Do institutions not matter in China? Evidence from manufacturing enterprises

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Abstract

This study addresses the apparent puzzle that China achieved spectacular economic performance despite weak institutions. From a World Bank survey of 1,566 manufacturing enterprises in 18 Chinese cities, we investigated whether property rights protection mattered for enterprise performance. We found that property rights protection had a positive and statistically significant impact on enterprise productivity. The two-step GMM estimation and the difference-in-difference estimation further established the causal impacts of property rights protection on enterprise productivity. These findings were robust to various controls, outliers, and alternative measures of productivity and property rights protection.

Key Words: Institutions, Property Rights, Productivity, External Dependence, Entry Barriers, China

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1. Introduction

Numerous cross-country and within-country studies have shown that institutions are fundamental to economic performance (Besley, 1995; Knack and Keefer, 1995, 1997; Mauro, 1995; Hall and Jones, 1999; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999; and Acemoglu, Johnson, and Robinson, 2001, 2002). Indeed, the World Bank and International Monetary Fund have stressed the importance of sound institutions in the growth of developing economies (Carothers 2006; *Economist*, March 15, 2008).

However, the record of the Chinese economy over the past thirty years seems to contradict the scholarly finding that institutions are essential to economic performance. Until recently, China provided little formal protection of private property, and its legal system was far from independent (Blanchard and Kremer, 1997; Rodrik, 2004a and 2004b; Allen, Qian, and Qian, 2005; *Economist*, March 15, 2008). Nevertheless, China's economic performance has been nothing less than spectacular.

Did institutions really not matter for the performance of the Chinese economy? One possible explanation is that institutional quality varied widely across China (Du, Lu, and Tao, 2008; World Bank, 2008; Lu and Tao, 2009a), and that China's economic development was concentrated in the coastal regions, where institutions are reasonably good. Another possible explanation is that the importance of institutions varied across industries and that China's economic development was concentrated among industries for which institutions are less important. These two explanations might possibly explain the apparent contradiction between the poor state of China's institutions and the country's spectacular economic performance at the macro level.

In a recent study, Fang and Zhao (2007) addressed the China puzzle (i.e., that institutions were not important for economic performance) in a cross-section of 47 Chinese cities. They found that property rights did have a significant effect on income, as measured by log GDP per capita. They used city-level measures of property rights from surveys by Ni et al. (2004, 2005) instrumented by a historical measure, viz., lower primary enrolment in missionary schools in 1919.

Here, using detailed data at the enterprise level, we were able to go further and address the China puzzle at the microeconomic level. Specifically, we investigated

whether enterprises enjoying better property rights protection exhibited better performance.[1]

We drew on the *Survey of Chinese Enterprises*, conducted by the World Bank with the Enterprise Survey Organization of China in early 2003.[2] The data set covered 1,566 enterprises drawn from 9 manufacturing industries and 18 cities. To measure enterprise performance, we used labor productivity, i.e., the logarithm of output per worker of an enterprise, and total factor productivity estimated using either the panel fixed-effect method or the methodology developed by Levinsohn and Petrin (2003). Our focus on productivity was motivated by Acemoglu, Johnson, and Robinson (2001), who studied the impact of institutions on income per capita, and interpreted the results as providing implications for the impact of institutions on economic growth.

Following Johnson, McMillan, and Woodruff (2002) and Cull and Xu (2005), we measured the degree of property rights protection as the perceived share of government officials oriented toward helping rather than hindering business. A key economic institution is constraints on expropriation by government and elites, i.e., property rights protection (North 1991). Moreover, property rights protection has been shown to be more important than other economic institutions (e.g., contract enforcement) in determining economic performance (Johnson, McMillan, and Woodruff, 2002; Acemoglu and Johnson, 2005).

We found a positive and statistically significant relation between property rights protection and productivity at the enterprise level. In order to conclude that this relation was indeed due to a causal impact, that stronger protection of property rights increased productivity, we ruled out a number of alternative explanations and conducted various robustness checks.

First, we checked that our finding was not driven by some omitted variables. We introduced a host of covariates related to CEO and enterprise characteristics used in

[1] Our study differed from that of Fang and Zhao (2007) in two important ways: (i) our study was at the level of individual enterprises rather than cities; and (ii) we applied three estimation methods – ordinary least squares with multiple controls, the two-step generalized method of moments with two alternative instruments, and the Rajan and Zingales (1998) difference-in-difference method of exploiting differences in external dependence and entry barriers.

[2] The data set has recently been used by Cull and Xu (2005), Ayyagari, Demirgüç-Kunt, and Maksimovic (2007), and Dong and Xu (2009), among others.

previous research, as well as industry and city dummies. Our result was robust to the inclusion of these controls. It is also important to note that the magnitude of impact of property rights protection on productivity was lower with the inclusion of city dummies, which supports our earlier conjecture that part of the China puzzle could be explained by the concentration of growth in particular geographical areas with better institutions.

Second, we worried that our finding might still be biased due to some unobserved characteristic correlated with both property rights protection and productivity. To address such potential endogeneity, we used the two-step Generalized Method of Moments (GMM) estimation with two alternative instruments for property rights, viz., the average assessment of the degree of property rights protection by enterprises of other industries located in the same city, and the logarithm of population in the respective city around 1918-19. The two-step GMM estimates reinforced our findings that property rights protection had a positive and significant causal impact on productivity.

Third, we applied the difference-in-difference method à la Rajan and Zingales (1998). Following Blanchard and Kremer (1997) and Rajan and Subramanian (2007), we used the number of suppliers to measure, for each enterprise, its reliance on the external environment. We found that enterprises which were more reliant on the external environment (in the sense of using more external suppliers) exhibited relatively higher productivity in cities with stronger property rights protection. In addition, following Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002), we used the number of days to register a new business to measure, for each enterprise, the level of entry barriers. We found that enterprises which faced lower entry barriers exhibited relatively higher productivity in cities with stronger property rights protection.

In further robustness checks, we explored alternative measures of productivity and property rights protection, used quantile regressions to deal with possible impact of outlying observations, and investigated whether the results were biased due to the inclusion of state-owned enterprises.

The remainder of the paper is structured as follows. Section 2 introduces the data and variables for the empirical study, while Section 3 presents the main results. The paper concludes with Section 4.

2. Data and Variables

Our empirical analysis drew on data from the *Survey of Chinese Enterprises* (SCE), conducted by the World Bank in cooperation with the Enterprise Survey Organization of China in early 2003. For balanced representation, the SCE selected 18 cities from five regions of China: Northeast – Benxi, Changchun, Dalian, and Haerbin; Coastal region – Hangzhou, Jiangmen, Shenzhen, and Wenzhou; Central China – Changsha, Nanchang, Wuhan, and Zhengzhou; Southwest – Chongqing, Guiyang, Kunming, and Nanning; and Northwest – Lanzhou and Xi'an.

