The Dynamic Role of Subnational Regions in Firm Performance*

Abstract

We investigate dynamics of subnational regions in determining firm performance over time and across ownership types using annual survey data of manufacturing firms in China from 1998 to 2007. In contrast to previous studies we examine subnational regional effects not only for multinational corporations (MNCs) at a point in time but for all ownership types across time. Other ownership types are more prevalent and compete against, cooperate with, supply to, and buy from MNCs. We find that subnational regions are increasingly important over time even as China's economy develops and globalizes and differ greatly across ownership types. Their role is most important and increase the most over time for firms most exposed to market forces (private firms) and are least important and remain level over time for those least exposed (state-owned enterprises). We discuss theoretical and practical implications of these findings and possible explanations to motivate future research.

Keywords: subnational region; firm performance; dynamic profit components; institutional environment

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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 has focused primarily on whether performance derived from industrial structure (industry-based view)[1], firm resources (resource-based view) or institutions (institution-based view). Consistent with the last, 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 that intra-country regions matter in explaining variation in MNCs' performance (Chan *et al.*, 2010; Ma *et al.*, 2013) and MNCs choice of location intra-country affects many strategic decisions (Hutzschenreuter *et al.* (2020) reviews numerous studies). This is at least in part because intra-country differences often exceed cross-country differences (Beugelsdijk and Mudambi, 2013) in terms of culture (Shenkar, 2001; Dow *et al.*, 2016), institutions (Shi *et al.*, 2017), economic development (Goerzen *et al.*, 2013; Shi *et al.*, 2017), and network embeddedness and agglomeration (Dellestrand and Kappen, 2012; Stallkamp *et al.*, 2016).

To the best of our knowledge, all previous studies of subnational regional effects (SREs) focus on MNCs. However, MNCs comprised only 10% of world output in 2014 (World Bank Group, 2015). Examining non-MNCs is important in and of itself given the large fraction of global output produced by these firms but also because global value chains (GVCs) are now more vertically disintegrated (Kano *et al.*, 2020). This disaggregation means that MNCs interact with many other firms as suppliers, buyers, complementors, and partners including those of other

[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).

ownership types such as local private firms and state-owned enterprises (SOEs).[3] Also, to the best of our knowledge, previous studies examine SREs at a single point in time. The dramatic vertical disintegration in GVCs, due to development and globalization, illustrate that firm practices change dramatically over time. Non-MNC practices also change dramatically over time which is important both directly and because they interact with MNCs in their value chain.

This raises two crucial questions vis-a-vis previous studies. First, how do SREs evolve over time with rapid development and globalization? Firms must understand the dynamics of location choice over time to form a prediction of how SREs might evolve in the future. This question is raised in the previous literature. Makino *et al.* (2004: 1038) asks how country-level effects change over time with development and globalization, Chan *et al.* (2010: 1237) suggests examining how industry-region relationships evolve over time with globalization as reflected in SREs, and Hutzschunreuter *et al.* (2020: 11) calls for longitudinal studies since subnational region characteristics change over time. The previous literature on location effects concerns cross-sectional comparisons of MNCs. Makino *et al.* (2004) find larger country effects among less-developed countries and Chan *et al.* (2008) find that the variance of firm profits is negatively related to country institutional development. Two studies compare SREs in less- and more-developed regions cross-sectionally. SREs among MNCs are stronger for affiliates in China versus in the US (Chan *et al.*, 2010) and in less- versus more-developed regions of China (Ma *et al.*, 2013). These results have led to speculation that SREs are inversely related to institutional and economic development (Chan *et al.*, 2010) and prompts us to examine whether SREs decrease over time as a country and its institutions develop and globalize.

[3] As Kano *et al.* (2020: 578) summarize, ". . . a transition from hierarchically organized MNEs, with their traditional focus on managing internalized overseas investments, to MNEs as international lead firms. These firms work with and integrate their geographically dispersed strategic partners, specialized suppliers, and customer bases into complex structures . . ."

Second, how does ownership type influence SRE dynamics over time as an economy develops and globalizes? Firms of all ownership types must understand this to predict how they will compete and interact with firms of the same and other types over time. For MNCs specifically, when supply chains are largely internalized, the role of SREs for other ownership types is less important. As supply chains disaggregate, MNCs must collaborate extensively with firms of other types to deliver their products (rivals, buyers, suppliers, joint-venture partners, and complementors) and therefore must understand how location affects the profits of these firms vis-à-vis their ownership type. These relationships can also change over time – suppliers can forward integrate to become competitors and complementors can become rivals. To understand these changes over time, MNCs must understand SRE dynamics for all ownership types. The previous literature establishes SREs' importance for MNCs and that ownership type matters in explaining variation in firm performance (Xia and Walker, 2014; Fitza and Tihanyi, 2017); however, it does not examine SREs by ownership type. Are SREs important for non-MNCs and, if so, how do their dynamics differ across ownership types and evolve over time within each type?

To answer these two questions, we apply a variance decomposition approach to a large sample of manufacturing firms in China from 1998 to 2007. This setting is ideal for several reasons. First, and most importantly, during this time period China developed and globalized rapidly and dramatically increased its role in MNCs' value chains (Appendix A provides validation tests). This allows the relationship between SREs and these trends to be examined while holding constant the national environment. At the same time, regional institutions improved (Appendix A provides a validation test) and evolved quickly in China due to infrastructure expansion, market-oriented reforms, and migration creating interesting institutional variation across regions

(Démurger, 2001). Second, the setting offers a variety of ownership types because China transitioned from an historical command-and-control to a more market-oriented economy. Third, as the second-largest economy, China is an important MNC destination. Given China's prominent role in global manufacturing and trade, understanding firm performance there is particularly valuable.

Counterintuitively, we find that SREs increase over time from 6.9% of total profit variance in 1998 to 21.4% in 2007, even 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 9.9% annually, and its trade grew by more than 23% annually.[4] It is useful to compare this to previous results. Chan *et al.* (2008) find that institutional development decreases firm profit variance at the country level. Our result shows that national institutional development does not necessarily lead SREs to decline over time as institutions can, at the same time, diverge within the country.[5] At a point in time, SREs are lower in a more- relative to a less-developed country (Chan *et al.*, 2010) and in more- relative to less-developed regions within a country (Ma *et al.*, 2013). Our results show that SREs may increase over time even while a gap in SREs remains between two countries (or two groups of regions) because institutions can diverge over time within both while the average institutional quality and SREs in

[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 institutions develop and 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. Institutional development increases average firm profits and reduces (country) regional effects. Across subnational regions the standard deviation of firm profits is 3 in year 2. Subnational regional effects increase even while institutions, and therefore firm profits, diverge across subnational regions.

the less-developed country (or group of regions) remain below that of the more-developed.[6] Intra-country variation can be extensive especially in countries like China (Hutzschenreuter *et al.*, 2020). We show that it is also widening over time.

We also find that SRE dynamics differ importantly across ownership types. SREs are greatest for private domestic firms, which are most subject to market forces, and least for SOEs, which are most insulated from market forces, with collectives and foreign firms (including MNCs) in between. SRE dynamics over time within type also correlate with exposure to market forces. SREs increase most over time for the ownership types most exposed to market forces (private domestic and collective firms) and remain level over time for those least exposed (SOEs). SREs for foreign firms (including MNCs) increase slightly over time. Overall, SRE dynamics are important not just for MNCs and they differ dramatically across ownership types in relation to exposure to market forces.

The ownership-type decomposition reveals that the increased importance of aggregate SREs over time is driven by both their increased importance for private domestic and collective firms and by these types representing an increased fraction of firms over time (from 50.6% of all firms in 1998 to 71.7% in 2007). It also suggests that market forces do not necessarily ensure similar profits for private firms across regions over time.

