DYNAMICS OVER TIME AND BY OWNERSHIP TYPE

Why and how might SREs change over time?

Our starting point is the institution-based view, which is the foundation for previous work on SREs. The institution-based view posits that underlying institutions influence organizational performance (North, 1990); therefore, institutional differences across subnational regions result in differing firm performance across regions (Chan *et al.*, 2010). To examine SRE dynamics, we consider the path dependent nature of institutions.[5]

Sydow *et al.* (2009) identify three phases of path dependence for a stochastic process. In the first (preformation) phase, the process' future path is completely unpredictable from its historical path (in mathematical terms the stochastic process is ergodic). This is followed by the second (formation) phase in which the process remains random but some paths are closed off (the stochastic process is non-ergodic) so that the process exhibits some, but not full, predictability. In the final (lock-in) phase, the process narrows to a single predominant path.

[5] Kingston and Caballero (2009) and Brousseau *et al.* (2011) survey different frameworks for institutional change while Roland (2004) classifies slow- and fast-changing institutions.

Although variation over time remains, it is insufficient to dethrone this predominant path. Dobusch and Kapeller (2013) formalize the three phases and argue that the transition from the first phase, which is purely contingent in nature, to the second occurs after a "critical juncture". Although there are many underlying reasons why path dependence might occur (Dobusch and Schüßler, 2012; Vergne and Durand, 2010), we focus on institutions in order to explain regional profit variation.[6]

We consider a setting that is in the second phase of path dependence. In this phase, the stochastic process fulfills two conditions of path dependence in the absence of major negative shocks: contingency and self-reinforcement (Vergne and Durand, 2010). Contingency recognizes the process' accidental nature and implies that outcomes cannot be mechanically traced back to their origin (Mahoney, 2000). Purposive forces, such as increasing returns or first-mover advantage, do not dominate the process although they may amplify the random events. In the context of institutions, North (1990, p. 94) acknowledges uncertainty's role in organizational evolution while Bassanini and Dosi (2001) highlight the role of chance at the institutional level in economic development.

The self-reinforcement property of path dependence means that over time some paths are more likely to occur than others. This could be caused by different mechanisms, but we focus on institutions given our concern with regional profit performance. By their nature, institutions are difficult and slow to change (North, 1990) which reduces the randomness in their evolution over time. Change is also incremental because the majority of incumbent organizations oppose rapid institutional change (North, 1990).

Directionally, changes over time tend to reinforce existing institutions because they benefit successful incumbent organizations that work to perpetuate them (North, 2005, p. 55 – 56). These dynamics are consistent with Garud and Karnøe (2001), Garud *et al.* (2010), and

[6] Bednar *et al.* (2012) extend path dependence theory to allow for outcomes to be revised ex-post and Bergek and Onufrey (2013) to allow for more than one path in the lock-in phase.

Keller *et al.* (2022) which argue that actors may influence path dependence rather than these paths being purely exogenous. Simmie (2012), Simmie *et al.* (2014), and Aaltonen *et al.* (2017) offer empirical evidence of such path creation.[7] The role of institutional path dependence has been shown over extremely long durations (Acemoglu *et al.*, 2002; Gao *et al.*, 2018; Maloney and Caicedo, 2016).

The self-reinforcing property of path dependence implies that institutional quality in regions with above-average quality will improve faster than those in below-average:

Hypothesis 1a: In the absence of major negative shocks to institutional quality, the gap in institutional quality across regions widens over time.

A major negative shock alters the dynamics of path dependence. As Vergne and Durand (2010, p. 752) explain, exogenous shocks "shake the system free of its history". Because of institutional persistence, a small shock is unlikely to have a large impact. However, a major negative shock can result in a realignment in which the self-reinforcement property is slowed or even reversed. In the absence of major negative shocks there is no re-evaluation of institutions; however, negative shocks can induce discontinuous institutional change (Wilson, 2009, p. 23-24). These shocks reveal societal changes that have gone unnoticed and realign the institutional matrix in favor of previously-disadvantaged organizations vis-à-vis previously-advantaged ones (Wilson, 2009, p. 24). As a result, the stochastic process of institutions exhibits less self-reinforcement and more contingency. Therefore, institutional quality in a region with institutions favorable to firm profitability will improve at a slower pace or even decrease relative to a region with unfavorable institutions:

Hypothesis 1b: Subsequent to a major negative shock to institutional quality, the gap in institutional quality across regions widens at a slower pace or even narrows.

[7] Sydow *et al.* (2012) integrate the path dependence and path creation approaches using structuration theory and Singh *et al.* (2015) provide empirical evidence on the combination.

To predict how these institutional dynamics affect SREs, we apply the institution-based view. Institutional quality increases firm performance through multiple avenues. Better-developed institutions reduce transaction costs by reducing uncertainty and search costs (Akerlof, 1970; Diamond, 1984; Khanna and Rivkin, 2001). Under-developed institutions increase the possibility of unenforceable contracts and insecure contracts leading firms to operate less efficiently (North, 1990) which has been shown empirically (Hsieh and Klenow, 2009; Park *et al.*, 2006). High institutional quality reduces the degree of corruption which otherwise leads to inefficient resource allocation (Murphy *et al*., 1991).

Chan *et al.* (2008) predict a positive but concave (due to diminishing returns or congestion effects) relationship between institutional quality and firm performance. We perform a validation test which confirms their hypothesis in our setting.[8] Although this is not necessarily a causal relationship, other studies find a positive causal effect (Dal Bó and Rossi, 2007; Fisman and Svensson, 2007) and other papers find that market reforms that increase institutional quality also increase firm performance (Cornelli *et al.*, 2013; Cuervo-Cazurra and Dau, 2009; Jefferson and Xu, 1991; Park *et al*., 2006).

This implies that regional firm profitability is increasing in institutional quality. Given that the gap in institutional quality across regions is widening and profitability is increasing in institutional quality, the gap in firm profitability across regions with high- and low-quality institutions is strictly increasing over time. Figure 1 illustrates these dynamics. In the absence of a major negative shock (time T to $T+1$), SREs strictly increase (shaded area) due to path dependence:

[Insert Figure 1 about here.]

Hypothesis 2a: In the absence of major negative shocks to institutional quality, SREs strictly increase.

[8] Chan *et al.* (2008) estimate a negative relationship using cross-country data in contrast to the hypothesis. We discuss reasons why our results might differ when we present them.

The impact of a negative shock on SREs depends on its magnitude. A negative shock slows the rate of divergence in institutional quality across regions or even alters it enough that institutional quality temporarily converges across regions. Given the positive relationship between institutional quality and firm performance, SREs increase at a slower pace or even decline subsequent to a major negative shock. However, this does not persist indefinitely. After the disruption, firms at an advantage post-shock invest in changing the institutional matrix to their advantage so that SREs eventually increase again.

Figure 1 illustrates SRE dynamics subsequent to a major negative shock. A negative institutional shock at time $T + t$ alters the trajectory of SREs (time $T + t$ to $T + (t + 1)$) reducing their rate of increase or even causing them to decline (shaded area):

Hypothesis 2b: Subsequent to a major negative shock to institutional quality, SREs increase at a slower pace or even decline.

Why might SRE dynamics differ by ownership type?

The key aspect of the institution-based view for SRE dynamics by ownership type is heterogeneity of organizational objectives. As North (1990, p. 73) argues, organizations are "purposive entities designed by their creators to maximize wealth, income, or other objectives defined by the opportunities afforded by the institutional structure of the society." An organization's objectives are determined not just by institutional constraints but by its creators' preferences (North, 1990). An organization's objectives, in turn, dictate the effort that it applies to realizing them (North, 1990). If the objective is profitability, the organization devotes effort to that while if it is political advancement the organization instead applies effort to that. As Ménard and Shirley (2014) note, competition plays a "powerful enforcement role in economic markets" but "is far weaker in political markets".

Regional variation in institutional quality as it relates to firm profitability affects organizations with primarily profit objectives more than those with primarily political ones.

As North (1990, p. 77) says, the institutional context ". . . determine[s] the pliable margins that offer the greatest promise in maximizing the organization's objectives." And, "[t]he kinds of knowledge, skills, and learning that the members of an organization will acquire will reflect the payoff – the incentives – embedded in the institutional constraints" North (1990, p. 74). This induces more extreme profit outcomes across locations for organizations primarily focused on profitability than for those with other objectives.

To be more specific, consider the two ownership types that we examine. POEs' primary objective is profits while for SOEs profits is one objective among others of possibly greater importance. These differences in organizational objectives are manifested in government involvement and management incentives. SOEs are government owned and managed with the government as residual claimant; while POEs are freer of government intervention with owners as residual claimants. The GVC literature has examined how the non-economic motivations and different risk preferences of SOEs leads to different entry modes than that of POEs (Grøgaard *et al.*, 2019). These characteristics narrow the range of SOE profitability relative to POEs.

SOEs' losses are often subsidized by the government limiting their downside profitability (Groves *et al.*, 1995; Lin *et al.*, 1998; Wang *et al.*, 2008). At the same time, SOEs' "excess" profitability is often diverted to other objectives limiting their upside. Governments impose non-profit objectives on SOEs such as social stability, employment, community development, output, and enrichment of bureaucrats (Lin *et al.*, 1998; Mi and Wang, 2000; Bai *et al.*, 2006). As Brandt and Li (2003, p. 388) note SOEs, ". . . may be willing to sacrifice profits in order to seek political, ideological or personal goals rather than profits."