In each city, the SCE randomly sampled 100 or 150 enterprises from 9 manufacturing industries (garment and leather products, electronic equipment, electronic parts making, household electronics, auto and auto parts, food processing, chemical products and medicine, biotech products and Chinese medicine, and metallurgical products), and 5 service industries (transportation service, information technology, accounting and non-banking financial services, advertisement and marketing, and business services). The total number of enterprises surveyed was 2,400.

The SCE comprised two parts. One was a general questionnaire directed at the senior management seeking information about the enterprise, such as innovation, product certification, marketing, relations with suppliers and customers, access to markets and technology, relations with government, labor, infrastructure, international trade, finance and taxation, and the CEO and board of directors. The other questionnaire was directed at the accountant and personnel manager, covering ownership, various financial measures, and labor and training. Most of the information from the first part of SCE pertained to the survey year – 2002, while the second part pertained to the period 2000-2002.

We focused on manufacturing enterprises, as they generally have more complicated supply chains than those of service enterprises, and furthermore their productivity is easier to measure and interpret. The SCE covered 1,566 manufacturing enterprises. We were concerned with the impact of institutions on the productivity of the enterprise. One measure was labor productivity, which was calculated as the logarithm of total output divided by total employment.[3] An alternative measure would be total

[3] Note that output was a revenue-based measure rather than quantity-based. In order to recover the quantity-based measure of output, we need the enterprise-level price to deflate the revenue.

factor productivity (TFP), estimated using either the panel fixed-effect method or the Levinsohn and Petrin (2003) methodology. As information about material inputs was fragmentary (missing in more than 25% of the sample), we used labor productivity for the main analysis, and total factor productivity as a robustness check.

Table 1 reports summary statistics of the data, while Table 2 reports bivariate correlations. Referring to Table 1, the mean value of labor productivity was 4.322 thousand Yuan per worker (±1.562), TFP (estimated using the fixed-effect method) was 4.151 (±1.077), and TFP (estimated using the Levinsohn and Petrin method) was 3.042 (±0.953).

-- Table 1 ---

-- Table 2 ---

According to North (1991), the economic institutions which are important for economic performance are those that constrain expropriation by government and elites, i.e., property rights protection.[4] To measure the degree of property rights protection, we followed the approach of Johnson, McMillan, and Woodruff (2002) and Cull and Xu (2005), who focused on the risk of expropriation through informal levies and extralegal payments to government agencies and related parties.[5]

Since enterprise-level prices are rarely available, a commonly-used way in the literature is to deflate the revenue-based output by the industry average price index. This procedure, however, introduces omitted price bias (Klette and Griliches, 1996). One way to address this problem is to assume a constant elasticity of substitution demand function and include industry total output as an additional control (Klette and Griliches, 1996; De Loecker, 2008). Accordingly, in most of our regressions, we included industry dummies, which, in a cross-section analysis, was essentially similar to the method of recovering the quantity-based output.

[4] Economic institutions also include institutions supporting private contracts, i.e., contract enforcement. However, various studies have shown that property rights protection is more important than contract enforcement in determining economic performance (Johnson, McMillan, and Woodruff, 2002; Acemoglu and Johnson, 2005).

[5] Note that the violation of property rights protection is not identical to corruption. Extralegal payments and informal levies are often imposed for undertaking some public projects or financing some local events, though they could also be disguises for government officials to enhance their private benefits (i.e., a form of corruption). Indeed, the correlation between our measure of property rights protection and a corruption index (measured as the ratio of entertainment expenses over sales following Cai, Fang, and Xu, 2009) is negative, albeit small in magnitude (with a correlation coefficient of 0.0259), implying that property rights protection and corruption are not identical. Moreover, our regression results are robust to the inclusion of this index of corruption as a control.

The SCE included the following question to the senior management, "Among the government officials that your enterprise regularly interacts with, what is the share that is oriented toward helping rather than hindering enterprises?"[6] Accordingly, we constructed the measure, *Property Rights Protection*, with responses varying from 0% to 100%, and mean value of 35.5% (±32.0%). In robustness checks regarding the measure of property rights protection, we used *Bureaucracy* as an alternative measure. It was the number of days the manager spent on dealing with government regulators deflated by total output, with mean 4.3% (±94.7%).

As a preliminary, we verified that the degree of property rights protection was indeed grounded in geographical differences. Appendix A reports a regression of *Property Rights Protection* on industry and city dummies, along with a list of control variables related to enterprise and CEO characteristics. Evidently, there was substantial and statistically significant variation in property rights protection across Chinese cities. Apparently, however, there was no significant systematic variation in property rights protection across industries.

In the empirical analysis, we also controlled for other factors that might possibly affect enterprise productivity, including enterprise and CEO characteristics as well as industry and city dummies. The enterprise characteristics included enterprise size (measured by the logarithm of employment in the previous year), enterprise age (measured by the logarithm of years of establishment up to the end of 2002), private ownership percentage (measured by the share of equity owned by parties other than government agencies), and skilled labor ratio (measured by the ratio of skilled labor in the total employment in the previous year). The CEO characteristics included measures of human capital – CEO education (years of schooling), CEO tenure (years as CEO), and deputy CEO previously (a dummy variable indicating whether the CEO had been the deputy CEO of the same enterprise before becoming CEO);[7] and measures of political capital – government cadre previously (a dummy variable indicating whether the CEO had previously been a government official), party member (a dummy variable indicating whether the CEO was a member of the Chinese Communist Party), and CEO government appointed (a dummy variable indicating whether the CEO was appointed by the

[6] Cull and Xu (2005) compared this measure with other measures of property rights protection used in the literature.

[7] Cull and Xu (2005) used these variables to investigate the impacts of property rights protection and finance on reinvestment rate.

government).[8] Finally, we included dummy variables for industry and city to account for possible differences in enterprise productivity across industries and cities.

In investigating the impact of property rights protection on enterprise productivity, the enterprise-level perception of property right protection should yield more precise estimates than the city-average perception. Enterprise-level productivity depends on various organizational and strategic decisions – including who to engage as investors and partners, whether to use capital or labor-intensive modes of production, how much to out-source the production of inputs, and whether to distribute through direct or indirect channels – all of which depend on the management's perception of property rights.

However, using an enterprise-level measure of property rights may introduce endogeneity in the form of omitted variables bias or reverse causality. For example, even with many controls included, there could still be some uncontrolled variables, such as favorable individual treatment, which correlate with both enterprise-level measure of property rights protection and enterprise performance. And it could also be possible that more productive enterprises have more resources, such as political connections, which lead to more secure de facto property rights protection.