We extend previous work in three primary ways. First, we quantify SRE dynamics over time. Previous literature suggests that SREs are inversely related to institutional development (Chan *et*

[6] Again consider a trivial, illustrative example. Suppose Country (or Group of Regions) A is less developed and firm profits are distributed Normal (5,3) across its subnational regions in year 1. Country (or Group of Regions) B is more developed and firm profits are 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).

al., 2010; Ma *et al.*, 2013).[7] In contrast to these papers, we examine SRE dynamics inter-temporally within a county rather than cross-sectionally. We provide empirical evidence that SREs in China increase over time even as institutions, as measured by commonly-used indices, are developing and the economy and trade are growing nationally. These empirical regularities are "stylized facts" that may form the basis for theoretical explanations (Helfat, 2007). We offer explanations for this descriptive evidence to motivate future research in a manner similar to Fitza and Tihanyi (2017) for ownership form.

Second, we extend the previous SRE literature, which focuses mostly on MNCs, to examine other ownership types. Besides the direct application to firms of these other types, this is of practical importance to MNCs as they increasingly interact with them in GVCs. Examining other ownership types is also useful because MNC headquarters have incentives to alter subsidiaries' reported versus actual performance for tax reasons (Slemrod, 1995) and to alter actual 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.

Third, we decompose SRE dynamics over time by ownership type. For each type, it is important to understand the evolution of how location affects firm profits over time as an economy expands and globalizes. Across all types it is important because aggregate SREs reflect each type's dynamics as well as their mix over time. Our results show that not only do market forces not ensure more uniform profits across locations over time, exposure to these forces increases variation over time. This is consistent with Chang and Wu (2014) which finds that

[7] Economic papers examine convergence 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 in that it includes the total value of all goods produced by firms and governments.

institutional barriers drive a wedge between firm efficiency and survival. From a practical standpoint, understanding type-specific SRE dynamics over time is relevant to MNCs because their relationship with non-MNCs in the value chain may change over time especially as GVCs disaggregate.

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 ACROSS OWNERSHIP TYPES

Why might SREs increase over time?

We focus primarily on institution-based reasons for changes in SREs over time because previous papers explain SREs using the institution-based theory. However, we discuss possible contributions of the resource- and industry-based theories. We then discuss the role of path dependency. For all three theories, we discuss only reasons why SREs might increase in the midst of development and globalization since previous papers implicitly assume they will decrease (Chan *et al.*, 2010) and because our sample period does not allow us to examine the conditions for and implications of declining SREs over time. We also provide only illustrative reasons since a comprehensive list is infeasible.

Institution-based reasons. Institutions can, although do not necessarily, diverge over time across subnational regions within a country whose institutions develop rapidly.[8] The institution-based theory posits that underlying institutions influence organizational performance; therefore institutional divergence across subnational regions over time results in diverging firm performance over time (Chan *et al.*, 2010). By extension, if institutions diverge across

[8] We say "can" instead of "does" because the effect of institutions on SREs also depends on an absence of negative shocks (North, 1990). Due to data constraints, we examine a period with no negative shocks.

subnational regions even while institutions develop on average at the country level then SREs increase over time even as the country develops.

Economic, political, and social institutions (the three institutional types) can diverge across subnational regions over time within a country even while its institutions improve on average and its economy develops. Economic institutions such as capital and labor markets are uneven across regions in early development and grow unevenly – a process that agglomeration exacerbates (Fujita and Hu, 2001). 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). Improved transport infrastructure over time results in greater population migration across regions (Baum-Snow *et al.*, 2017) which may exacerbate a difference in population density across regions. In the presence of imperfect competition and agglomeration effects this leads to diverging profits across regions over time.

Graph 1 provides quantitative evidence that economic institutions diverge over time in our sample. The red, small-dashed line shows the standard deviation across China's provinces of sub-index 4 of the annual marketization index (normalized to 100 in 1998) from Fan *et al.* (2007).[9] The marketization index measures each province's institutional development and is used extensively in the management literature (Chang and Wu, 2014). Sub-index 4 measures the development of factor markets. Its standard deviation increases to 222.6 by 2007 consistent with divergence of economic institutions across provinces over time.

[Insert Graph 1 about here.]

[9] The marketization index is composed of five dimensions (sub-indices) and each sub-index is composed of indicators. We believe sub-index 4 (development of factor markets) best captures economic institutions although the standard deviation of sub-index 5 (development of market and legal intermediaries) also increases over time. While sub-index 4 captures many aspects of economic institutions, it is not comprehensive.

Political institutions diverge over time due to a policy preference for faster-growing regions (Yang, 1997: 16; Fujita and Hu, 2001) and because different subnational regions change policies at different speeds (Chang and Wu, 2014). Political institutions interact with economic institutions to increase SREs over time: regulation influences regional economic activity (Holmes, 1998) and thereby influences agglomeration. Graph 1 provides quantitative evidence that political institutions diverge over time in our sample. The blue, solid line shows the standard deviation of indicator 1c across China's provinces of the annual marketization index constructed in Fan *et al.* (2007) normalized to 100 in 1998.[10] Indicator 1c measures government interventions in firms. Its standard deviation increases to 226.6 by 2007 consistent with divergence of political institutions across provinces over time.

Social institutions affect transaction efficiency and therefore profits (North, 1990). Trust prevents people from engaging in inefficient non-cooperative traps (Chan *et al*., 2008). Social network strength differs across subnational regions due to varying norms of reciprocity, trust, and risk taking while their reach differs due to cultural and linguistic heterogeneity (Emirbayer and Goodwin, 1994; Bertrand *et al.*, 2000) and span of connecting technology (Coscia *et al.*, 2017). These differences lead to variation in performance among MNCs (Lu *et al.*, 2018). Graph 1 provides suggestive evidence of increasing heterogeneity in social institutions across regions over time. The green large-dashed line shows the standard deviation of the percentage minority population, a proxy for cultural attributes, across China's provinces normalized to 100 in 1998.[11] The standard deviation of the index increases by six percent over the sample period.

[10] We believe indicator 1c (government interventions in firms) best captures political institutions. It is based on firm-level surveys asking managers to quantify their time spent dealing with the government. While indicator 1c captures important aspects of political institutions it is not comprehensive.

[11] Data is from *China Statistical Yearbook* 1999 – 2008 and contains data on 20 provinces. Percentage minority is not a comprehensive measure of social institutions.

Institutions can also diverge within a county in the midst of globalization. Globalization leads to information transmission across countries via trade (North, 1990). Institutions absorb information at different rates in different regions according to the preponderance of international versus domestic institutions, absorption rates of local institutions, and application of international mandates (He *et al*., 2008; Wilson, 2009). Infrastructure and globalization interact to increase SREs over time. Regional economic activity declines with transport distance from the nearest port (Storeygard, 2016). Thus, increased globalization over time will increase economic activity as a function of distance. In the presence of imperfect competition and scale economies this will cause profits to diverge across regions over time.

Resource-based reasons. The resource-based view argues that firm resources and capabilities are the primary source of sustainable competitive advantage and therefore above-average profits. The advantage conveyed by these resources and capabilities depends on location (Cantwell, 2009) and resource advantages of MNCs matter for intra-country location choice (Lei and Chen, 2011; Bu and Wagner, 2016). Our estimation includes firm factors that absorb immutable resources; however, location-specific changes in firm resources that are self-reinforcing over time increase SREs over time.[12] To discuss possibilities, we classify resources (including capabilities) as tangible versus intangible and intra- versus inter-organizational following Dyer and Singh (1998).

Intangible, intra-organizational resources can lead to diverging SREs. Learning-by-doing (LBD) generates positive feedback allowing firms with greater sales to move even further down the learning curve relative to those with lower sales. As their costs fall further, it allows them to lower prices and sell even more (Carlton and Perloff, 2015: 394 – 395). This can increase SREs

[12] Quantifying these in estimation would require three-way interactions of firm, region, and year but this is impossible as it would leave only one observation to identify each interaction.

over time as firms located in high-demand regions have larger customer bases from which to benefit from LBD. Positive feedback is also possible if firms with high profits are able to invest more in research and development (R&D) and further increase their profits over time (Carlton and Perloff, 2015: 392). This feedback can proceed at different rates across regions if local governments provide differing R&D incentives. Firm reputations also tend to be self-reinforcing over time – brand identities involve investment of sunk costs which gives an advantage to early movers (Sutton, 1991). Different regions can develop or undergo firm privatizations at different times (Démurger, 2001; He *et al.*, 2008), providing an earlier start for these investments in some regions.