Agency differences also narrow the range of SOEs' profitability relative to that of POEs. SOE manager compensation is regulated by government bureaucracy, reducing the role of performance-based incentives (Firth *et al.*, 2006; Mi and Wang, 2000). SOE managers are,

". . . likely to be appointed by the state, their budgets soft, and their incentive structures not directly linked with performance" (Peng and Luo, 2000, p. 489). Bai and Xu (2005) confirm empirically that profitability is not the only objective in SOE management incentives. In contrast, POE managers typically face performance incentives and focus more intensely on profit maximization (Hart, 1983).

Because of their different objectives, POEs experience more extreme profit outcomes than SOEs. Chen *et al.* (2017) provide direct evidence of this: POEs allocate more capital to units with greater investment potential while SOEs transfer capital from high- to low-performing units. Therefore, in cross section, POEs should exhibit higher profit variance across locations and greater SREs.

Applying path dependence theory, this also has implications over time. In the absence of major negative shocks, path dependence leads to regions with institutions favorable to profit-making becoming increasingly favorable over time while regions with unfavorable conditions become increasingly unfavorable. POEs are heavily influenced by this widening disparity over time while SOEs are not as much. As a result, profit divergence across locations is lower for SOEs over time and SREs increase at a slower rate relative to POEs.

Figure 2 illustrates SRE dynamics for the two types in the absence of major negative shocks. In period T there is a positive gap between SREs for POEs (top line) and SOEs (bottom line) reflecting their different objectives. This does not necessarily mean that POE profitability is higher than those for SOEs – only that the variance of profitability across locations is greater. Due to path dependence, SREs increase (shaded area) from time T to $T + 1$ for both types if there is no shock to institutions; however, due to stronger path dependence for POEs this widens the SRE gap between the two types:

[Insert Figure 2 about here.]

Hypothesis 3a: In the absence of major negative shocks to institutional quality related to firm profitability, the gap between SREs for firms of ownership types with profit-focused objectives (POEs) versus those with other or more diffuse objectives (SOEs) widens.

After a major negative shock to institutions related to firm profitability, the trend of increasing SREs is slowed or reversed more for POEs than for SOEs. A negative shock disrupts the institutional status quo. These effects are magnified for profit-focused organizations because they are more sensitive to institutional characteristics affecting profitability. SREs slow more for profit-focused organizations and the gap in SREs between POEs and SOEs narrows. Figure 2 illustrates the effects of a major negative shock on SREs for the two types. Subsequent to a shock at time $T + t$, SREs decline for both types of firms (shaded area) from time $T + t$ to $T + (t + 1)$ but more so for POEs. This reduces the gap in SREs between the two:

Hypothesis 3b: Subsequent to a major negative shock to institutional quality related to firm profitability, the gap between SREs for firms of ownership types with profit-focused objectives (POEs) versus those with other or more diffuse objectives (SOEs) narrows.

METHODOLOGY

Data

Our data is from 2000 to 2014 and encompasses two different regimes: before and after the negative institutional shock of the 2008 financial crisis. We begin in 2000 because this is after the negative shocks of the 1997 Asian financial crisis and one of the biggest floods in China's history in 1998.[9] We employ two different data sets. To measure institutional quality, we follow the previous literature (Shi *et al.*, 2012; Wang *et al.*, 2022) and use the annual province-level marketization index produced by the National Economic Research Institute (Fan *et al.*, 2017) based on official statistics and enterprise and household surveys. It

[9] For the severity of the flood, see for example Spignesi (2004, p. 37).

measures market-oriented institutional development and therefore captures pro-market institutions that facilitate firm profitability (Wang *et al.*, 2008).[10] The index is scaled to range from zero to ten in the base year 2001 with higher scores indicating more pro-market conditions. It can exceed ten or fall below zero in subsequent years to reflect improvements or declines over time. Park *et al.* (2006) show that market liberalization leads to higher firm performance in China and the marketization index captures the extent of market liberalization (Chang and Wu, 2014). We use this in our tests of path dependence in institutional quality. Panel A of Table I provides summary statistics.

[Insert Table I about here.]

The second data set is the annual Survey of Manufacturers from 2000 to 2014 compiled by the NBS which we use for testing SREs. The survey includes firms of all ownership types engaged in manufacturing. Following Brandt *et al.* (2012) we match firms over time to form an unbalanced panel. This matching process is careful and avoids interpreting name changes as different firms (Brandt *et al.* (2012); Section A.2 online appendix).[11] We drop any firm with a single year of data because we cannot identify a year effect. Following McGahan and Porter (1997) and Cai and Liu (2009), we drop any firm-year observation with less than RMB five million in assets. Our data include 3,039,150 observations of which 1,193,379 are pre-crisis (2000 to 2007) and 1,845,771 are post crisis (2008 to 2014).

We use return on assets (net income as a fraction of total assets) as the profit measure consistent with the previous literature. To determine the firm's subnational region, we use the four-digit level of its assigned Administrative Division Code of the PRC published by the NBS. The first two digits identify one of the 31 provinces and the third and fourth digits the prefecture or major city. There are 371 different four-digit regions in the data. We comment in our results on how the number of regions affects the estimates.

[10] A limitation of this data is that it primarily uses proxies to measure underlying institutions.
[11] Their Stata programs are posted at: http://feb.kuleuven.be/public/N07057/CHINA/appendix.

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 type. Many registration types (23 in total) are not meaningfully distinct (OECD, 2000; ADB, 2003). Basing ownership type on the 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 type exceeds 50% we rely on the registration type. There are six categories of paid-in capital: SOE, POE, collective, foreign, HMT, and legal person.[12] For the legal person type, we use information on the firm's registration type to classify it into one of the other five categories following Brandt *et al.* (2012).[13] Industry classifications are based on the four-digit classifications assigned by the NBS (795 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).

Panel B of Table I shows summary statistics for the data. Firm performance has a mean of 11.5% with significant variation. Of the two ownership types we examine separately, POEs are much more profitable than SOEs and all other ownership types are in between.

Analytical approach

To measure subnational region's importance, we perform a variance decomposition analysis using an HLM (Guo, 2017; Hough, 2006; Meyer-Doyle *et al.*, 2019; Misangyi *et al.*, 2006; Short *et al.*, 2007). The key advantage of HLM is that it allows for cross-nesting of firms within subnational regions, industries, and ownership types. HLM assesses the amount of profit variation associated with different categories (factors) describing the firms. Hough (2006) and Guo (2017) both provide an overview of HLM's advantages relative to other

[12] Private foreign firms include MNC affiliates and stand-alone firms owned by foreigners. Collectives are owned and managed by residents of local communities but under the purview of a local government. Hong Kong/Macau/Taiwan (HMT) firms are geographically located in mainland China but owned by a Hong Kong, Macau, or Taiwan based entity.

[13] Firms of hybrid ownership represent no more than 8.3% of POE observations and even fewer for SOEs. The results are similar excluding these firms.

decomposition approaches.[14] We include factors previously used in the literature (year, industry, ownership type, and firm strategy) and supplement this with the firm's production location.[15] We model firm performance as a three-level model: year is nested within firm which is nested within the cross-classifications of industry, subnational region, and ownership type. This setup acknowledges that a firm belongs to an industry, a region, and an ownership type and allows the effects of the three to be correlated. We implement a conditional model allowing for a random-coefficient, linear time trend. A random-effects model estimates how the population of profitability differs from the overall average rather than assuming a pre-specified (and necessarily large) set of fixed effects. A linear time trend allows for more general macroeconomic effects.

As a preliminary step and for use in attributing variance to the year factor we first estimate an unconditional model to explain return on assets of the i^{th} firm in the j^{th} industry in the k^{th} region with ownership type l in year t:

$$ROA_{tijkl}=\pi_{0ijkl}+\epsilon_{tijkl}, \quad (1a)$$

where π_{0ijkl} is the mean ROA across years of firm i in industry j and location k with ownership type l. The variance across years is captured by ϵ_{tijkl} which is assumed to be distributed $N(0,\sigma_\epsilon^2)$. The second level of the model specifies the mean ROA for firm i:

$$\pi_{0ijkl}=\beta_{00jkl}+r_{0ijkl}, \quad (1b)$$

[14] Alternative methods all have disadvantages relative to HLM. Variance component analysis can produce unreliable variance estimates and, in extreme cases, negative variance estimates. In analysis of variance approaches, the variance attributed to different factors depends on the order in which they are entered. Two-stage least squares requires dummy variables for segments creating problems of dimensionality and attributes variance to SREs by averaging across all regions rather than attributing variance to individual regions.

[15] Factors examined in the previous literature also include 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 as 95.1% of the observations in our sample are single-plant firms. For the few multi-plant firms, we do not know all of the products the firm produces because the firm is not required to report them. Our results are robust to excluding these few multi-plant firms.

where β_{00jkl} is the mean ROA across firms in industry j and location k with ownership type l. r_{0ijkl} is distributed $N(0, \sigma_i^2)$ and captures between-firm variance. The third level specifies the mean ROA across firms:

$$\beta_{00jkl}=\gamma_{00000}+\mu_{00j00}+\mu_{000k0}+\mu_{0000l}, \text{ (1c)}$$

where γ_{00000} is the grand mean of ROA across firms. The between-firm variance in ROA is decomposed into between-industry $\left(\mu_{00j00}\sim N\left(0, \sigma_j^2\right)\right)$, between-region $\left(\mu_{000k0}\sim N(0, \sigma_k^2)\right)$, and between ownership-type $\left(\mu_{0000l}\sim N(0, \sigma_l^2)\right)$.