To address these endogeneity issues, we applied two-step Generalized Method of Moments (GMM) estimation using two alternative instruments. One instrument was the average response by enterprises of other industries located in the same city to the SCE question regarding the degree of property rights protection. The other instrument was the logarithm of population in the respective city around 1918-19. We discuss the identification strategy using these instruments in Section 3.2.

As a further robustness check, we applied difference-in-difference estimation a la Rajan and Zingales (1998). First, we tested whether property rights protection had differential impacts on enterprises with different degrees of dependence on the external environment. Following Blanchard and Kremer (1997: 1116) and Rajan and Subramanian (2007: 323), we used the number of suppliers to operationalize reliance on the external environment.[9] An enterprise with more suppliers would have a more complex production system and supply chain, hence would be more reliant on the external environment. This measure showed substantial variation, with a mean value of

[8] Li, Meng, Wang, and Zhou (2008) used these variables to examine the impact of political connections on enterprise performance.

[9] Owing to data limitations, Blanchard and Kremer (1997) and Rajan and Subramanian (2007) used industry-level measures of reliance. By contrast, our measure was at the enterprise level.

42 (±199). Second, following McMillan and Woodruff (2002), we tested whether property rights protection had differential impacts on enterprises facing different levels of entry barriers. Following Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002), we used the number of days to register a new business to operationalize the level of entry barriers. This measure showed substantial variation, with a mean value of 8.817 (±11.811).

3. Empirical Analysis

3.1 Benchmark Results

To investigate the impact of property rights protection on enterprise productivity, we used the following basic specification:

$$y_{eic} = \mu + \alpha R_{eic} + \varepsilon_{eic}, \quad (1)$$

where y_{eic} is enterprise productivity (i.e., *Labor Productivity* and *Total Factor Productivity*) of enterprise, *e*, belonging to industry, *i*, and located in city, *c*; μ is a constant; R_{eic} measures the quality of property rights protection as reported at the enterprise level (i.e., *Property Rights Protection*); and ε_{eic} is an independently and identically distributed error with a normal distribution and mean zero. To deal with possible heteroskedasticity, we used standard error clustered at the industry-city level. [10]

Table 3, column (i), presents OLS estimates of specification (1). Property rights protection had a positive and statistically significant impact on labor productivity. To gauge the economic significance of this result, we calculated that a one standard deviation increase in property rights protection was associated with an increase of 0.511 x 0.320 = 0.164 in labor productivity or 3.8% relative to the mean labor productivity. This impact is reported in the last row of Table 3.

[10] The standard errors for micro-level data need to be adjusted for the possibility that error terms could be correlated within a cluster (Liang and Zeger, 1986). However, when the number of clusters is small (specifically, fewer than 42), the clustered standard errors could be misleading (e.g., Wooldridge, 2003, 2006a; Angrist and Pischke, 2009). As our study includes just 18 cities and 9 industries, we can not use the clustered standard errors at the city-level or industry-level. Instead, we use standard errors clustered at the industry-city level.

-- Table 3 ---

Do these results truly reflect the causal effect of property rights protection on labor productivity? An immediate concern is that the estimates could be biased owing to the omission of relevant variables. Then,

$$E(R_{eic} \cdot \varepsilon_{eic}) \neq 0. \quad (2)$$

To the extent that we can find a comprehensive set of control variables, X_{eic}, such that the residual error term, $\eta_{eic} \equiv \varepsilon_{eic} - X_{eic}' \cdot \gamma$, is not correlated with R_{eic}, then we can isolate the causal effect of property rights protection on labor productivity (Goldberger, 1972; Barnow et al., 1981). We specified, as controls, CEO characteristics (human capital and political capital), enterprise characteristics (enterprise size, enterprise age, private ownership percentage, and skilled labor ratio), industry dummies, and city dummies. Accordingly, the specification was:

$$y_{eic} = \mu + \alpha R_{eic} + X_{eic}' \cdot \gamma + \eta_{eic}. \quad (3)$$

Table 3, columns (ii)-(vi), reports the results. To avoid issues of multicollinearity and poor controls (Angrist and Pischke, 2009), we included the control variables in a stepwise fashion. Among enterprise characteristics, the coefficient of enterprise size was positive and significant in all specifications. Apparently, enterprises with larger workforces exhibited relatively higher labor productivity, suggesting the presence of economies of scale. This would be consistent with evidence of local protectionism within China (Young, 2000; Bai, Du, Tao, and Tong, 2004), which would result in production at sub-optimal scale.

The coefficient of enterprise age was negative and significant. Apparently, enterprises with longer history exhibited relatively lower labor productivity. This is consistent with the experience of China's economic reform that new firms drove economic development through creating jobs, supplying consumer goods, mobilizing savings, and ending the monopoly of state enterprises (McMillan and Woodruff, 2002).

The coefficient of skilled labor ratio was positive and significant. Apparently, enterprises with more skilled labor exhibited higher labor productivity. This is consistent with the finding on the importance of skilled labor in less developed countries (e.g., Acemoglu and Zilibotti, 2001), and the observed shortage of skilled labor in China (Asian Development Bank, 2003; Wang, 2006).

Among the CEO characteristics, the coefficient of CEO education was positive and significant, while the coefficient of government appointment was negative and significant in all specifications. Previous research into education and growth focused on the impact of the education of the workforce (e.g., Barro, 2001). The novelty of our result is the impact of the CEO's education on the overall productivity of the enterprise. The negative impact of government appointment is a phenomenon that would be unique to a transitional economy. It is consistent with the view that government appointment of CEOs is based on political considerations rather than managerial talent.

With respect to the central issue, the coefficient of property rights protection was positive and significant in all specifications, ranging from 0.245 to 0.448. Accordingly, we infer that our finding that property rights protection increased labor productivity was robust to the various controls.

It is important to note that the coefficient of property rights protection was about 21% lower with the inclusion of city dummies. This is consistent with our preliminary analysis, reported in Appendix A, that a substantial part of the variation of property rights protection across enterprises was due to variation across cities. It is consistent with our conjecture that part of the China puzzle (that institutions seem unimportant for economic performance) could be explained by the concentration of economic activities in geographic areas with better institutions.

3.2 GMM Estimation

While we included a comprehensive set of control variables, X_{eic}, it could still be possible that the residual error, η_{eic}, even including the controls X_{eic}, might be correlated with the index of property rights protection, R_{eic}, so that $E(R_{eic} \cdot \eta_{eic}) \neq 0$, in which case the estimates would be biased. To address this endogeneity issue, we applied the two-step GMM using two alternative instruments for property rights protection.