Intangible resources involving linkages between firms may also increase SREs over time. LBD may require coordination with suppliers, buyers, or complementors and increase SREs over time as described above. For example, firms may accumulate more customer data or improve coordination with suppliers over time. Furthermore, local academic and industrial activities affect knowledge spillovers differently (Alcácer and Chung, 2007) and inter-firm relationships also influence firm innovation (Whittington *et al*., 2009). Such relationships and learning cannot be displaced quickly and provide an advantage in regions where they begin earlier or proceed more quickly. Intangible network effects (Katz and Shapiro, 1994) that are local in scope and involve inter-firm linkages (e.g., common standards) may lead to diverging profits across regions over time if customer densities differ across regions.

Firms' internal tangible resources can change over time and increase SREs. Firms' asset values, such as land, may increase differentially across locations over time with development or globalization leading to diverging profits across regions. Serendipitous, local innovations may convey a competitive advantage which is sustained over time by patents or causal ambiguity

(Reed and Defillippi, 1990). Export-oriented firms benefit from proximity to ports (Gries *et al.*, 2009) – a benefit which increases with globalization.

Tangible resources that involve linkages with other firms may also increase SREs over time. Physical infrastructure such as shared distribution networks can convey a competitive advantage to participating firms. If density economies differ across regions, these local networks lead to diverging profits across regions over time. Physical relationships between complementary-goods firms may also increase SREs over time. For example, co-location of complementary firms may lower costs (Joskow, 1990).

Industry-based reasons. The industry-based view argues that industry structure primarily determines firms' long-term profitability. Our estimation includes industry factors that absorb immutable industry effects; however, changes in industry structure over time that enhances regions with high-profit industries and degrade those with low-profit increase SREs over time.[13] These changes could occur to any of the five competitive forces (Porter, 1979).

Location-specific rivalry can change over time for either structural or behavioral reasons. In the presence of scale economies, minimum-efficient-scale (MES) relative to market size determines the number of firms in an industry (Carlton and Perloff, 2015: 65). If regions grow unevenly over time with development or globalization as discussed earlier, industry structures will diverge across locations over time and increase SREs. The number of firms will also influence firm behavior. Repeated interactions among firms in imperfectly-competitive industries, can lead to outcomes ranging from perfectly-competitive to perfectly-collusive (Friedman, 1971).

[13] In theory these could be quantified by a three-way interaction of industry, subnational region, and year factors but given the number of industries and regions in our data the resulting dimensionality prevents this. Previous work finds interactions between industry and location in static contexts. Chan *et al.* (2010: 1236) find evidence of non-uniformity of industries across locations in China for Japanese MNCs. Ma *et al.* (2013) find evidence of significant interactions between industry effects and SREs in a static analysis while Li and Sun (2017) find SREs are moderated by firm characteristics such as age and size.

More firms make cooperation more difficult (Carlton and Perloff, 2015: 158) so that behavior diverges over time with numbers of firms. Agglomeration effects can be industry-specific (Ellison and Glaeser, 1997) and depend on historical activity (Henderson, 1999). In the presence of market power, industry profitability diverges across regions. Globalization exacerbates these effects. Foreign firms locate in regions with more firms from the same country and industry (Head *et al.*, 1995; Crozet *et al.*, 2004).

Both globalization and development can alter supplier power differentially across regions over time. In early development, moving costs are disproportionately overcome in more-developed regions leading to greater labor migration (Williamson, 1965) and better matches between firm-specific human capital and firms relative to less-developed regions. Input suppliers face increased competition and lower bargaining power in coastal vis-a-vis inner regions as globalization impacts coastal regions more (as discussed earlier). If inputs are industry-specific, SREs increase over time. Development and globalization can affect buyer power in the same way for intermediate-input producers as they face suppliers with varying power over time.

As globalization causes economic activity to grow at different rates across locations based on their proximity to coasts (as discussed earlier), entry barriers change differentially across regions in industries with scale economies. MES relative to market size determines entry difficulty (Carlton and Perloff, 2015: 282) and differences in incumbent firms' abilities to charge supra-competitive prices.

Differential changes in the quality of substitutes or complements for an industry's product across locations over time increases SREs over time. Local, industry-specific spillovers (Ellison and Glaeser, 1997) allow firms in more-innovative locations to build on each other's innovations over time and outpace firms in less-innovative locations. These innovations may diffuse slowly

due to intellectual-property protection or tacit knowledge. If so, industries face increasingly better substitutes in some regions than in others over time. As discussed earlier, exposure to globalization depends on distance to ports, differentially altering the variety and quality of imported substitutes available for an industry's product across locations.

Role of path dependency. Increasing SREs are reinforced over time by institutional path-dependency in the absence of large, negative shocks (North, 1990). Once the direction of their impact is set, institutions continue to influence SREs in the same way unless a dramatic negative shock occurs. The importance of path dependency has been shown over extremely long durations. Income differences 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). Institutional changes due to colonization affects performances of societies centuries later (Acemoglu *et al.*, 2002) and the impact of historical conflicts results in differences in firm performance decades later (Gao *et al.*, 2018).

This is true whether the SREs derive from institutions, industry structure, or firm resources. Under the institution-based view, 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 those with a lower initial knowledge stock. Under the resource-based view, firms with advantageous endowments have a vested interest in preserving the status quo and greater resources to do so than those at a disadvantage (North, 1990). Similarly, under the industry-based view, industries with a favorable industry structure prefer the status quo and have more resources to invest in its continuation relative to those of less-favorable structures.

Why might SREs differ across ownership types?

Our data contain five ownership types: private domestic, private foreign, SOE, collective, and Hong Kong/Macau/Taiwan (HMT) firms. 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. SOEs are government owned and managed with the government as residual claimant. 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. HMT enterprises do not fall neatly into a specific category[14] so we focus on four canonical categories in this discussion: private domestic, private foreign, SOEs, and collectives.[15] Private domestic and private foreign firms face similar constraints so we discuss them together except when they differ.

Different ownership forms convey different firm endowments. All ownership types in a location face the same institutional environment, but differing endowments mean that these impose different formal and informal constraints. This leads to different objectives and payoffs and therefore different SREs across types. For example, Peng and Heath (1996) describe the different constraints faced by SOEs and private firms and how this affects their performance. The two key dimensions that determine how endowments and institutions interact to affect performance via ownership type are government involvement and agency issues.

The degree of government involvement determines a firm's exposure to institutional constraints and the effectiveness of its endowment. Involvement is the greatest for SOEs and

[14] HMT firms are geographically located in mainland China but 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 home locations and mainland China.

[15] Although we do not discuss HMT firms in this section all of the results in the paper include these firms except for Table 4 and Graph 3 which compare different ownership subsamples.

least for private firms with collectives in between. SOEs have direct government ties and enjoy preferential access to political institutions relative to private firms. This includes access to financing (Brandt and Li, 2003; Lu *et al.*, 2012), avoidance of government fees (Li *et al.*, 2006), and preferential treatment in government contracts (Chen *et al.*, 2014). On the other hand, 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). In contrast, private firms primarily pursue profits (Peng and Luo, 2000) and are least affected by government.

Because they have multiple objectives, SOEs' profits are less variable than those of private firms. Private firms allocate more capital to units with greater investment opportunities while SOEs transfer capital from high- to low-performing units to preserve employment (Chen *et al.*, 2017) and are often subsidized by the government through grants or loans at favorable rates (Groves *et al.*, 1995; Lin *et al.*, 1998). Collectives experience an intermediate level of government involvement: they pursue other goals (e.g., supporting local jobs) in addition to profits but because of the mixed government-private ownership less so than SOEs.