Our baseline model follows Hough (2016) and Misangyi *et al.* (2006) and expands the unconditional model to a linear growth, random coefficients regression:

$$ROA_{tijkl}=\pi_{0ijkl}+\pi_{1ijkl}Year_{ti}+\epsilon_{tijkl}, \text{ (2a)}$$

where $Year_{ti}$ is the number of years since 2000. The model is completed by:

$$\pi_{0ijkl}=\beta_{00jkl}+r_{0ijkl}, \text{ (2b)}$$
$$\beta_{00jkl}=\gamma_{00000}+\mu_{00j00}+\mu_{000k0}+\mu_{0000l}, \text{ (2c)}$$
$$\pi_{1ijkl}=\beta_{10jkl}+r_{1ijkl}, \text{ (2d)}$$
$$\beta_{10jkl}=\gamma_{10000}. \text{ (2e)}$$

Equations (2b) and (2c) correspond to (1b) and (1c) respectively. The interpretation of all the parameters from the unconditional model remain the same except that γ_{00000} is now the grand mean of ROA over all firms in 2000. The new parameter γ_{10000} is the linear time trend in ROA with each subsequent year and $r_{1ijkl}\sim N(0, \sigma_t^2)$ is the profit variance across time (conditional on the time trend) for firm i in industry j and location k with ownership type l.

The percentage variance attributable to each factor except for year is based on parameter estimates from the unconditional model (see Misangyi *et al.* (2006) for a description of computing percentage variances). Letting the subscript u denote the unconditional model and defining the total variance of the unconditional model as $\sigma_u^2 = \sigma_{iu}^2 + \sigma_{ju}^2 + \sigma_{ku}^2 + \sigma_{lu}^2 + \sigma_{\epsilon u}^2$, the variance attributable to each factor is: σ_{iu}^2/σ_u^2 for firm, σ_{ju}^2/σ_u^2 for industry, σ_{ku}^2/σ_u^2 for

subnational region, and σ_{lu}^2/σ_u^2 for ownership. The percentage variance for year is more complicated and requires both the conditional and unconditional models. It equals $(\sigma_{\epsilon u}^2 - \sigma_{\epsilon c}^2)/\sigma_u^2$ where c denotes the conditional model. The percentage of total variance that is unexplained is given by $\sigma_{\epsilon c}^2/\sigma_u^2$.

We estimate the parameters using the SAS HPMIXED command. One issue with variance decomposition is that aggregating a factor at a higher level can obscure its importance in explaining variance (McGahan and Porter, 2005). We comment 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.

Assessing significance

For the fixed and random effects parameters of the HLM model we use the SAS MIXED command where possible to generate standard errors. For some models the data set is too large to do so. In these cases we use bootstrap sampling, which 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,…,R* samples of size n with replacement from the full data. We choose a large n to reduce simulation error while allowing for a reasonable run time. The standard error for a random effects parameter is then:

$$\sqrt{\sum_{r=1}^{R}\left(\bar{\sigma^2}-\sigma_r^2\right)^2/\left(R-1\right)}\sqrt{n/(n-1)}, \quad (3)$$

where $\bar{\sigma^2}=\sum_{r=1}^{R}\sigma_r^2/R$ is the mean estimate over all draws and σ_r^2 is the r^{th} bootstrap estimate. We draw samples of 10,000 observations (i.e., n=10,000) and perform 100 bootstrap iterations for each model (R=100).

Since the total variance of the unconditional model (σ_u^2) is a constant, the standard errors for the percentage of total variance explained by firm, industry, subnational region, ownership, and year are calculated as $se(\sigma_{iu}^2)/\sigma_u^2$, $se\left(\sigma_{ju}^2\right)/\sigma_u^2$, $se(\sigma_{ku}^2)/\sigma_u^2$, $se(\sigma_{lu}^2)/\sigma_u^2$, and $\sqrt{var(\sigma_{\epsilon u}^2) + var(\sigma_{\epsilon c}^2) - 2cov(\sigma_{\epsilon u}^2, \sigma_{\epsilon c}^2)/\sigma_u^2}$. The standard error of the unexplained variance as a percentage of total variance is $se(\sigma_{\epsilon c}^2)/\sigma_u^2$.

RESULTS

SREs across all firm types

Before examining SRE dynamics, we assess whether their importance for MNCs found in the previous 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 examine SRE dynamics by ownership type. If SREs are unimportant in aggregate then assessing their dynamics by ownership type is meaningless.

Arguments in the extant literature for why SREs affect MNCs extend to other ownership types. Under the institution-based view, region-specific institutions affect firm performance in that region, a mechanism that is not unique to MNCs. Chan *et al.* (2010) provides a comprehensive discussion of these arguments. Many of the papers and arguments cited therein apply to all firms not just MNCs. "Locally oriented organizations" provide support to firms – not just MNCs (Chan *et al.*, 2010, p. 1228). Differences of firm embeddedness in regional institutions, such as local inter-firm networks (Saxenian, 1991), yield differences in competitive advantage (McEvily and Zaheer, 1999) for all ownership types. These local institutions affect performance of small and medium enterprises (Nguyen *et al.* 2013) suggesting that SREs' importance extends to other ownership types. This implies:

Validation Test 1: SREs are significant irrespective of ownership type.

Column 2 of Table II shows parameter estimates for the unconditional model (Equations (1)) along with bootstrapped standard errors since the data was prohibitively large to generate

them using the SAS MIXED procedure.[16] The parameters and standard errors are both multiplied by 100 for ease of presentation. Column 3 displays parameter estimates and bootstrap standard errors for the conditional model (Equations (2)) with all coefficients and standard errors multiplied by 100. Adding the linear growth trend reduces the proportional variance by 12.6% consistent with it better capturing year effects.

[Insert Table II about here.]

Column 4 of Table II computes the percentage of variance explained by each factor using the results in Columns (2) and (3) and calculated as described in the Methodology section. The five factors in the base model explain 64.6% of the total profit variance over the fifteen years. The error contains 35.4% of the total variance and captures idiosyncratic shocks unrelated to the included factors. Year effects, representing annual macroeconomic shocks affecting all firms, capture 5.1% of variance. Stable industry effects account for 1.6% 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).[17]

Ownership type explains only 1.3% of total variance compared to 6.8% in Xia and Walker (2014) using the same data set from 1998 to 2007. Besides examining a different sample period, the paper's methodology differs. 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.[18] 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 (35.4%) in explaining total variance.

[16] Estimating standard errors for the full sample would require approximately 113 terabytes of memory in the MIXED procedure based on SAS Institute (2015, p. 6168).

[17] 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 795 industry categories versus 625 in McGahan and Porter (1997).

[18] 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 (11.6%) validating that SREs are important across all ownership types. Location effects are greater than industry effects by a ratio of 7.2 to 1. This is not because they are measured more finely. Column 1 of Table II displays the number of levels for each factor. While the few levels for ownership may explain its 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. Endogenous location choices of firms may affect these estimates.[19] Firms may choose to move (or exit) from regions with institutions unfavorable to profitability and move (or enter) into regions with favorable ones. However our objective is not to separate the causal effect of institutions on organizations or vice versa but rather to quantify the portion of variation in firm performance attributable to location.

Institutional dynamics over time

Before examining institutional dynamics over time we first provide evidence that the 1998 financial crisis was a major negative shock to institutional quality as it relates to firm performance. Figure 3 plots the marketization index averaged across China's provinces in each year. Pre-crisis, it increases from 4.3 in 2000 to 7.5 in 2007 consistent with rapid institutional development that facilitates markets and therefore firm profitability. The financial crisis interrupts this upward trend. The index falls from 7.2 in 2008 to 5.4 in 2010 – a significant deterioration of institutional quality – before starting to climb again. The institutional realignment in China after the financial crisis is reflected in government policy changes. For example, the central government initiated a four-trillion CNY stimulus package that benefitted rural and western areas at the expense of the more-successful eastern seaboard

[19] A similar distinction arises in attributing variation in performance to industry factors since the endogenous choices of firms affect industry structure over time (e.g., Sutton, 2007).

areas and a home-appliance subsidy program that benefitted poorer households.[20] Gang *et al.* (2018, p. 257) describe the realignment of institutions post-crisis as ". . . government intervention increased to cope with the Global Financial Crisis (GFC)".

[Insert Figure 3 about here.]