3.2.1 Instrumental Variable 1: Average Perceived Property Rights Protection Among Other Industries in Same City

Following the recent literature on empirical industrial organization (e.g., Berry, Levinsohn, and Pakes, 1995; Nevo, 2000, 2001), we first used the average response of

enterprises belonging to other industries and located in the same city to the SCE question regarding the degree of property rights protection as an instrument for the enterprise-level perception of property rights protection.

Note that with the inclusion of industry and city dummies, the only possible remaining omitted variables were at the industry-city level or individual enterprise-level. Thus, the average perceived property rights protection among enterprises belonging to other industries located in the same city should not be correlated with industry-city level or individual enterprise-level characteristics, implying the satisfaction of the exclusion restriction condition for two-step GMM estimation.

Meanwhile, the average perception of property rights protection among enterprises belonging to other industries located in the same city should be negatively correlated with the enterprise-level perception of property rights protection. With city dummies controlling for the absolute levels of property rights protection across different cities, the enterprise-level and other industry property rights variables are deviations from the city averages and so, should sum to zero. Intuitively, the level of property rights protection reflects the behavior of government officials and related parties, for example, the time and effort devoted by government officials to protecting private property. As the city dummies controlled for the total time and effort that government officials devoted to protecting private property across different cities, the inter-industry difference within a city reflected the allocation of time and effort across different industries within the city. Thus, since the officials' total time and effort is limited, it seems reasonable that if officials devoted more time or effort to one industry, then they would have less for other industries. In other words, the instrumental variable should be negatively correlated with the endogenous explanatory variable, and so, the relevance condition for the two-step GMM estimation is satisfied.

-- Table 4 ---

Table 4, columns (i)-(ii), reports the two-step GMM estimates. We included the various control variables -- CEO characteristics, enterprise characteristics, industry dummies, and city dummies in all estimates. Regarding the relevance condition for a valid instrument, the correlation between the instrument and the degree of property rights protection was negative and highly significant, consistent with the intuition presented above. Moreover, the Anderson canonical correlation LR statistic and the Cragg-Donald χ-statistic provided further support for the satisfaction of the relevance condition. We also

checked for a weak instrument, which was ruled out by the large Shea partial R^2 and the Cragg-Donald *F*-statistic.[11]

With respect to the central issue, the coefficient of property rights protection, instrumented by the average perceived property rights protection among enterprises belonging to other industries located in the same city, was positive and statistically significant. The coefficient was 1.331 (± 0.766), which was almost four times larger than the OLS estimate. Correspondingly, the estimated impact of a one standard deviation increase in property rights protection on labor productivity was 9.9% of the mean labor productivity, which was almost four times larger than the OLS estimate. Apparently, any bias due to endogeneity served to bias the coefficient of property rights protection *downward* rather than upward. Another possibility is that there were measurement errors which drove the OLS estimates downward to zero.

To provide further support on the satisfaction of the assumption that the instrumental variable was not correlated with the residual error, η_{eic}, we conducted a test following Acemoglu, Johnson, and Robinson (2002). The premise for the test is that, if the instrumental variable affects labor productivity only through property rights protection, then instrumental variable should not have any significant impact on labor productivity conditional on property rights protection. Indeed, as shown in Table 4, columns (iii)-(iv), the instrumental variable had a negative and significant impact on labor productivity, but the effect vanished with the inclusion of property rights protection.

3.2.2 Instrumental Variable 2: City Population Around 1918-19

Motivated by the literature on economic institutions (e.g., La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997, 1998; Acemoglu, Johnson, and Robinson, 2001, 2002), we developed a historical proxy, $R_{c,history}$, for the general level of property rights protection in each city. A historical proxy should not be correlated with unobserved characteristics of enterprises in 2002, and hence should satisfy the exclusion condition, i.e., $E(R_{c,history} \cdot \eta_{eic}) = 0$.

[11] The F-statistic was significantly above the critical value of 10 (Staiger and Stock 1997).

The historical proxy of the city's property rights protection would arguably be correlated with the contemporary level of property rights protection, i.e., $E(R_{c,hisotry} \cdot R_c) \neq 0$. A large body of empirical work has shown that differences in economic institutions across countries persist over time (Young, 1994; Acemoglu, Johnson and Robinson, 2001, 2002; La Porta, Lopez-de-Silanes, and Shleifer, 2008).[12] Some reasons include the persistence of culture, beliefs, and ideologies across generations (e.g., Bisin and Verdier, 2000; Dohmen, Falk, Huffman, and Sunde, 2006; Tabellini, 2007a, 2007b, 2009).

Specifically, with regard to China, there is also evidence that geographical differences in economic institutions have persisted over time, despite radical changes in the political regime, beginning with the collapse of the Qing Dynasty in the early 20th century. For example, areas with higher industrial and commercial activities in the pre-Communist era were faster and more effective in market reform in recent years (e.g., Zhu, 2001; Fu, 2003). And areas with larger population during the Qing Dynasty continue to prosper in the Communist era (e.g., Li and Lu, 2009).

To proxy for the historical level of city's property rights protection, we used the logarithm of population in the respective city around 1918-19. This is similar to the instrument used by Fang and Zhao (2007), viz., lower primary enrolment in missionary schools. Absent systematic national censuses, our source of data on city populations was a study conducted by the China Continuation Committee, an organization of Protestant churches and missions (Special Committee on Survey and Occupation of China Continuation Committee, 1987). The Committee based its estimates on various sources, including reports by police commissioners and local missions, the 1910 census by the Ministry of the Interior, and a 1919-20 census by the Post Office. Given the fragmentary state of information on China's population (Chen 1947; Ho 1959), we believe that the

[12] "[A]lthough we commonly described the independent polities as 'new states', in reality they were successors to the colonial regime, inheriting its structures, its quotidian routines and practices, and its more hidden normative theories of governance" (Young, 1994: 283). Acemoglu, Johnson, and Robinson (2001) discussed three mechanisms that would result in institutional persistence: (i) it was costly to set up institutions that restricted government expropriation; (ii) the formation of institutions was influenced by the elites which were quite persistent; (iii) the established institutions would induce irreversible investments that were complementary to the existing institutions, which made people more willing to support those institutions. La Porta, Lopez-de-Silanes, and Shleifer (2008) argued that cultures, religions and ideologies are likely to persist over time despite regime changes.

China Continuation Committee study is a reasonable source for the population of Chinese cities at the time.