Agency issues influence management incentives to create differences in SREs across ownership types. SOE manager compensation is regulated by government bureaucracy reducing the role of performance-based incentives (Mi and Wang, 2000) as shown empirically (Firth *et al.*, 2006). This reduces variation in SOE profits. In contrast, private firm managers typically face performance incentives and focus more intensely on profit maximization (Hart, 1983) with the attendant higher profit variation. Collective firm managers' incentives are in between SOEs and private firms given their mixed government-private ownership.

Private domestic and foreign firms while otherwise facing similar constraints, differ in one key respect. Private domestic firms usually grow organically from the founder's location and are intimately tied to local institutions. Private foreign firms have much greater discretion in where to locate because they have no extant local ties. This difference is borne out in empirical 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).

In summary, interactions between firm endowments and institutions suggest that SREs are greatest for domestic private firms and lowest for SOEs with collectives and private foreign firms in between.

Why might SRE dynamics over time differ across ownership types?

Location-specific changes in environment over time due to development or globalization can lead to differing profit paths over time across ownership types. This leads to SREs growing or declining depending on how the changes interact with each type's endowments.

Development proceeds at different rates across locations (Fujita and Hu, 2001) which leads to different SRE trajectories for ownership types based on their exposure to market forces. Development leads to formalization of political and legal institutions allowing private firms to better access them (Li *et al.*, 2006) including government resources, regulatory protection from competition (Chen *et al.*, 2014), better financing access, preferential tax treatment, and better access to regulated industries (Feng *et al.*, 2015). With economic development, private firms hire more people with political connections (Feng and Johansson, 2017). All these reasons lead to a divergence of private firms' profits across locations as they develop at different rates. Because these factors do not change significantly for SOEs, SREs for them do not significantly change over time.

The resource-based view plays a role in these dynamics. Firms have different resources to respond to local, institutional changes vis-à-vis their ownership type. Discrimination between SOEs and private firms in credit allocation diminishes over time with increased competition as the economy expands (Gou *et al.*, 2016). Firms' endogenous responses hasten this convergence. Private firms compensate for their disadvantage relative to SOEs in accessing financial institutions by investing in banks (Lu *et al.*, 2012). Historically, SOEs had an advantage in hiring because their employees were virtually guaranteed lifetime employment. However, SOE privatization and restructuring makes their labor market access more similar to that of private firms (Démurger *et al.*, 2012). More generally, private firms face differing treatments across locations over time based on local leaders' incentives (Xu, 2011) who make decisions about local infrastructure, property rights, and regulations (Xu and Zhang, 2010).

Differential changes in industry structure across locations due to development (as discussed earlier) lead to diverging profit paths across locations for private firms but relatively stable paths for SOEs because the latter are more insulated from these changes. This suggests a role for industry-based reasons in ownership-specific SRE changes over time.

As globalization proceeds at different rates across intra-country regions (Wilson, 2009), different ownership types are affected differently vis-à-vis their endowments. Globalization leads to greater access to financing mechanisms (Biles, 2004) which primarily benefits historically-disadvantaged non-SOEs. This leads to diverging SREs over time for private firms but not SOEs. Globalization increases idea flow across boundaries (Rivera-Batiz and Romer, 1991) about "ways of doing things," access to which differs across ownership types depending on how embedded firms are in institutions (Wilson, 2009: 15).

In summary, interactions between firm endowments and changes in local environments over time suggest that SREs will diverge over time for firms most exposed to market forces (private firms) but remain fairly stable for those insulated from market forces (SOEs).

METHODOLOGY

Data

Our data is the annual Survey of Manufacturers 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 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.[16] The firm panel is unbalanced because firms "enter" and "exit" from the data as their revenues fall above or below this cutoff.[17]

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 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 net income or total assets do not equal their totals because these are essential for our profitability measure. Following McGahan and Porter (1997) and Cai and Liu (2009) we drop any firm-year observation with less than RMB

[16] This means that our SRE measures do not reflect those arising from these smaller firms.
[17] We comment later on possible endogeneity problems this may introduce.

five million in assets. Finally, we lose a few observations due to missing values. This leaves 1,116,722 observations.

We use return on assets (net income as a fraction of total assets) as the primary profitability measure consistent with the previous literature. 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 the prefecture or major city. There are 358 different four-digit regions in the data.[18] We comment in our results on how the number of regions affects the estimates.

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 (there are 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 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 into 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).

[18] For 19 observations only the provincial-level code is disclosed. For these we use provincial averages.

Table 1 shows summary statistics for the data.[19] Firm performance has a mean of 7.0% with significant variation. Profits increase over time (although not monotonically) consistent with China's reform and opening-up. Private domestic firms are the most profitable followed by collectives, private foreign firms, HMT firms, and finally SOEs.

[Insert Table 1 about here.]

Analytical approach

To measure subnational region's importance, we perform a variance decomposition analysis using a hierarchical linear model (HLM) (Hough, 2006; Misangyi *et al.*, 2006; Short *et al.*, 2007; Meyer-Doyle *et al.*, 2019). This 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) provides an overview of HLM's advantages relative to other decomposition approaches. We include factors previously used in the literature (year, industry, ownership type, and firm strategy) and supplement this with the firm's production location.[20] 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.

[19] 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.

[20] 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 95.7% of the observations in our sample are single-location 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.

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:

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

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:

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

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 1998. 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 1998. 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. 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,…,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.

Most arguments in the extant literature for why SREs are important for MNCs extend to other ownership types. The mechanism is that region-specific institutions affect firm performance in that region, 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 relevant for other ownership types. MNC performance depends on the local institutions of its host-county headquarters (Ma and Delios, 2010) and subnational institutions affect performance of small and medium enterprises (Nguyen *et al.* 2013) suggesting that SREs' importance extends to other ownership types. Chan *et al.* (2010: 1228-1229) provides a comprehensive discussion of these arguments. This implies the validation test:

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

Column 2 of Table 2 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.[21] The parameters and standard errors are both multiplied by 100 for ease of presentation. All of the parameter estimates are extremely significant. Column 3 displays parameter estimates and bootstrap standard errors for the conditional model (Equations (2)) with random effects parameters again multiplied by 100. The fixed and random effects parameters are all extremely significant. Adding the linear growth trend reduces the proportional variance by 13.3% consistent with better representing year effects.

[21] Estimating standard errors for the full sample would require approximately 461 terabytes of memory in the MIXED procedure based on SAS Institute (2015: 6168).

Column 4 of Table 2 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 66.5% of the total profit variance over the ten years. The error contains 33.5% of the total variance and captures idiosyncratic shocks unrelated to the included factors. Year effects, representing annual macroeconomic shocks affecting all firms, capture 5.2% 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).[22]

[Insert Table 2 about here.]

Ownership type explains only 2.3% 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.[23] 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 (46.5%) in explaining total variance.

After firm, subnational region is the most important factor (10.7%) validating that SREs are important across all ownership types. Location effects are greater than industry effects by a ratio of 5.6 to 1. This is not because it is measured more finely than other factors. Column 1 of Table 2 displays the number of levels for each factor. 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

[22] 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 525 industry categories versus 625 in McGahan and Porter (1997).

[23] 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.

explain region's large role vis-à-vis industry. The number of industry levels exceeds that of region.

As discussed earlier, SREs could arise from local institutions (institution-based view), firm resources (resource-based view), or industry characteristics (industry-based view). SREs may also reflect the initial sorting of firms in the data. Since few firms move during the sample period, selection effects arising during the sample period are minor.