To examine institutional dynamics over time we argue qualitatively that our empirical setting is in the second phase of institutional path dependence.[21] We view the starting point of China's modern institutions as beginning with its "reform and opening up" in 1978. This represented a break from the preceding centrally-planned economy. In the immediate wake of the opening up, China's institutions were in flux and can be viewed as being in the contingent phase. By the beginning of our sample period, China had completed most of the de-collectivization of agriculture and privatization of state-owned industries (Huang *et al.*, 2017) so that the critical juncture (Dobusch and Kapeller, 2013) had passed and institutions had entered the self-reinforcement phase. However, China's institutional path was not yet irreversible so that the third phase of institutional path dependence had not begun.[22]

In the second phase, the stochastic process of institutions should exhibit contingency and self-reinforcement (Vergne and Durand, 2010). To implement our tests of Hypotheses 1, we follow Vergne and Durand (2010) in assuming that the stochastic process is a Markov chain – the probability of an event depends only on its immediate previous state. We also follow

[20] See https://web.archive.org/web/20081113141416/http://news.xinhuanet.com/english/2008-11/09/content_10332422.htm and https://www.reuters.com/article/businesspro-china-economy-appliances-dc-idUKPEK26642620080221.

[21] Lin *et al.* (2015) also use qualitative arguments to identify the three phases of China's cadastral system. Their phases also span long time periods (28, 21, and 15 years respectively) although they consider a stochastic process that begins with the founding of modern China (1949) and has reached the lock-in phase by the end of their sample period.

[22] We offer evidence consistent with this later by demonstrating that the 2008 financial crisis at least temporarily changes the path of institutions.

Dobusch and Kapeller (2013) which argues that positive feedback in the second phase can be analyzed empirically and that the mechanisms are probabilistic.[23]

To implement these tests, we use the marketization index. We denote the index in a province p in year t as IQ_{pt}. To discretize the states we use a binary variable. In each year t, we classify a province p as being above or below the median institutional quality in year $t-1$ and estimate the effect this has on the province experiencing an above-median change in quality in year t:

$$\Delta_{pt} = \alpha_1 + \beta_1 \mathrm{I}_{pt-1} + \varepsilon_{pt}, \quad (4)$$

where Δ_{pt} equals one if the change in the province's institutional quality from the last period $\left(\Delta IQ_{pt} = IQ_{pt} - IQ_{pt-1}\right)$ is above the median change across all provinces in that year and zero otherwise, I_{pt} equals one if the province's institutional quality exceeds the median quality across all provinces in year t and zero otherwise.

β_1 is the coefficient of interest and captures the nature of the stochastic process in China's regional institutional quality. If the process is purely contingent, $\beta_1 = 0$: a province with either above- or below-average institutional quality in the last period is equally likely to be above as below the median change in quality in the current period. If the process is locked-in, $\beta_1 = 1$: regions with above-average quality in the previous period always improve while those below-average always decline. If the process is self-reinforcing and contingent: $0 < \beta_1 < 1$. In this case, a province with above-average quality in the previous period is more likely, but not certain, to experience an above-average improvement in institutional quality relative to a below-average province and a below-average province is more likely, but not certain, to experience a below-average improvement. Following a negative institutional shock, β_1 temporarily declines and may even become negative. To test Hypothesis 1a, we run

[23] Previous empirical work on path dependence primarily focuses on firms (Bertheussen, 2022; Bohnsack *et al.*, 2014; Laudien and Daxböck, 2016; Rothman and Koch, 2014; Wang *et al.*, 2022), industries (Ma and Hassink, 2014), and individuals (Dlouhy and Biemann, 2018).

the regression using the pre-crisis data ($t < 2008$) data and to test Hypothesis 1b the post-financial crisis data ($t \geq 2008$).

Table III reports the results. Pre-crisis (Column 1), β_1 is estimated as 0.145 with a standard error of 0.063 (significant at the 2.2% level). This is consistent with the stochastic process of institutional quality pre-crisis being self-reinforcing and contingent. A province with an above-average institutional quality in the previous year is 14.5% more likely to experience an above-average increase in quality in the current year than a province with below-average quality. This implies that the gap in quality between above- and below-average areas widens over time consistent with Hypothesis 1a.

[Insert Table III about here.]

Post-crisis (Column 2), this pattern is disrupted. β_1 is not significantly different than zero (0.080 with a standard error of 0.068). A province's previous institutional quality is not predictive of its quality change in the current year. Since the direction of institutional quality is independent of its past state, the gap between above- and below-average quality regions will no longer widen and may even decrease, consistent with Hypothesis 1b.

SRE dynamics over time

The institution-based view predicts that local firm profitability is increasing in local institutional quality. We confirm this relationship in our data:

Validation Test 2: Regional firm profitability is increasing in regional institutional quality.

To estimate, we follow Chan *et al.* (2008) and estimate a quadratic relationship:

$$\overline{ROA}_{pt} = \alpha_2 + \beta_2 IQ_{pt} + \beta_3 \left(IQ_{pt}\right)^2 + \epsilon_{pt}, \quad (5)$$

where $\overline{ROA}_{pt}$ is the average equal-weighted profitability of all firms in province p in year t. Column (3) of Table III shows the results. There is an increasing, concave relationship between institutional quality and firm profitability. The relationship is strictly increasing over the range of the data (the estimated function declines beginning at an index of 17.2) and is

significant in magnitude. The difference in predicted profitability for a province-year one standard deviation above versus below the mean marketization index is 0.035. These results are consistent with Hypothesis 1 of Chan *et al.* (2008); however, that paper finds a negative empirical relationship using cross-country data. There are two main reasons why our results might differ. One is our measure of institutional quality is more targeted at firm profitability. Second is that within a country firms in different regions face the same national institutions (e.g., tariffs, legal system, monetary policy, trade policy, and immigration policy).

Combining the institutional dynamics results in Column (1) of Table III with these results, firm profitability before the crisis should increase faster in high- than in low-profit regions and SREs should increase over time. Post-crisis, this pattern should be disrupted. The lack of any self-reinforcement in institutions post-crisis (Column (2)) implies that profitability will not further diverge across regions so that SREs should be non-increasing.

To examine SRE evolution over time, we estimate the HLM model year-by-year. This collapses to the unconditional model with only two levels rather than three because the firm and time-trend random effects are not identified with a single year of data:

$$ROA_{tijkl}=\beta_{00jkl}+\epsilon_{tijkl}, \quad (6a)$$

$$\beta_{00jkl}=\gamma_{00000}+\mu_{00j00}+\mu_{000k0}+\mu_{0000l}. \quad (6b)$$

The solid, black line in Figure 4 plots the percentage of variance explained by SREs in each year along with the 95% confidence interval (dashed lines) using standard errors produced by the SAS MIXED procedure. For Hypothesis 2a, we examine SRE behavior pre-crisis (left of the vertical dashed line). SREs increase slowly from 6.4% of total variance in 2000 to 7.9% in 2004 and then increase rapidly to reach about 21.2% in 2007. This is an increase of 14.8 percentage points with a 95% confidence interval of (10.0, 19.5).[24]

[Insert Figure 4 about here.]

[24] The standard error is 2.4 percentage points estimated by the procedure in Appendix A.

SREs increase over the pre-crisis period but are they more likely to increase rather than decline in any given year? If there is no path dependence, changes in SREs over time are affected only by randomness and they are as likely to go up as down in each successive year. Therefore, the null hypothesis is that SREs have a 50% probability of increasing in a given year and the alternative hypothesis is that path dependence overcomes this randomness and the probability exceeds 50%. Over the sample period this is a sequence of Bernoulli trials and can be analyzed by estimating the probability parameter of a binomial distribution. We estimate the parameter using maximum likelihood and bootstrap standard errors using the Wilson score interval (Wilson, 1927).[25] Online Appendix B describes the procedure in detail. This yields a probability parameter of 0.58 and a 95% confidence interval of (0.54, 0.63) that SREs increase in a given pre-crisis year. The upward trend is not due to an increase in the number of regions across years: the footnote of Figure 4 shows no systematic increase over time. It is, however, consistent with Hypothesis 2a: underlying institutions lead to a divergence in firm profitability across regions over time.

To test Hypothesis 2b we examine SRE behavior after the major negative shock of the financial crisis. The trend of steadily rising SREs prior to the financial crisis is halted in the year of the financial crisis (2008) and SREs decline further over time from 17.4% of total variance in 2008 to 12.4% in 2014.[26] This is a decrease of 5.4 percentage points with a 95% confidence interval of (1.7%, 9.1%).[27] A maximum likelihood estimate of the probability that SREs increase in any given year is 0.49 with a 95% confidence interval of (0.44, 0.53): SREs are just as likely to decline as to increase post-crisis. This is consistent with Hypothesis 2b:

[25] The Wilson score interval offers several attractive properties including not suffering from overshoot or zero-width intervals and being suitable for small samples and skewed observations. Using a bootstrap procedure incorporates the precision of the underlying data including the fact that some years have more data than others and that the magnitude of change in SREs is greater in some years than in others.
[26] SREs increase in 2010; however a downward trend is still within the 95% confidence interval.
[27] The standard error is 1.9 percentage points estimated by the procedure in Appendix A.

the financial crisis disrupted the pre-crisis path dependence of institutional quality by making the institutional matrix less favorable to the status quo.

It is useful to relate these results to the previous literature, which speculates that SREs are inversely related to economic development (Chan *et al.*, 2010). Online Appendix C provides a validation test showing that over the sample period China's economy is rapidly developing. Thus, our results show that SREs can either increase or decrease over time as an economy develops. This is because path dependence leads to divergence of institutional quality across regions even as institutions improve on average; unless a major negative shock disrupts this path and lowers cross-regional institutional heterogeneity.