China was besieged by foreign powers in the late 1800s and early 1900s. During the same period, it was beset by civil war. Absent a strong central government and in the face of financial difficulties, expropriation of private properties was widespread (Wu, 1955; Li, Li, Li, Yang, and Gong, 1994; Dong, Zhang, and Jiao, 2000). Given geographical mobility, especially among wealthy people, the population of a city in 1918-19 could reasonably reflect the state of property rights protection at that time, with a larger population indicating better property rights protection. Appendix B provides the detailed rationale for this proxy.

-- Table 5 ---

Table 5, column (i), reports the two-step GMM estimates using the logarithm of population in the city around 1918-19 as the instrument for property rights protection. We included the various control variables -- CEO characteristics, enterprise characteristics, industry dummies, and city characteristics in all estimates. With regard to the relevance condition for an effective instrument, the logarithm of population in the city around 1918-19 was highly correlated with the degree of property rights protection. The condition was further confirmed by the Anderson canonical correlation LR statistic and the Cragg-Donald χ-statistic. Any concern about a weak instrument was ruled out by the large Shea partial R^2 and the Cragg-Donald F-statistic.

The two-step GMM estimated coefficient of property rights protection, as instrumented by the logarithm of population in China's respective city around 1918-19, was 4.787 (± 1.487), which was positive and statistically significant. It was even larger than the estimates using the average perceived property rights protection by enterprises of other industries located in the same city as the instrument.

The identification strategy using the logarithm of population in the city around 1918-19 as the instrumental variable relied on the exclusion restriction, specifically, the assumption that the instrument should not affect labor productivity through channels other than property rights protection. Note that the historical variable was not expected to be correlated with enterprise-level characteristics in 2002. However, since the instrumental variable was at the city-level, precluding the use of city dummies, there could be some city-level omitted variables through which the instrumental variable might affect labor productivity. While we might not be able to check the exclusion restriction

assumption with certainty as the data did not allow us to control for all the city-level variables, we investigated several prominent city-level factors.

First, the number of population in the city around 1918-19 may be negatively determined by the severity of crime rate around that time, which may persist over time. To control for this possibility, we included a proxy for the contemporaneous crime rate, specifically, the average losses due to theft among other enterprises situated in the same city.

Second, the population in the city around 1918-19 might be correlated with clustering of suppliers in the city at that time, which may persist over time. To control for this possibility, we included a proxy for the contemporaneous clustering of suppliers in each city, which was measured by the average ratio of suppliers located in the same city over the total number of suppliers among other enterprises situated in the city.

Third, the population in the city around 1918-19 might reflect the behavior of government officials and elites towards protection of the local economy in the city at that time, which may persist over time. To control for this possibility, we included a proxy for the contemporaneous degree of local protectionism in each city, which was measured by the average ratio of state ownership among other enterprises situated in the city following Bai et al. (2004) and Lu and Tao (2009b).

We, stepwisely, included the above three city-level variables, along with the controls for CEO and enterprise characteristics, industry dummies and city characteristics. Table 5, columns (ii)-(iv), reports the results. It is clear that our central findings regarding the importance of property rights protection for labor productivity was robust to the inclusion of these additional controls.

Overall, the two-step GMM estimates reinforced the OLS estimates. Our conclusion is that the relation between stronger property rights protection and higher labor productivity was not biased by endogeneity.

3.3 Difference-in-Difference Estimation

As an alternative way to check the causal impact of property rights protection on enterprise productivity, we applied the difference-in-difference estimation strategy pioneered by Rajan and Zingales (1998). As argued by Rajan and Zingales (1998), the

advantage of the difference-in-difference estimation lies in its ability to establish causality by focusing on the details of theoretical mechanisms through which property rights protection may affect enterprise productivity.

Our first hypothesis is that the impact of property rights protection on firm productivity varies across enterprises with different degrees of reliance on external environment. The impact of poor protection of private property would be higher on an enterprise with a greater reliance on the external environment. Thus, it is reasonable to expect that enterprises which are more reliant on the external environment should exhibit relatively higher labor productivity in cities with stronger property rights protection.

Following Blanchard and Kremer (1997) and Rajan and Subramanian (2007), we used the number of suppliers to measure, for each enterprise, its reliance on the external environment. Accordingly, we estimated the following equation:

$$y_{eic} = \mu + \alpha R_{eic} + \beta S_{eic} + \delta R_{eic} \cdot S_{eic} + X_{eic}' \cdot \gamma + \eta_{eic}, \qquad (4)$$

where S_{eic} measures the reliance on the external environment at the enterprise level (*Supplier*); X_{eic} is a vector of controls (CEO and enterprise characteristics, industry dummies, and city dummies); and η_{eic} is an independently and identically distributed error with a normal distribution and mean zero.

Table 6, column (i), reports the OLS estimate of (4). Labor productivity was positively associated with property rights protection and also the degree of external dependence, as measured by the number of suppliers. More importantly, the impact of property rights protection on labor productivity significantly increased with reliance on the external environment.[13] In terms of economic magnitude, the impact of a one standard deviation improvement in property rights protection on labor productivity was 0.080, or 3.1% of the mean labor productivity, at the mean number of suppliers.

-- Table 6 ---

Our second hypothesis was that the impact of property rights protection on enterprise productivity varied across enterprises facing different levels of entry barriers.

[13] In the interaction between property rights protection and the number of suppliers, the number of suppliers was specified as its difference from the sample mean (Wooldridge, 2006b: 204-205). Hence, the coefficient of property rights protection represents the partial effect of property rights protection on labor productivity at the mean number of suppliers.

According to McMillan and Woodruff (2002), poor property rights protection increases the entry costs, leading to less competition and lower productivity. With the same level of improvement in property rights protection, the percentage of reduction in entry costs is smaller in industries with higher levels of entry barriers than in industries with lower levels of entry barriers. Thus, it is expected that the enterprises facing lower levels of entry barriers should exhibit relatively higher labor productivity in cities with stronger property rights protection.

Following Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2002), we used the number of days to register a new business to measure, for each enterprise, the level of entry barriers. Accordingly, we estimated the following equation:

$$y_{eic} = \mu + \alpha R_{eic} + \beta EB_{eic} + \delta R_{eic} \cdot EB_{eic} + X_{eic}' \cdot \gamma + \eta_{eic}, \qquad (5)$$

where EB_{eic} measures the level of entry barrier at the enterprise level; X_{eic} is a vector of controls (CEO and enterprise characteristics, industry dummies, and city dummies); and η_{eic} is an independently and identically distributed error with a normal distribution and mean zero.

Table 6, column (ii), reports the OLS estimate of (5). It was found that the impact of property rights protection on labor productivity was larger for enterprises facing lower levels of entry barriers.[14] In terms of economic magnitude, the impact of a one standard deviation improvement in property rights protection on labor productivity was 0.034, or 2.2% of the mean labor productivity, at the mean level of entry barriers.