SRE dynamics over time

Our single-country data is ideally suited to examine SRE dynamics over time 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 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:

$$ROA_{tijkl}=\beta_{00jkl}+\epsilon_{tijkl}, \quad (4a)$$

$$\beta_{00jkl}=\gamma_{00000}+\mu_{00j00}+\mu_{000k0}+\mu_{0000l}. \quad (4b)$$

The solid, black line in Graph 2 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. SREs are steady at about 7.0% of total variance from 1998 to 2002 and then increase rapidly to reach about 21% in 2007.[24]

This upward trend is not due to an increase in the number of regions across years: the footnote of Graph 2 shows no systematic increase over time. It is, however, consistent with path dependency. Underlying institutions lead to a divergence in firm profits over time and this path is reinforced over time. Why do SREs begin to increase most dramatically in 2002? This is

[24] SREs drop in 2004, however an upward trend is still within the 95% confidence interval as shown in Graph 2.

consistent with the institution-based theory. The acceleration coincides with China joining the WTO in December 2001 – a positive institutional shock that reinforces the SRE divergence. 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 government (Jefferson, 2002) because non-compliance would be prohibitively costly (Wilson, 2009: 63; Zweig, 2002: 29).

[Insert Graph 2 about here.]

Formal tests of significance. Since we have a large sample, the parameter estimates can be viewed as normally distributed and a Wald test applied to see whether the SRE effects differ significantly across a pair of years (Snijders and Bosker, 2012). Using subscripts t and t' to denote the two years, the test statistic is:

$$W = \frac{\left(\sigma^2_{kt}/\sigma^2_t - \sigma^2_{kt'}/\sigma^2_{t'}\right)^2}{var(\sigma^2_{kt})/\sigma^2_t + var\left(\sigma^2_{kt'}\right)/\sigma^2_{t'} - 2cov\left(\sigma^2_{kt}, \sigma^2_{k,t'}\right)\left(\sigma^2_t + \sigma^2_{t'}\right)/\left(\sigma^2_t \sigma^2_{t'}\right)}. \quad (5)$$

This is a chi-squared test with a single degree of freedom and collapses to a standard *z*-test. To estimate the variance and covariance terms we must allow for correlation between the two years' residuals. We do so by pooling the two years' data in a seemingly-unrelated regression (Zellner, 1962). Table 3 shows the differences and test statistics for each pair of adjacent years. Subnational regional effects increase in all years except in moving from 1998 to 1999 and 2003 to 2004. All of the increases are significant at better than the 0.01% level. The difference over the whole sample period (1998 to 2007) is 0.00348 and from 2002 (after China joins the WTO) to 2007 is 0.00336 – both significant at better than the 0.01% level.[25]

SRE dynamics by ownership type

Table 4 examines SREs by ownership type over the whole sample period. It displays the percentage of total variance explained by each factor calculated from estimating the

[25] If 2003, when SREs temporarily increase, is instead compared to 2007 the difference is still very significant.

unconditional and conditional models on ownership subsamples (i.e., 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.[26] SREs are most important for private domestic (16.2%) and collective firms (10.6%) and least important for SOEs (2.5%). The effects are in between for foreign firms (4.5%).[27, 28]

High SREs for private domestic firms is consistent with their intense focus on profits due to less government involvement and more powerful performance incentives. The converse is consistent with low SREs for SOEs. SREs are in between these two extremes for collectives, consistent with their facing intermediate profit motives due to government involvement and management incentives that lie between the two extremes. Foreign private firms (including MNCs) have lower SREs than private domestic firms. Both face similar levels of government involvement and use similar incentive schemes but foreign firms are less tied to a location.

In summary, although firms of different ownership types face the same institutions within a subnational region, their differing endowments result in differing constraints. This yields different firm objectives and levels of SREs across ownership types.

[Insert Table 4 about here]

Graph 3 shows SRE dynamics over time for each ownership subsample except for HMT firms.[29] The graph displays the percentage of total variance explained by the subnational region factor based on year-by-year estimates of the unconditional model (Equations (4)) but omitting

[26] Estimating standard errors for the smallest ownership subsample (foreign firms) would require approximately 467 gigabytes of memory in the MIXED procedure based on SAS Institute (2015: 6168).
[27] The point estimate for foreign firms differs from that for Japanese MNCs operating in China (12.9%) (Chan *et al.*, 2010: 1233). However, our sample of foreign firms differs by including MNCs headquartered in other countries besides Japan and firms operating only in China that are owned by foreigners.
[28] Applying Equation (5), formal tests of the differences between the SRE random effects for each of the ownership types are extremely significant. The test statistics are: private domestic versus collectives (1,001.8), collectives versus private foreign (2,009.0), and private foreign versus SOE (116.8). The test statistic follows a standard normal distribution.
[29] SREs as a percentage of total variance increase 7.5 percentage points over the sample period for HMT firms.

the unidentified ownership factor. SREs for private domestic firms increase the most (by 9.6 percentage points) over the sample period followed by collectives (6.2 percentage points) and then foreign firms (3.5 percentage points).[30] SREs decline for SOEs over the sample period (by 1.8 percentage points) although the difference is not significant (test statistic of 1.9 using Equation (5)). Thus, SREs increase most for firms most exposed to market forces and remain the same for those least exposed. This is consistent with endowments interacting with local environmental changes over time in ways that lead to the most disparate outcomes across locations for firms most exposed to market forces and remaining roughly the same for those most insulated.

Aggregate SREs become more important over time both because they increase in importance for most ownership types (all except for SOEs) and because private domestic firms comprise a larger fraction of firms and SOEs a smaller fraction over time. In 1998, 15.0% of firms are private domestic firms increasing to 65.2% in 2007 while SOEs decline from 31.1% to 5.0%.

[Insert Graph 3 about here]

DISCUSSION

Theoretical and practical implications

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, the profit divergence across China's subnational regions should continue into the future with greater divergence for ownership types most exposed to market forces. Given

[30] These increases are all extremely significant. Applying Equation (5), the test statistics for the differences between the SRE random effects in 2007 versus 1998 are: private domestic (553.1), collectives (433.8), and private foreign (342.7). The test statistic follows a standard normal distribution.

this, our results have three main theoretical and practical implications for firm strategies during periods of incremental, not sudden, change.

First, our results suggest that firms choosing where to locate must not only understand current institutions, industry structures, and firm endowments but also forecast their future directions. If no major negative shocks are expected these will exhibit a high degree of path dependence making a forecast feasible – a continuation of the pre-existing trend. The firm can use the historical antecedents of local institutions, industrial structure, and firm resources to predict this direction. From a practical standpoint, location is becoming more important over time. MNCs must consider this as they decide where to invest in developing and globalizing economies and which firms to include in their value chain.

Second, significant SRE differences across ownership types suggest that the interaction between institutions and firm endowments plays a critical role in firm profits. Although a firm and its competitors face the same institutions, their competitive positions can differ due to differences in institutional access that result from systematic differences in ownership-specific endowments. This also lends additional theoretical support to the existence of firm heterogeneity under both the resource- and institution-based views (Oliver, 1997). From a practical standpoint, this implies that a firm's performance will be heavily influenced by its competitors' types and it must consider the ownership and governance structures of competitors when assessing how local institutions will affect its profits. Also, an MNC's success depends on the locations and ownership types of other firms in its value chain. Our results that variation in profits is greater for private firms than for SOEs means that MNCs should exercise additional caution and incur greater costs in selecting private firms as partners compared to SOEs because the expected cost of a mistake is higher with the former. It also means that high-performing private firms have

greater negotiating leverage vis-a-vis low-performing ones while leverage among SOEs will be more uniform.

Third, economic development and globalization can alter the trajectory of SREs for specific ownership types differently over time depending on how their respective endowments affect institutional access. From a practical standpoint, our results indicate that firms must assess how its access and that of competitors with which it interacts will change over time according to their type. This implies that it is important for MNCs to consider not just how underlying institutions evolve as an economy develops and globalizes but also how institutional access for each ownership type with which it interacts in its value chain evolves. If no major negative shocks are expected, a forecast is feasible based on the historical endowments of each ownership type. A firm can potentially alter its access to improve its competitive position without altering local institutions in ways that might benefit competitors. Given institutional path dependence, analysts predicting future industry profitability should consider current ownership-type mix.