SRE dynamics by ownership type

We first perform a validation test to verify that SREs for POEs exceed those of SOEs, consistent with institutional quality influencing POE more than SOE profitability:

Validation Test 3: SREs are greater for firms of ownership types with more profit-focused objectives (POEs) than for types that have other or more diffuse objectives (SOEs).

Table IV compares SREs for POEs and SOEs over the whole sample period. It displays the percentage of total variance explained by each factor calculated from estimating the unconditional and conditional models on ownership subsamples (Equations (1) and (2) but omitting the unidentified ownership random effect). Bootstrap standard errors are used since the samples are too large to estimate them using the MIXED procedure.[28] SREs for POEs (13.9%) greatly exceed those for SOEs (2.6%).

[Insert Table IV about here]

Figure 5 shows SRE dynamics over time for POEs (green solid line) versus SOEs (black dashed line). The figure displays the percentage of total variance explained by the subnational region factor based on year-by-year estimates of the unconditional model (Equations (6)) but

[28] Estimating standard errors for the smallest subsample (SOEs) would require approximately 829 gigabytes of memory in the MIXED procedure based on SAS Institute (2015, p. 6168).

omitting the unidentified ownership factor. SREs for POEs exceed those of SOEs in all years (14.0 percentage points on average). POEs are more affected by institutional factors that influence profitability and experience more variation in profitability across regions than SOEs. Although firms of different ownership types face the same institutions, their differing objectives result in differing responses to those institutions.

[Insert Figure 5 about here]

Hypothesis 3a predicts that the gap in SREs between POEs and SOEs widens pre-crisis. Figure 5 shows that the gap remains fairly constant from 2000 to 2004 after which it widens substantially. The gap increases from 9.4% in 1998 to 22.4% in 2007. The net increase is 13.0 percentage points with a 95% confidence interval of (1.9, 24.1).[29] A maximum likelihood estimate of the probability that the gap increases in any given year is 0.65 with a 95% confidence interval of (0.61, 0.69) using a Wilson score interval.

Post-crisis the gap declines from 16.6% in 2008 to 12.1% in 2014. The net decrease is 4.5 percentage points with a 95% confidence interval of (-12.1, 3.1).[30] A binomial test indicates that the gap is neither more likely to increase nor decrease with a point estimate of 0.52 and a 95% confidence interval of (0.47, 0.57). The negative institutional shock of the financial crisis, by interrupting path dependence, stops the increasing SRE-gap between POEs and SOEs but does not reverse it. This is consistent with organizations that primarily focus on profitability being more affected by institutional shocks relevant to profitability than are organizations with more politically-oriented objectives.

[29] The standard error of the difference in gaps between 2000 and 2007 is 5.7 percentage points estimated by the procedure in Appendix A.
[30] The standard error of the difference in gaps between 2008 and 2014 is 3.9 percentage points estimated by the procedure in Appendix A.

DISCUSSION

Theoretical and practical implications

Our results have theoretical implications for three areas of literature. First, our results shed light on the dynamic relationship between economic development and SREs and inform the "going subnational" literature. Our results show that national-level development can occur alongside either a decline or an increase in SREs over time,[31] suggesting that it is important to look at firm performance both within and across countries. SREs may diverge within one country (it has experienced no major negative shocks) but converge within another (it has experienced a major negative shock) even if at an aggregate level the countries are similarly developed. This has important implications for multi-level modeling in the "going subnational" literature (Peterson, *et al.*, 2012), which emphasizes that different geographic levels may evolve differently and at different rates (Cantwell, *et al.*, 2010). As a result, estimates may attribute effects to the wrong level, especially if they evolve over time (Hutzschenreuter *et al.*, 2020, p. 11). It also adds to the evidence on outcomes, "a research stream [that] has so far attracted the least attention" in the "going subnational" literature (Hutzschenreuter *et al.*, 2020, p. 11).

Second, our study contributes to both the "effects of causes" and "causes of effects" aspects of the path dependency literature of institutional change (Micelotta *et al.*, 2017). Our conceptual framework, based on path dependency theory, predicts increasing SREs over time in the absence of major negative shocks; but SREs that increase more slowly or even decrease after such a shock. Our longitudinal empirical evidence shows increasing SREs

[31] For the latter, consider a trivial, illustrative example. Suppose there are three regions in a country with 100 firms in each region. In year one, firm profitability in Region 1 is distributed Normal (6,6), in Region 2 Normal (8,4), and in Region 3 Normal (10,2). At the country level, the mean profitability is 8 and the standard deviation of firm profitability is about 4.62. Across subnational regions the standard deviation of firm profitability is 2. In year 2 suppose that institutions develop and profitability in the three regions is distributed Normal (7,3), Normal (10,2), and Normal (13,1) respectively. At the country level, firm profitability has a mean of 10 and a standard deviation of about 3.27. Institutional development increases average firm profitability and reduces (country) regional effects. Across subnational regions the standard deviation of firm profitability is 3 in year 2. Subnational regional effects increase even while institutions, and therefore firm profitability, diverge across subnational regions.

before the 2008 financial crisis but decreasing SREs post-crisis, confirming theoretical predictions for both periods. This reconciles the difference between our results and those from previous studies: institutions can diverge over time within countries while the average institutional quality and SREs in the less-developed country or group of regions remain below that of the more-developed.[32] But it also offers evidence for both the alignment (pre-crisis period) and displacement (post-crisis period) paths among the four paths of institutional change (Micelotta *et al.*, 2017). Our empirical results on institutional dynamics before and after the 2008 financial crisis also contribute to the "causes of effects" category in this literature, which is highly understudied (Micelotta *et al.*, 2017). Our evidence confirms the divergence (convergence) of institutions before (after) the external shock in keeping with potential path breaking around the crisis. Furthermore, our results suggest that large economic or financial crises could serve as ideal settings for further studies related to institutional changes and institutional path dependency, especially for studies on path breaking, which have received increased attention lately (De Groote and Kammerlander, 2023; Stache and Sydow, 2023).

Third, our results have important implications for the GVC literature. The potentially different trajectories of national-level development and within-country SREs emphasize the importance of evaluating MNC activity at different geographic levels (Beugelsdijk and Mudambi, 2013). Also, the differing SRE dynamics over time for different ownership types suggests examining ownership types by their upstream versus downstream position to potentially explain the asymmetry of localization in the two directions (Mudambi, *et al.*, 2018). The ownership-specific results also have important ramifications for temporal

[32] Again, consider a trivial, illustrative example. Suppose Country (or Group of Regions) A is less developed and firm profitability is distributed Normal (5,3) across its subnational regions in year 1. Country (or Group of Regions) B is more developed and firm profitability is distributed Normal (8,2) across its subnational regions. In year 2, suppose both countries (or groups) enjoy development so that SREs are distributed Normal (7,4) in Country (or Group) A and Normal (10,3) in Country (or Group) B across subnational regions. As shown in Footnote 5, country (regional) effects may still converge in year 2 consistent with Chan *et al*. (2008).

considerations of GVCs, an area that has "received limited attention in GVC studies to date" (Kano *et al.*, 2020, p. 613), particularly as MNCs increasingly alter the configuration of their value chains over time (Benito *et al.*, 2019). These ownership results also contribute to explanations of MNC performance as it relates to partners' embeddedness (Morris and Staritz, 2013) as ownership types vary in local embeddedness.

Our paper also has practical implications for firm strategies. First, our results suggest that firms choosing where to locate must not only understand current institutions but also forecast their future direction. In the absence of negative shocks, future opportunities are more likely to appear in regions with better institutional development. However, opportunities may emerge in regions with initially poor development after a major negative shock. If no such shocks are expected, a forecast can be made based on the historical antecedents of local institutions; and profitability continues to diverge across subnational regions with greater divergence for organizations more sensitive to institutional features. MNCs must consider this as they decide where to invest in developing economies and which firms to include in their value chain. Major negative shocks upset this divergence with greater consequences for organizations most sensitive to institutions. Firms with politically-oriented objectives are more insulated, so MNCs wishing to diversify with respect to the bargaining power or bankruptcy potential of partners should dual-source from different ownership types based on their economic versus political objectives.

Second, SRE trajectories for specific ownership types differ over time depending on how their respective objectives affect institutional influence. Thus, a firm's performance over time is influenced by its competitors' types and it must consider this when assessing local institutions. Similarly, MNCs need to consider both the location and ownership type of value chain partners. Greater variation in profitability across locations for POEs than SOEs means that MNCs should exercise additional caution and incur greater costs in selecting the location

of POE than SOE partners because the expected cost of a mistake is higher with the former. It also means that POEs in high-performing locations have greater negotiating leverage vis-a-vis those in low-performing areas while leverage among SOEs is more uniform.

Limitations and future research

There are five main areas of future research suggested by our study. First, SREs concern only the outcome of economic competition. SOEs, via their manager bureaucrats, are often more concerned with the outcome of political competition. To further inform the "going subnational" literature, it would be useful to test whether payoffs for politically-oriented organizations exhibit divergence across subnational regions in the absence of major negative shocks and if SOEs exhibit greater payoff divergence than POEs. This could be implemented by measuring sales growth (as political advancement could depend on maximizing employment and therefore output) or the attainment of higher political positions by SOE managers. It would also be useful to examine how regional institutions affect other outcomes such as stock prices, sales growth, and innovation for different ownership types both in the absence of negative institutional shocks and after negative shocks that are unrelated to firm profitability.