3.4 Robustness Checks

We conducted four other sets of robustness checks of the impact of property rights protection on enterprise productivity. First, we re-estimated equation (3) using two alternative measures of enterprise productivity, viz., total factor productivity calculated using either the panel fixed-effects method and the methodology of Levinsohn and Petrin (2003). Table 7, columns (i)-(ii), reports the results. Clearly, our earlier finding

[14] In the interaction between property rights protection and the level of entry barriers, the level of entry barriers was specified as its difference from the sample mean (Wooldridge, 2006b: 204-205). Hence, the coefficient of property rights protection represents the partial effect of property rights protection on labor productivity at the mean level of entry barriers.

regarding the impact of property rights protection on enterprise productivity was robust to these alternative measures of productivity.

Next, we used an alternative measure of property rights protection. Motivated by Johnson, McMillan, and Woodruff (2002) and Cull and Xu (2005), we used *Bureaucracy*, measured as the number of days the manager spent on dealing with government regulators deflated by total output. Table 7, column (iii), reports OLS estimates using this alternative measure of property rights protection. As with the benchmark estimates reported in Table 3, property rights protection had a positive and statistically significant impact on labor productivity. (The coefficient of *Bureaucracy* was negative and significant. Note that *Bureaucracy* is negatively related to property rights protection.)

Another concern might be that our results were driven by particular outliers. To address this issue, we used a quantile regression to estimate specification (3). Table 7, column (iv), reports the results. Clearly, our earlier finding regarding the impact of property rights protection on labor productivity was robust to outliers.

Finally, yet another concern might be that our results could be biased due to the inclusion of state-owned enterprises. This is because state-owned enterprises conduct business under the auspices of national and regional governments (good property rights protection), and they have low productivity due to the multiple responsibilities that they are charged with (Bai, Li, Tao, and Wang, 2000). To rule out this concern, we restricted our sample to private enterprises, which were defined as those enterprises with more then 50% percentage of private ownership. Table 7, column (v), reports the results. Clearly, our earlier finding regarding the impact of property rights protection on labor productivity was robust to this subsample. In terms of economic magnitude, the impact of a one standard deviation improvement in property rights protection on labor productivity was 0.097, or 6.2% of the mean labor productivity. Consistent with the above argument, this value was significantly higher than that obtained from the whole sample (see Table 3, column (vi)).

4. Conclusion

It is widely believed that China's spectacular growth in the last thirty years contradicts the prevailing view of the importance of institutions to economic performance (Blanchard and Kremer 1997; Rodrik 2004a and 2004b; Allen, Qian, and Qian 2005; *Economist*,

March 15, 2008). Indeed, protection of private property was not formally written into China's constitution until 2004, and its court system was not independent.

Using data from a World Bank survey of 1,566 manufacturing enterprises in 18 Chinese cities, we found that property rights protection had a positive and statistically significant impact on enterprise productivity. These results were robust to the inclusion of a comprehensive list of controls related to CEO and enterprise characteristics, as well as industry and city dummies.

To further establish the causal impacts of property rights protection on enterprise productivity, we applied two-step GMM estimation with two alternative instruments, viz, the average perception of property rights protection among other enterprises belonging to other industries located in the same city, and the logarithm of population in the respective city around 1918-19. The two-step GMM estimates reinforced our findings that property rights protection had a positive and significant causal impact on productivity.

In addition, we applied difference-in-difference estimation (Rajan and Zingales, 1998) to further establish causality by focusing on the theoretical mechanisms through which property rights protection might affect enterprise performance. We found that enterprises which were more reliant on the external environment exhibited relatively higher productivity in cities with stronger property rights protection. Moreover, we found that enterprises which faced lower levels of entry barriers exhibited relatively higher productivity in cities with stronger property rights protection.

In further robustness checks, we explored alternative measures of productivity and property rights protection, used quantile regressions to deal with possible impact of outlying observations, and investigated whether the results were biased due to the inclusion of state-owned enterprises.

Finally, we did find evidence that property rights protection was, to some extent, correlated with geography. This would be consistent with the explanation of China’s growth as being concentrated in the coastal areas, where institutional quality is relatively higher. However, we found no evidence that property rights protection was correlated with industry, hence China’s growth could not be explained as being concentrated in industries which were less sensitive to institutional quality.

References

Acemoglu, Daron and Simon Johnson (2005) "Unbundling Institutions", *Journal of Political Economy* 113, 949-995.

Acemoglu, Daron, Simon Johnson, and James A. Robinson (2001) "The Colonial Origins of Comparative Development: An Empirical Investigation", *American Economic Review* 91, 1369-1401.

Acemoglu, Daron, Simon Johnson, and James A. Robinson (2002) "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution", *Quarterly Journal of Economics* 117, 1231-1294.

Acemoglu, Daron and Fabrizio Zilibotti (2001) "Productivity Differences", *Quarterly Journal of Economics* 116, 563-606.

Allen, Franklin, Jun Qian, and Meijun Qian (2005) "Law, Finance, and Economic Growth in China," *Journal of Financial Economics* 77, 57-116.

Angrist, Joshua and Jörn-Steffen Pischke (2009) *Mostly Harmless Econometrics*, Princeton University Press.

Asian Development Bank (2003) "The Development of Private Enterprises in the People's Republic of China", March.

Ayyagari Meghana, Alis Demirgüç-Kunt, and Vojislav Maksimovic (2007) "Formal versus Informal Finance: Evidence from China," working paper.

Bai, Chong-en, Yingjuan Du, Zhigang Tao, Sarah Y. Tong (2004) “Local protectionism and regional specialization: evidence from China's industries”, *Journal of International Economics* 63, 397-417.

Bai, Chong-en, David D. Li, Zhigang Tao, and Yijiang Wang (2000) “A Multi-Task Theory of the State Enterprise Reform”, *Journal of Comparative Economics* 28, 716-738.

Barro, Robert (2001) “Human Capital and Growth”, *American Economic Review* 91, 12-17.

Berry, Steven, James Levinsohn, and Ariel Pakes (1995) “Automobile Prices in Market Equilibrium”, *Econometrica* 60, 889-917.

Bisin, Alberto and Thierry Verdier (2000) "Beyond the Melting Pot: Cultural Transmission, Marriage, and the Evolution of Ethnic and Religious Traits", *Quarterly Journal of Economics* 115, 955-988.

Besley, Timothy (1995) "Property Rights and Investment Incentives: Theory and Evidence from Ghana", *Journal of Political Economy* 103, 903-937.

Blanchard, Olivier and Michael Kremer (1997) "Disorganization," *Quarterly Journal of Economics* 112, 1091-1126.