Our results also have practical implications for specific ownership types. Location choice is a crucial decision not just for MNCs and is most important for private firms that are most exposed to market forces. SREs are least important for SOEs consistent with their being most insulated from market forces. Location plays an intermediate role for foreign firms possibly because some of these are MNCs who shift profits across countries for tax or strategic reasons or because their flexibility in location choice insulates them from local constraints.

Limitations and future research

There are five main areas of future research suggested by our study. First, we have identified possible underlying reasons for increasing SREs. Future work could pin down the precise mechanisms. For industry-based reasons this could be done by interacting location and industry

effects but would require a setting with fewer regions and industries to make identification feasible. Identifying the resource-based reasons would require a different estimation approach; for example, by measuring dimensions of firm resources at the regional level over time and relating them to the changing SREs.

Second, since we identify different SRE dynamics for different ownership types, future work could investigate how the types an MNC interacts with affects the sources of its performance, in particular SREs. For example, 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 (as buyer, supplier, complementor, etc.) with other firm ownership types in the supply chain affect SREs? This would require identifying the nature of connections between MNCs and other firms.

Third is the sample and generalizability of our results. We find that SREs increase over time even as China develops and globalizes rapidly. This raises the question of whether this would apply to other economies – particularly smaller and less diverse. It would be useful to also investigate the relationship between development and SREs in more developed countries.

Fourth, our sample does not include a major negative shock that could trigger dramatic institutional change. It would be useful to examine SRE dynamics before and after such an event (e.g., the 2008 global financial crisis or COVID-19). If large enough, negative shocks may interrupt the path dependence of institutions or even reverse SREs' pre-existing trend.

Fifth, it would be useful to test the relationship between ownership and SREs in other contexts. Does the relative unimportance of location for SOEs in China extend to other countries? This is a critical question as government-controlled firms account for a significant fraction of output.

Does location's importance for private firm performance extend to other countries and what is the underlying cause?

Besides these five areas, our results raise some miscellaneous questions. Our sample includes only manufacturing firms. This raises the question of how SRE dynamics would compare in service industries. Since services tend to be more local in scope we might expect greater effects. Industry effects play a minor role in explaining firm performance in our setting 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. Like previous papers, we find yearly effects explain relatively little of firm performance. This suggests examining higher-frequency data to see if this is due to data aggregation.

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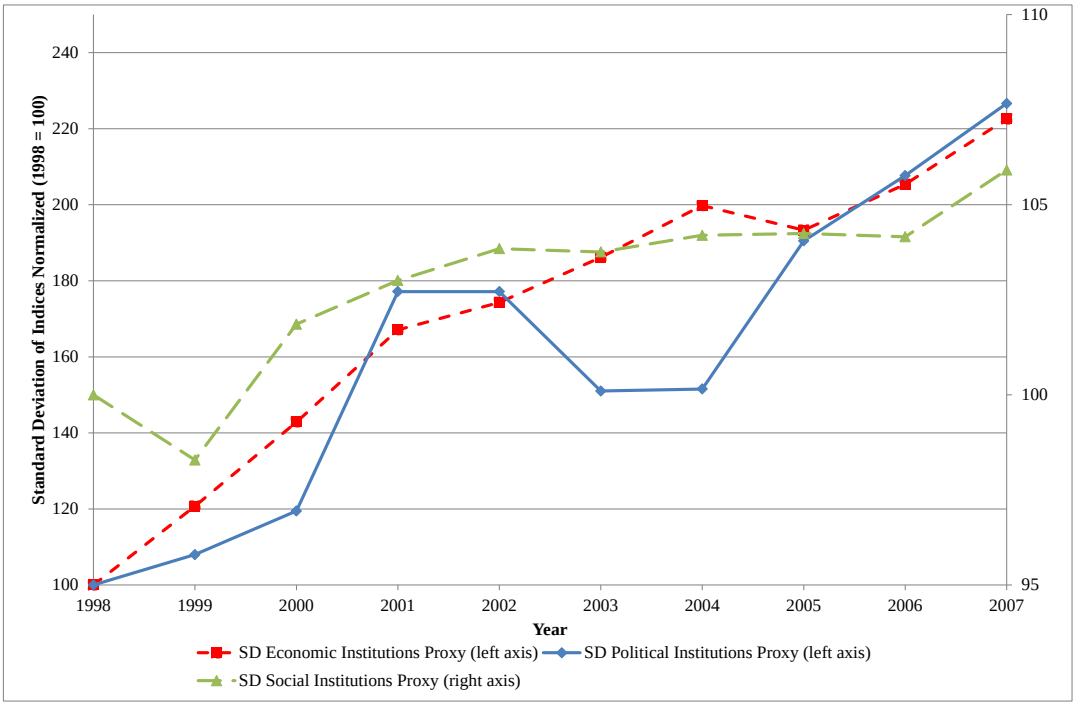
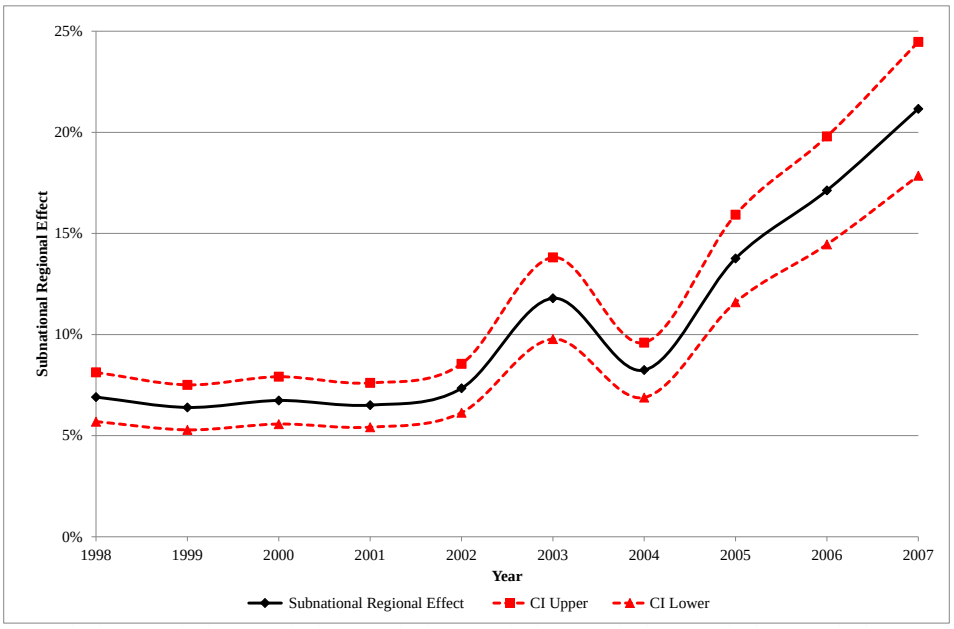
Graph 1 **Standard deviation of institutional indices and proxies for China 1998 to 2007**



Standard deviation of sub-index 4 (development of factor markets) and indicator 1c (government interventions in firms) of the Marketization Index based on Fan, *et al.* (2007) across provinces of China both normalized to 100 in 1998. Standard deviation of percentage minority in 20 of China's provinces based on *China Statistical Yearbook* 1999 – 2008 normalized to 100 in 1998.