Second, since we identify different SRE dynamics for different ownership types, future work could investigate MNC interactions. How does the number of firms of different ownership types with which an MNC interacts affect SREs and how does this vary over time? How does the nature of the MNCs' interaction (e.g., as buyer, supplier, complementor) with other firm ownership types in the value chain affect SREs? This would help identify important factors for the GVC literature to investigate.

Third, China's is a regionally decentralized authoritarian system (Xu, 2011). It would be useful to examine how SRE dynamics compare in other countries with different economic, political, and social institutions. The main avenue of difference is likely the strength of

institutional self-reinforcement.[33] Higher self-reinforcement implies greater institutional divergence and higher SREs in the absence of major negative shocks and less institutional realignment after a negative shock. More culturally-diverse countries are likely to exhibit greater institutional self-reinforcement over time because social institutions tend to change most slowly. For economic institutions, free-market economies pose fewer impediments to firm relocations and therefore lower institutional self-reinforcement over time while centrally-planned economies would have more impediments. The most relevant dimension of political institutions is the degree of centralization. Decentralized decision-making leads to more localized political institutions and less ability to re-allocate resources across regions than centralized. Both of these would lead to more self-reinforcement under a decentralized system. The other key aspect that would vary across countries is the ownership type mix. Our results predict greater self-reinforcement if the proportion of POEs is greater.

Fourth, it would be useful to examine interaction effects between subnational regions and other factors such as industry or year. Industry interactions would be useful for determining whether region-specific institutions have differential effects on SREs across industries while year interactions would allow SRE dynamics to be evaluated controlling for stable firm effects (Guo, 2017). This would require different estimation techniques to overcome the dimensionality constraint. Our framework can also easily be extended to determine how much a specific institutional aspect contributes to overall SREs by applying the two steps we use to quantify the contribution of institutions overall. First, is there a structural break in the institutional aspect at the time of the negative shock (estimating Equation (4) using a measure of the institutional aspect)? If so, then interacting the measure with the location factor and nesting it within the location factor would quantify the portion of the overall SRE effect explained by this aspect.

[33] The same institutions will likely influence firm performance similarly in different countries.

Fifth, our sample includes only manufacturing firms. This raises the question of how SRE dynamics would compare in service industries. SREs for services are likely to exhibit more divergence in the absence of negatives shocks. Services are provisioned more locally and are less exportable than manufactured products. This means that services are influenced primarily by local institutions, while manufactured goods are also influenced by national and trans-national institutions. This would lead to more co-movement across regions in firm performance in response to institutional changes for manufactured goods. Also, services are generally more labor-intensive and therefore more influenced by social institutions than manufactured goods and social institutions tend to change more slowly.

Besides these five areas, our results raise some miscellaneous questions. Like other empirical work on institutions we rely on proxies for underlying institution characteristics. It would be useful to have measures of underlying institutions. Industry effects play a minor role in explaining firm performance in our setting as it 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.

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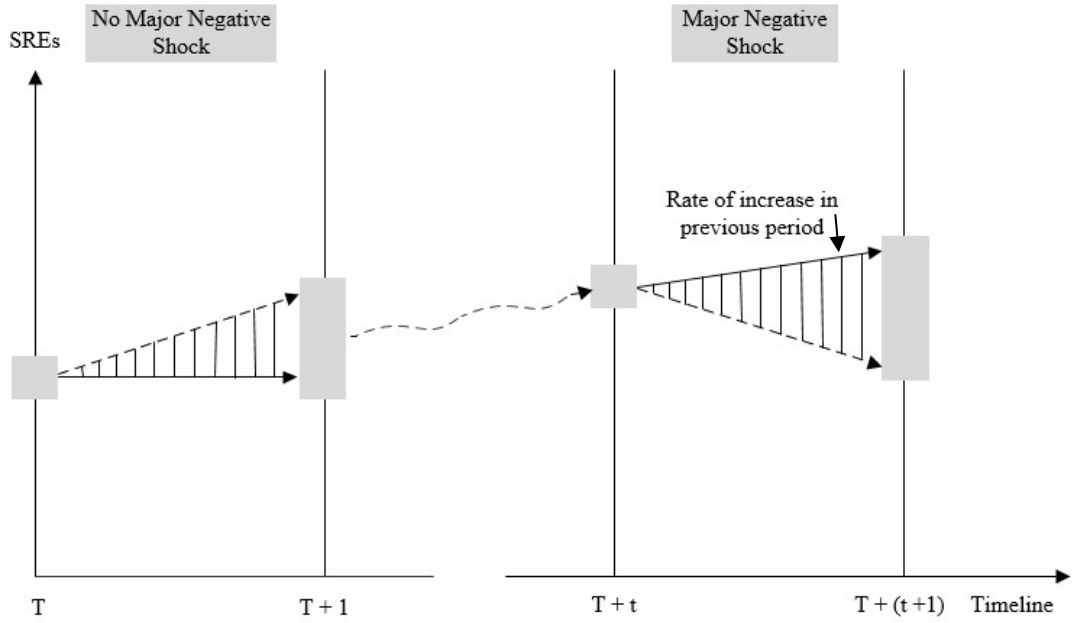
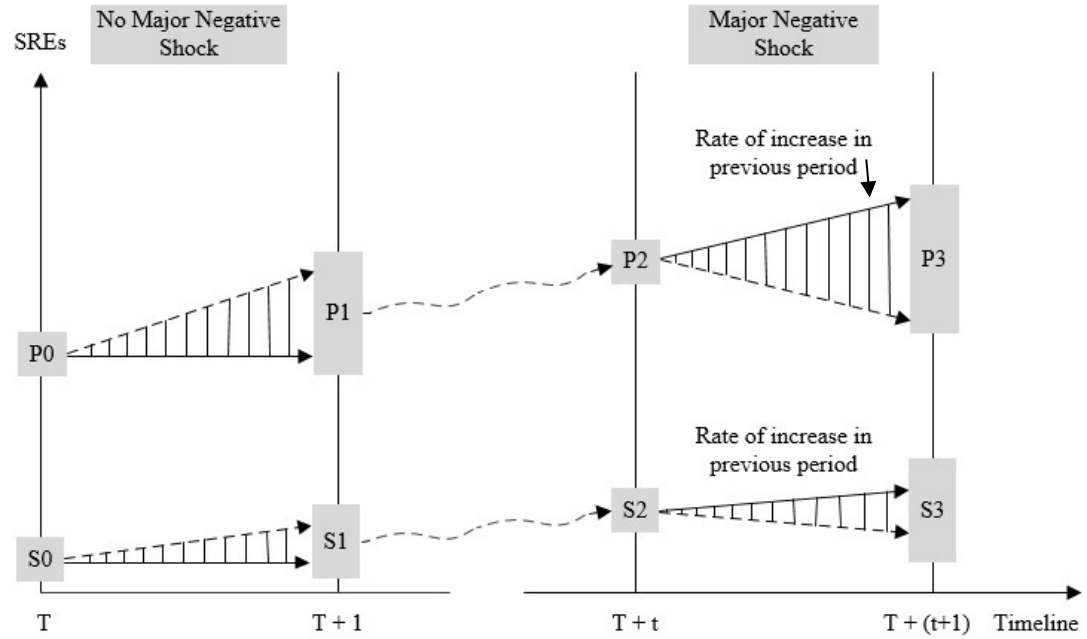
Figure 1 **The path-dependence of SREs over time without and with a major negative shock to institutions**



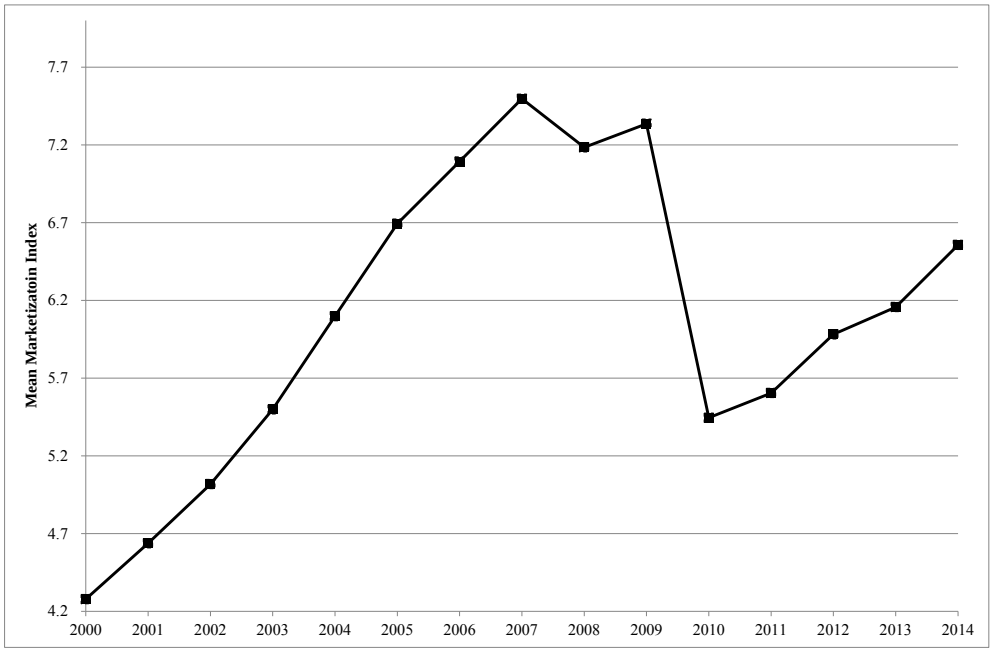
Illustrative graph for SREs over time in the presence of no major negative shocks (period T to $T + 1$) and a major negative shock (period $T + t$ to $T + (t + 1)$).