Carothers, Thomas (2006) *Promoting the Rule of Law Abroad: In Search of Knowledge*, Washington, DC: Carnegie Endowment for International Peace.

Chen, Ta (1947) “An Appraisal of China's Historical Population Data”, *American Journal of Sociology* 52, Supplement: Population in Modern China, 1-6.

Cull, Robert and Lixin Colin Xu (2005) "Institutions, Ownership, and Finance: the Determinant of Profit Reinvestment among Chinese Firms", *Journal of Financial Economics* 77, 117-146.

De Loecker, Jan (2008) “Product Differentiation, Multi-Product Firms and Estimating the Impact of Trade Liberalization on Productivity”, working paper.

Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer (2002) "The Regulation of Entry", *Quarterly Journal of Economics* 117, 1-37.

Dohmen, Thomas, Armin Falk, David Hu¤man, and Uwe Sunde (2006) "The Intergenerational Transmission of Risk and Trust Attitudes", IZA DP 2380.

Dong, Shouyi, Lizhen Zhang, and Runmin Jiao (2000) *Lectures on Modern History of China* Volume I. Beijing, China: Chinese Social Science Press.

Dong, Xiao-yuan and Lixin Colin Xu (2009) “Labor Restructuring in China: Toward a Functioning Labor Market”, *Journal of Comparative Economics*, forthcoming.

Du, Julan, Yi Lu, and Zhigang Tao (2008) "Economic Institutions and FDI Location Choice: Evidence from US Manufacturing Firms in China", *Journal of Comparative Economics* 36, 412-429.

Economist (2008) “Economics and the Rule of Law”, March 15, 2008, 83-85.

Fan, Wenlan (1955) *Modern History of China*. Beijing, China: People's Press.

Fang, Ying, and Zhao, Yang (2007) “Do Institutions Matter? Estimating the Effects of Institutions on Economic Performance in China”, working paper, http://ssrn.com/abstract=957719.

Fu, Yunsheng (2003) "Business Culture Tradition and Regional Economic Development Analysis", Economist (Jing Ji Xue Jia, a Chinese journal), No. 5.

Hall, Robert E. and Charles I. Jones (1999) "Why Do Some Countries Produce So Much More Output per Worker than Others?" *Quarterly Journal of Economics* 114, 83-116.

Ho, Ping-ti (1959) *Studies on the Population of China, 1368-1953*, Cambridge, MA: Harvard University Press.

Johnson, Simon, John McMillan, and Christopher Woodruff (2002) "Property Rights and Finance", *American Economic Review* 22, 1335-1356.

Klette, Tor Jakob and Zvi Griliches (1996) “The Inconsistency of Common Scale Estimators when Output Prices are Unobserved and Endogenous”, *Journal of Applied Econometrics* 11, 343-361.

Knack, Stephen and Philip Keefer (1995) "Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures", *Economics and Politics* 7, 207-227.

Knack, Stephen and Philip Keefer (1997) "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation", *Quarterly Journal of Economics* 112, 1251-1288.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer (2008) "The Economics Consequences of Legal Origin", *Journal of Economic Perspectives* 46, 285-332.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1997) "Legal Determinants of External Finance", *Journal of Finance* 52, 1131-1150.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1998) "Law and Finance", *Journal of Political Economy* 106, 1113-1155.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1999) "The Quality of Government", *Journal of Law, Economics and Organization* 15, 222-279.

Levinsohn, James and Amil Petrin (2003) "Estimating Production Functions Using Inputs to Control for Unobservables", *Review of Economic Studies* 70, 317-342.

Li, Ben and Yi Lu (2009) "Geographic Concentration and Vertical Disintegration: Evidence from China", *Journal of Urban Economics* 65, 294-304.

Li, Hongbin, Lingsheng Meng, Qian Wang, and Li-an Zhou (2008) “Political Connections, Financing and Firm Performance: Evidence from Chinese Private Entrepreneurs”, *Journal of Development Economics* 87, 283-299.

Li, Kan, Shiyue Li, Dezheng Li, Ce Yang, and Shuduo Gong (1994) *Modern History of China*, Beijing, China: Zhonghua Book Company.

Liang, Kung-Yee and Scott L. Zeger (1986) "Longitudinal Data Analysis Using Generalized Linear Models", *Biometrika* 73, 13-22.

Lu, Jiangyong and Zhigang Tao (2009b) “Trends and Determinants of China's Industrial Agglomeration”, *Journal of Urban Economics* 65, 167-180.

Lu, Yi and Zhigang Tao (2009a) "Contract Enforcement and Family Control of Business: Evidence from China", *Journal of Comparative Economics*, forthcoming.

Mauro, Paolo (1995) "Corruption and Growth", *Quarterly Journal of Economics* 110, 681-712.

McMillan, John and Christopher Woodruff (2002) “The Central Role of Entrepreneurs in Transition Economies”, *Journal of Economic Perspectives* 16, 153-170.

Nevo, Aviv (2000) “Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry”, *RAND Journal of Economics* 31, 395-421.

Nevo, Aviv (2001) “Measuring Market Power in the Ready-to-Eat Cereal Industry”, *Econometrica* 69, 307-342.

Ni, Pengfei, et al. (2004 and 2005) *Zhong Guo Cheng Shi Jing Zheng Li Bao Gao* (*Annual Report on Urban Competitiveness*) Beijing, China: Social Sciences Academic Press.

North, Douglass C. (1991) "Institutions", *Journal of Economic Perspectives* 5, 97-112.

Rajan, Raghuram G. and Arvind Subramanian (2007) "Does Aid Affect Governance?" *American Economic Review Papers and Proceedings* 97, 322-326.

Rajan, Raghuram G. and Luigi Zingales (1998) "Financial Dependence and Growth", *American Economic Review* 3, 559-586.

Rawski, Thomas G. (1989) *Economic Growth in Prewar China*, Berkeley, CA: University of California Press.

Rodrik, Dani (2004a) "Rethinking Economic Growth in Developing Countries", The Luca d'Agliano Lecture.

Rodrik, Dani (2004b) “Getting Institutions Right”, DICE Report 2/2004, CESifo, 10-15.

Special Committee on Survey and Occupation of China Continuation Committee (1987) *Statistics of China Christianism (Revised Edition by Chinese Academy of Social Sciences): 1901-1920.* Beijing: Chinese Academy of Social Sciences Press.

Staiger, Douglas and James Stock (1997) "Instrumental Variables Regression with Weak Instruments", *Econometrica* 65, 557-586.

Tabellini, Guido (2007a) "Culture and Institutions: Economic Development in the Regions of Europe", working paper.

Tabellini, Guido (2007b) "Institutions and Culture", working paper.