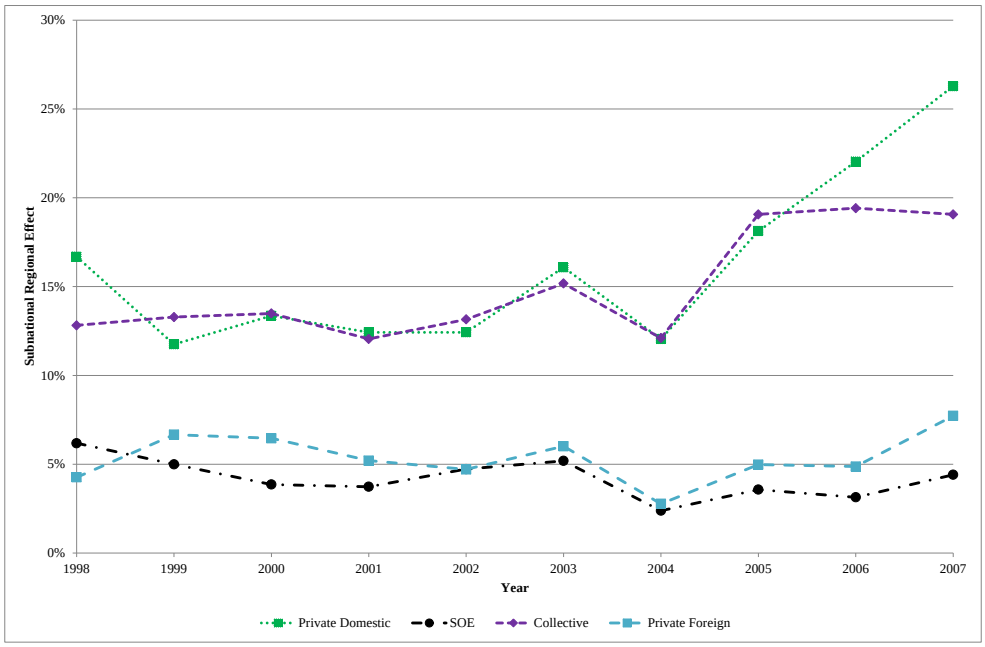
Graph 2 **HLM estimates of subnational regional effects on operating margins for manufacturing firms in China estimated year-by-year from 1998 to 2007**



Number of Subnational Regions									
1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
346	346	344	343	343	333	336	342	345	339

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.

Graph 3 **HLM estimates of subnational regional effects on operating margins for manufacturing firms in China estimated in ownership type subsamples from 1998 to 2007**



Percentage variance explained by subnational region factor in HLM estimates of return on assets for manufacturing firms in China based on year-by-year, ownership type subsample estimations (Equations (4) in the text but without unidentified ownership random effect).

Table 1 **Descriptive statistics for sample of Chinese manufacturing firms 1998 to 2007**

	N	Mean	Standard Deviation	Min	Max
Return on Assets	1,116,722	0.070	0.184	-6.217	55.043
Return on Assets by Year:					
Year 1998	66,590	0.027	0.120	-2.287	4.746
Year 1999	70,726	0.034	0.119	-2.106	5.012
Year 2000	70,244	0.043	0.121	-1.866	5.708
Year 2001	86,292	0.044	0.159	-2.298	30.033
Year 2002	94,549	0.051	0.218	-2.007	55.043
Year 2003	71,784	0.073	0.141	-2.662	6.221
Year 2004	138,715	0.066	0.164	-5.305	8.414
Year 2005	169,635	0.079	0.189	-6.217	11.601
Year 2006	179,152	0.091	0.198	-2.885	9.581
Year 2007	169,035	0.108	0.230	-5.147	18.068
Return on Assets by Ownership Type:					
State-Owned Enterprises	138,223	0.007	0.130	-3.294	30.033
Collectives	169,870	0.081	0.199	-2.182	18.068
Private Domestic	555,486	0.089	0.184	-2.335	14.002
Hong Kong/Macau/Taiwan	127,530	0.046	0.134	-3.851	11.601
Private Foreign	125,613	0.065	0.229	-6.217	55.043

Summary statistics for all firms in the sample.

Table 2 **HLM estimates of operating margins for manufacturing firms in China between 1998 and 2007**

	(1)	(2)	(3)	(4)
			Conditional Model	
Fixed Effects			Coefficient	
Intercept			0.02716 ***	
			(0.00657)	
Trend			0.00437 ***	
			(0.00004)	
	#	*Unconditonal Model*		% of Total
Random Effect	Categ.	Variance (x100)	Variance (x100)	Variance
Year	10		0.010 ***	5.147% ***
			(0.000)	(0.047%)
Firm	331,182	0.640 ***	0.359 ***	46.521% ***
		(0.022)	(0.022)	(1.594%)
Ownership	5	0.031 ***	0.020 ***	2.261% ***
		(0.005)	(0.004)	(0.381%)
Subnational Region	358	0.147 ***	0.100 ***	10.687% ***
		(0.015)	(0.013)	(1.076%)
Industry	525	0.027 ***	0.020 ***	1.927% ***
		(0.008)	(0.007)	(0.602%)
Error		0.531 ***	0.460 ***	33.457% ***
		(0.016)	(0.015)	(1.060%)
Total		1.376		
Sample Size			1,116,722	

HLM estimates of return on assets for full sample of Chinese manufacturing firms in years 1999 through 2007. 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 random effects variances 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. * = 10% significance, ** = 5% significance, *** = 1% significance for a one-sided t-test.

Table 3 Wald tests of differences in subnational regional effects between years

	(1) 1999 vs. 1998	(2) 2000 vs. 1999	(3) 2001 vs. 2000	(4) 2002 vs. 2001	(5) 2003 vs. 2002	(6) 2004 vs. 2003	(7) 2005 vs. 2004	(8) 2006 vs. 2005	(9) 2007 vs. 2006
Difference	-0.00004 ***	0.00006 ***	0.00001 ***	0.00011 ***	0.00073 ***	-0.00036 ***	0.00099 ***	0.00076 ***	0.00123 ***
Wald statistic	(45.981)	(21.032)	(9.021)	(106.424)	(1209.262)	(661.132)	(1245.637)	(232.989)	(192.602)

Difference in subnational-region random effects variances between the two years on the top row and Wald test statistic for significance of difference between the two years on the secondrow. The parameter estimates are based on year-by-year estimates of Equations (4) in the text. The test statistics are based on Equation (5) in the text and are distributed as a standard normal distribution. * = 10% significance, ** = 5% significance, *** = 1% significance for a one-sided t-test.

Table 4 HLM estimates of operating margins for manufacturing firms in China between 1998 and 2007 by ownership type

	(1) SOEs	(2) Collective	(3) Private Domestic	(4) Private Foreign
Random Effects (% Variance)				
Year	8.140% ***	6.338% ***	4.057% ***	4.000% ***
	(0.072%)	(0.054%)	(0.042%)	(0.048%)
Firm	55.476% ***	50.433% ***	44.325% ***	47.765% ***
	(2.906%)	(1.326%)	(1.316%)	(1.672%)
Subnational Region	2.463% ***	10.633% ***	16.147% ***	4.537% ***
	(0.752%)	(0.898%)	(1.157%)	(0.737%)
Industry	5.852% ***	3.473% ***	1.968% ***	1.857% ***
	(1.703%)	(0.660%)	(0.416%)	(0.619%)
Error	28.070% ***	29.123% ***	33.502% ***	41.841% ***
	(1.689%)	(0.852%)	(1.042%)	(1.098%)
Sample Size	138,223	169,870	555,486	125,613

Percentage variance explained by factors in HLM estimates of return on assets in ownership sub-samples of Chinese manufacturing firms in years 1998 through 2007 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. * = 10% significance, ** = 5% significance, *** = 1% significance for a one-sided t-test. Sample sizes do not sum to full sample because HMT firms are not shown.