Figure 2 **The path-dependence of SREs over time for POEs versus SOEs without and with a major negative shock to institutions**



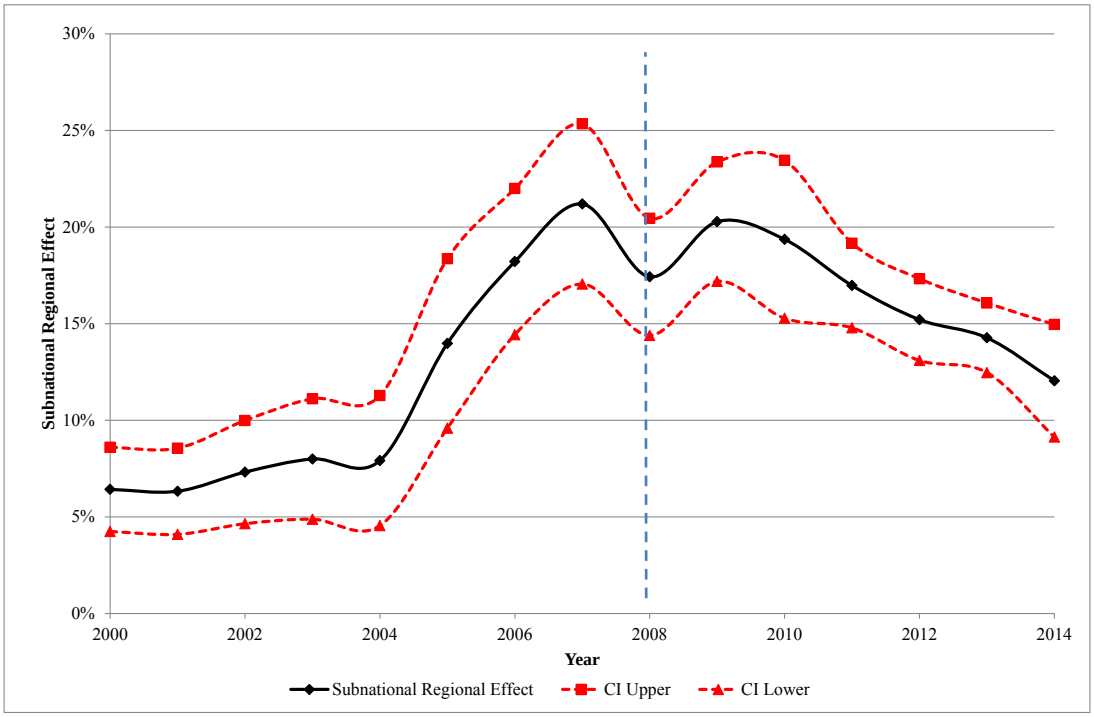
Illustrative graph for POE ("P") versus SOE ("S") SREs over time in the presence of no major negative shocks (period T to $T + 1$) and a majot negative shock (period $T + t$ to $T + (t + 1)$).

Figure 3 **Index of institutional quality related to firm profits for China 2000 to 2014**



Marketization Index from Fan, *et al.* (2017) – mean value in each year across provinces of China.

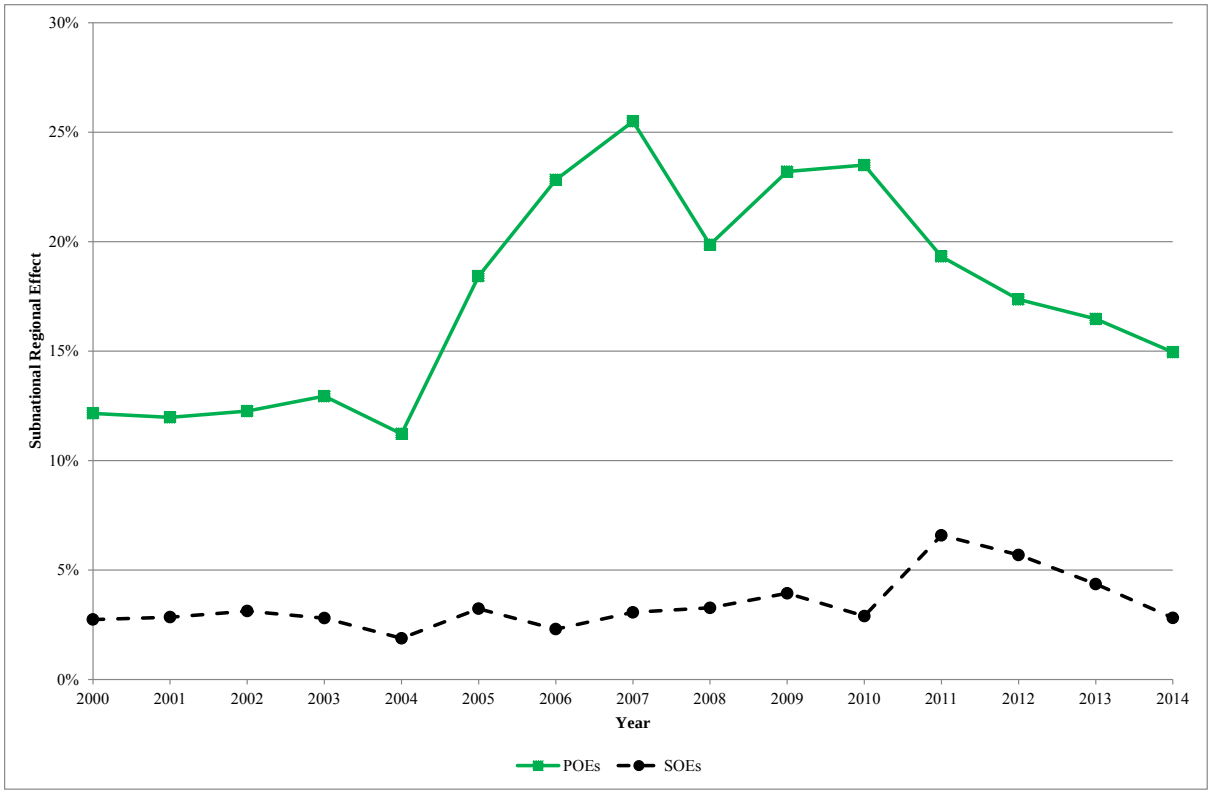
Figure 4 **HLM estimates of subnational regional effects on operating margins for manufacturing firms in China estimated year-by-year from 2000 to 2014**



Number of Subnational Regions														
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
345	343	344	342	343	346	347	343	342	339	319	339	361	339	345

Percentage variance explained by subnational region factor in HLM estimates of return on assets for manufacturing firms in China based on year-by-year estimates of Equations (4). Dashed lines are 95% confidence intervals. The table shows the number of levels for subnational region factor in each year.

Figure 5 **HLM estimates of subnational regional effects on operating margins for manufacturing firms in China estimated in POE and SOE subsamples from 2000 to 2014**



Percentage variance explained by subnational region factor in HLM estimates of return on assets for manufacturing firms in China based on year-by-year estimation for POE and SOE subsample (Equations (6) in the text but without unidentified ownership random effect).

Table I **Descriptive statistics for institutional quality index and sample of Chinese manufacturing firms 2000 to 2014**

	N	Mean	Standard Deviation	Min	Max
Panel A: Institutional Quality (Province-Year)					
Marketization Index	464	6.08	2.17	-0.30	11.80
Average Profitability	464	0.083	0.071	-0.017	0.362
Panel B: Firm Profitability (Firm-Year)					
Return on Assets	3,039,150	0.115	0.266	-9.056	55.043
Return on Assets by Ownership Subsamples:					
State-Owned Enterprises	219,303	0.028	0.199	-9.056	44.859
Private-Owned Enterprises	1,987,123	0.141	0.288	-8.608	48.071
All Other Ownership Types	832,724	0.077	0.212	-7.801	55.043

Summary statistics for 2000 to 2014. Provincial institutional quality data from Fan *et al.* (2017) (Panel A) and firm profitability data from NBS (Panel B).

Table II **HLM estimates of operating margins for manufacturing firms in China between 2000 and 2014**

	(1)	(2)	(3)	(4)
			Conditional Model Coefficient (x 100)	
Fixed Effects				
Intercept			0.03302 ***	
			(0.00790)	
Trend			0.00630 ***	
			(0.00003)	
		Unconditonal Model		
Random Effect	# Categ.	Variance (x100)	Variance (x100)	% of Total Variance
Year	15		0.013	5.089% ***
			(0.099)	(0.492%)
Firm	625,745	1.511 ***	0.482 ***	44.966% ***
		(0.093)	(0.001)	(2.756%)
Ownership	5	0.045 **	0.027 **	1.330% **
		(0.021)	(0.016)	(0.624%)
Subnational Region	371	0.389 ***	0.242 ***	11.573% ***
		(0.076)	(0.065)	(2.250%)
Industry	795	0.054 **	0.033	1.598% **
		(0.030)	(0.021)	(0.879%)
Error		1.362 ***	1.191 ***	35.443% ***
		(0.073)	(0.061)	(1.811%)
Total		3.360		
Sample Size			3,039,150	

HLM estimates of return on assets for full sample of Chinese manufacturing firms in years 2000 through 2014. Column 1 lists the number of categories for each factor. Column 2 contains parameter estimates for the unconditional model and Column 3 for the conditional model with standard errors in parentheses. All coefficientss and their standard errors multiplied by 100 for ease of presentation. Column 4 contains percentage variance explained by each factor in the conditional model along with standard errors in parentheses. Standard errors for fixed effects according to SAS MIXED. Standard errors for random effects based on 100 bootstrap iterations. Standard errors for percentage variances calculated as described in the text. ** = 5% significance, *** = 1% significance for a one-sided t-test.

Table III **Regressions of path dependence in institutional quality (pre- and post-crisis) and relationship between institutional quality and firm profitability**

	(1)		(2)		(3)
	Change in institutional qualty > median				
	Pre-crisis (2000-2007)		Post-crisis (2008-2014)		Firm Profitability
Intercept	0.408	***	0.434	***	-0.0166
	(0.044)		(0.049)		-0.0175
Lagged(institutional quality > median)	0.145	**	0.080		
	(0.063)		(0.068)		
Institutional quality					0.0271 ***
					(0.0057)
(Institutional quality)^2					-0.0016 ***
					(0.0005)
R^2	0.021		0.006		0.082
Number of observations	248		217		464

Columns (1) and (2) report results from estimating Equation (4) in the main text. Column 1 uses pre-crisis (2000 to 2007) data while Column 2 uses post-crisis (2008 to 2014) data. Column (3) reports results from estimating Equation (5) from the main text. Quality measures are annual, provincial measures based on the marketization index in Fan *et al.* (2017). Firm profitability measures are annual provincial averages based on the NBS survey data. Column (3) has one less observation because profit data is missing from one province in one year. *** p<0.01, ** p<0.05.

Table IV HLM estimates of operating margins for POEs and SOEs in China between 2000 and 2014

	(1) SOEs		(2) POEs	
Random Effects (% Variance)				
Year	4.728%	***	4.636%	***
	(0.134%)		(0.140%)	
Firm	54.917%	***	43.420%	***
	(5.890%)		(2.486%)	
Subnational Region	2.618%	**	13.899%	***
	(1.571%)		(1.963%)	
Industry	3.858%		1.836%	***
	(3.693%)		(0.760%)	
Error	33.879%	***	36.209%	***
	(3.540%)		(1.935%)	
Sample Size	219,303		1,987,123	

Percentage variance explained by factors in HLM estimates of return on assets in ownership sub-samples of Chinese manufacturing firms in years 2000 through 2014 obtained from estimates of conditional and unconditional models. Standard errors calculated as described in the text using bootstrap standard errors for conditional and unconditional models based on 100 iterations are shown in parentheses. ** = 5% significance, *** = 1% significance for a one-sided t-test.

Online Appendix
for
The Dynamic Role of Subnational Regions in Firm Performance

Online Appendix A
Procedure for Calculating Standard Errors for Difference in SREs between Two Years

The bootstrap procedure for calculating standard errors for the difference between two years (a and b) is:

1. Repeat the following steps for $r = 1,2,\cdots,R-1,R$ iterations (we set $R = 100$):
    a. Draw a sample of size n with replacement. We set $n = 10{,}000$.
    b. Estimate the year-by-year model for years a and b. The equation estimated depends on the sample:
        i. For aggregate SREs Equation (4) in the main text.
        ii. For SREs of a specific ownership type, Equation (4) omitting the unidentified ownership factor.
    c. Compute percentage of variance attributable to subnational region for each iteration and the two years: SRE_{ra} and SRE_{rb}.
    d. Calculate the difference in SREs between the two years for each iteration: $Diff_r = SRE_{ra} - SRE_{rb}$.
2. Calculate the average difference over all iterations: $\overline{Diff} = \frac{1}{R}\sum_{r=1}^{R} Diff_r$.
3. Calculate the bootstrap standard error for the difference: $\sigma^{Diff} = \sqrt{\frac{n}{n-1}}\sqrt{\sum_{r=1}^{R}\frac{\left(\overline{Diff}\text{-}Diff_r\right)^2}{R-1}}$.

Online Appendix B
Estimation Procedure for Binomial Tests

The procedure for generating the probability parameter and confidence intervals for the binomial tests is:

1. Repeat the following steps for $r = 1,2,\cdots,R-1,R$ iterations (we set $R = 100$):
    a. Draw a sample of size n with replacement. We set $n = 10{,}000$.
    b. Estimate the year-by-year model for each year $t = \underline{T},\underline{T}+1,\cdots,\overline{T}-1,\overline{T}$. For the pre-crisis sample $\underline{T} = 2000$ and $\overline{T} = 2007$. For the post-crisis sample $\underline{T} = 2008$ and $\overline{T} = 2014$. The equation estimated depends on the sample:
        i. For aggregate SREs Equation (4) in the main text.
        ii. For specific ownership type SREs Equation (4) omitting the unidentified ownership factor.
    c. Compute percentage of variance attributable to subnational region for each iteration r and year t: SRE_{rt} .
    d. For each r and each t set $k_{rt} = 1$ if $SRE_{rt} > SRE_{rt-1}$; otherwise set $k_{rt} = 0$.
2. Use maximum likelihood to estimate the probability parameter: $\hat{\rho} = \sum_{t=\underline{T}+1}^{\overline{T}}\sum_{r=1}^{R}\frac{k_{rt}}{R(\overline{T}-\underline{T})}$.
3. Following Wilson (1927), calculate the 95% confidence interval where $z = 1.96$ is the z-value corresponding to significance level $\alpha = 0.05$: $\left(\frac{1}{1+\frac{z^2}{R(\overline{T}-\underline{T})}}\right)\left[\left(\hat{\rho}+\frac{z^2}{2R(\overline{T}-\underline{T})}\right)\pm\sqrt{\frac{\hat{\rho}(1-\hat{\rho})}{R(\overline{T}-\underline{T})}+\frac{z^2}{4R^2(\overline{T}-\underline{T})^2}}\right]$.

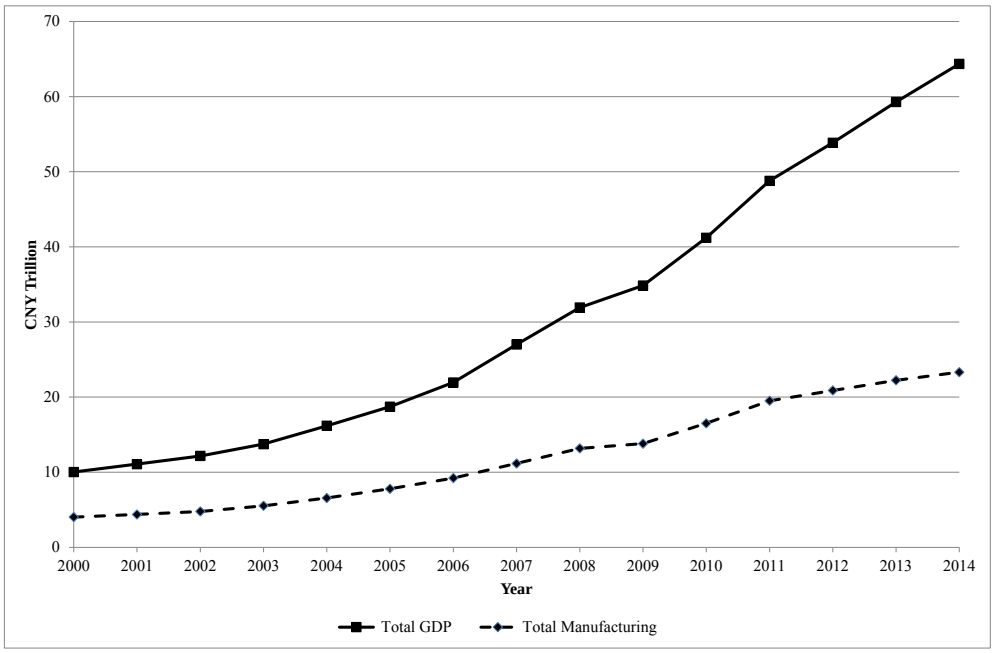
4. To adjust for simulation error in the estimate of the confidence interval, multiply both ends of the confidence interval by $\sqrt{\frac{n}{n-1}}$.

Online Appendix C
Validation Test – China's Macroeconomic Environment

This appendix establishes that over time during the sample period China is rapidly developing economically.

Validation Test: 2000 to 2014 is a time of rapid economic development in China.

The solid line in the graph below plots China's aggregate GDP from 2000 to 2014 and the dashed line aggregate manufacturing output. The former increases 13.5% annually on average and the latter 12.8% consistent with rapid economic development in both total and manufacturing output.



China's GDP and manufacturing output in CNY trillion. Data from *China Statistical Yearbook* (2016).