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

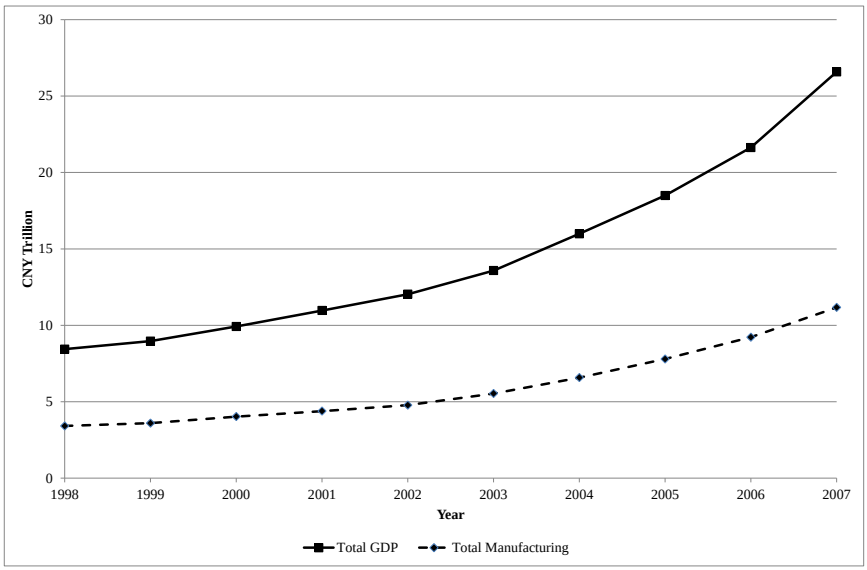
Online Appendix A
Validation Tests – China's Macroeconomic Environment

This appendix establishes that over time during the sample period China is rapidly:

A. Developing economically.
B. Developing institutionally.
C. Globalizing.
D. Becoming a more important part of global value chains.

Validation Test A: 1998 to 2007 is a time of rapid economic development in China.

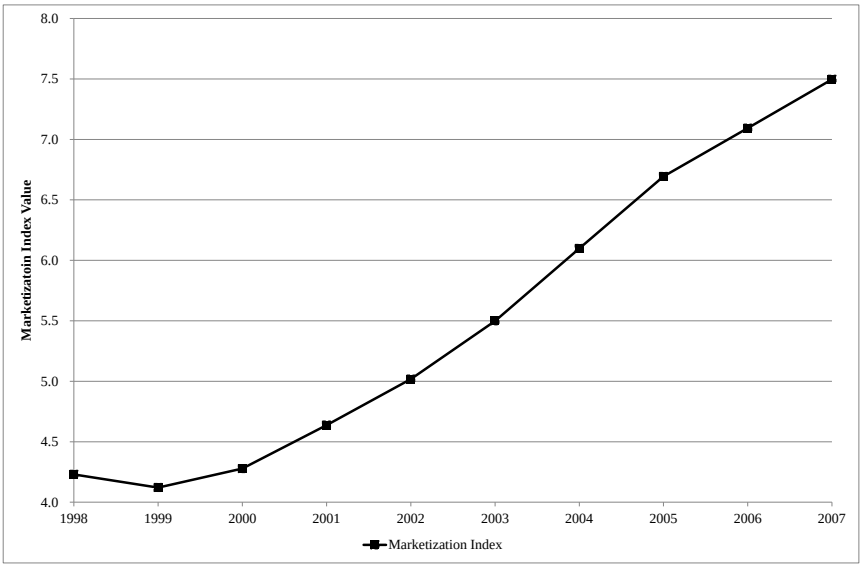
The solid line in the graph below plots China's aggregate GDP from 1998 to 2007 and the dashed line aggregate manufacturing output. The former increases 12.2% annually on average and the latter 12.6% consistent with rapid economic development in both total and manufacturing output.



China's GDP and manufacturing output in CNY trillion. Data from *China Statistical Yearbook* (2009).

Validation Test B: 1998 to 2007 is a time of rapid institutional development in China.

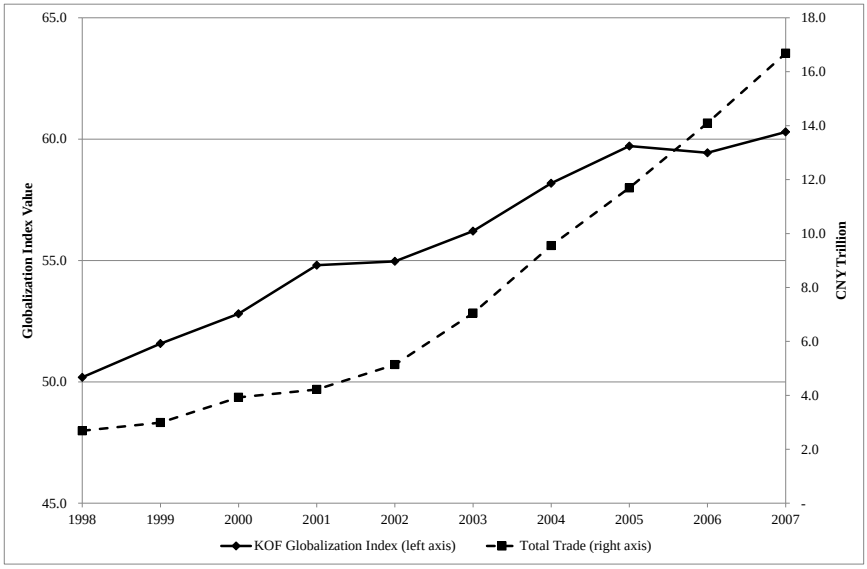
The graph below shows the marketization index constructed in Fan *et al.* (2007) averaged across all of China's provinces in each year. The index increases from 4.2 in 1998 to 7.5 in 2007 consistent with rapid institutional development during this time.



Marketization Index based on Fan, *et al.* (2007) mean value across provinces of China.

Validation Test C: 1998 to 2007 is a time of rapid globalization in China.

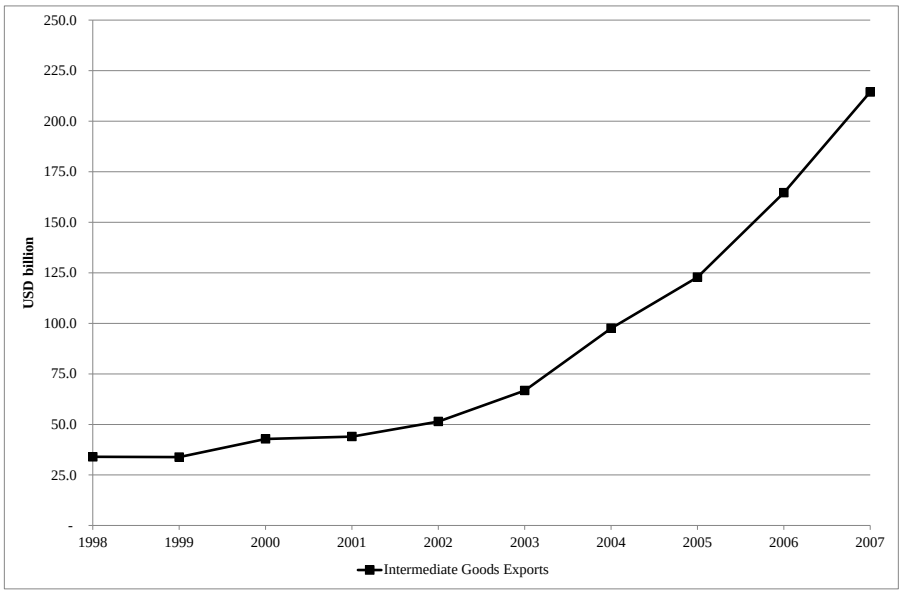
The solid line in the graph below shows the globalization index constructed in Gygli *et al.* (2018). The index for China increases from 50.2 to 60.3 over the sample period consistent with increased globalization. The dashed line shows the sum of China's imports and exports in each year. Total trade activity increases 20.0% annually on average during this time also consistent with rapid globalization.



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). China's total trade (imports plus exports) in CNY trillion (right axis). Data from *China Statistical Yearbook* (2009).

Validation Test D: from 1998 to 2007 China rapidly becomes a more important part of global value chains.

The graph below plots China's export of intermediate products from 1998 to 2007. The measure increases 20.2% annually on average during this time consistent with rapidly increased participation in global value chains.



China's intermediate goods exports in USD billion. Data from *World Integrated Trade Solution (WITS)* database compiled by the World Bank.