Tabellini, Guido (2009) "The Scope of Cooperation: Values and Incentives", *Quarterly Journal of Economics*, forthcoming.

Wang, Ke (2006) "China Faced with Skilled Labor Shortage", *China.org.cn*, http://www.china.org.cn/english/MATERIAL/172145.htm (accessed on August 24, 2009).

Wooldridge, Jeffrey M. (2003) "Cluster-Sample Methods in Applied Econometrics", *American Economic Review* 93, 133-138.

Wooldridge, Jeffrey M. (2006a) "Cluster Sample Methods in Applied Econometrics: An Extended Analysis", working paper.

Wooldridge, Jeffrey M. (2006b) *Introductory Econometrics: A Modern Approach, Third Edition*, Mason, OH: Thomson.

World Bank (2008) *Doing Business in China 2008*, Beijing, China: Social Science Academic Press.

Wu, Jiang (1955) "Some Characteristics of China's Capitalist Economic Development", *Jingji Yanjiu* (*Journal of Economic Research*, in Chinese), 5.

Young, Alwyn (2000) “The razor’s edge: distortions and incremental reform in the People’s Republic of China”, *Quarterly Journal of Economics* 115, 1091– 1135.

Young, Crawford (1994) *The African Colonial State in Comparative Perspective*, New Haven, CT: Yale University Press.

Zhu, Ying (2001) *Merchants and Society in Modern China*, Hubei, China: Hubei Education Press.

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor productivity	1557	4.322	1.562	-3.989	11.893
Total factor productivity (fixed effect)	1356	4.151	1.077	-0.983	11.069
Total factor productivity (LP)	1356	3.042	0.953	-2.363	10.123
Property rights protection	1462	0.355	0.320	0.000	1.000
Bureaucracy	1520	0.043	0.947	0.000	36.667
Average perceived property rights protection among other industries in same city	1566	0.349	0.106	0.175	0.623
Logarithm of population in 1918-19	1437	11.926	0.836	10.463	13.385
Enterprise size	1563	5.040	1.454	0.000	9.899
Enterprise age	1566	2.494	0.777	1.099	3.970
Private ownership percentage	1566	0.813	0.376	0.000	1.000
Skilled labor ratio	1542	0.026	0.060	0.000	1.000
CEO education	1553	15.359	2.511	0.000	19.000
CEO tenure	1548	6.240	4.580	1.000	33.000
Deputy CEO previously	1548	0.280	0.449	0.000	1.000
Government cadre previously	1548	0.036	0.185	0.000	1.000
Party member	1524	0.648	0.478	0.000	1.000
Government appointed CEO	1544	0.243	0.429	0.000	1.000
Number of suppliers (in thousands)	1509	0.042	0.199	0.000	7.100
Entry barriers	778	8.817	11.811	0.000	100.000
Property rights protection x suppliers[1]	1423	0.000	0.044	-0.041	0.825
Property rights protection x entry barriers[2]	733	-0.380	4.284	-8.817	28.414

Notes:

1. Number of suppliers was specified as its difference from the sample mean.
2. Entry barriers were specified as their difference from the sample mean.

Table 2. Correlations

	Labor productivity	Total factor productivity (fixed effect)	Total factor productivity (LP)	Property rights protection	Bureaucracy	Average perceived property rights protection among other industries in same city	Logarithm of population in 1918-19
Labor productivity	1.000						
Total factor productivity (fixed effect)	0.825	1.000					
Total factor productivity (LP)	0.822	0.967	1.000				
Property rights protection	0.110	0.111	0.097	1.000			
Bureaucracy	-0.369	-0.377	-0.380	0.002	1.000		
Average perceived property rights protection among other industries in same city	0.076	0.078	0.059	0.259	-0.001	1.000	
Logarithm of population in 1918-19	0.112	0.143	0.111	0.102	-0.022	0.309	1.000

Table 3. OLS estimates

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Dependent variable	Labor productivity					
Property rights protection	0.511***	0.448***	0.426***	0.321**	0.309**	0.245**
	[0.142]	[0.142]	[0.138]	[0.130]	[0.118]	[0.104]
CEO characteristics						
Human capital						
CEO education		0.152***	0.154***	0.101***	0.077***	0.068***
		[0.019]	[0.019]	[0.020]	[0.021]	[0.020]
CEO tenure		-0.020**	-0.009	0.008	0.016*	0.001
		[0.009]	[0.010]	[0.009]	[0.008]	[0.008]
Deputy CEO previously		-0.183**	-0.022	0.075	0.038	0.026
		[0.078]	[0.082]	[0.077]	[0.077]	[0.071]
Political capital						
Government cadre previously			0.036	0.044	0.075	0.133
			[0.213]	[0.188]	[0.170]	[0.176]
Party member			-0.250***	-0.175**	-0.177**	-0.051
			[0.093]	[0.087]	[0.078]	[0.073]
CEO government appointed			-0.635***	-0.308***	-0.309***	-0.260**
			[0.099]	[0.110]	[0.104]	[0.111]
Enterprise characteristics						
Enterprise size				0.249***	0.237***	0.139***
				[0.039]	[0.040]	[0.038]
Enterprise age				-0.555***	-0.528***	-0.455***
				[0.071]	[0.069]	[0.065]
Private ownership percentage				0.146	0.156	0.170
				[0.139]	[0.141]	[0.137]
Skilled labor ratio				2.756***	2.110**	2.023***
				[0.751]	[0.853]	[0.763]
Industry characteristics						
Industry dummies					Yes	Yes
City characteristics						
City dummies						Yes
Constant	4.139***	2.004***	2.172***	2.695***	2.968***	2.621***
	[0.110]	[0.333]	[0.324]	[0.386]	[0.459]	[0.527]
No. of observations	1453	1424	1385	1369	1369	1369
R-squared	0.0111	0.0828	0.1221	0.2106	0.2587	0.334
p-value for F-test	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Impact of property rights protection[2]	0.164	0.143	0.136	0.103	0.099	0.078

Notes:

1. Standard errors, clustered at the industry-city level, are reported in the bracket; *, **, *** represent significance at 10%, 5%, and 1%, respectively.
2. Impact as measured by a one standard deviation increase in *Property Rights Protection*.

Table 4. GMM estimates, I

Estimation specification	(i)	(ii)	(iii)	(iv)
	GMM		OLS	
Dependent variable	First stage Property rights protection	Second stage Labor productivity	Labor productivity	
Property rights protection		1.331*		0.201*
		[0.766]		[0.108]
Average perceived property rights protection among other industries in same city	-3.063***		-4.018*	-3.462
	[0.239]		[2.410]	[2.468]
CEO characteristics				
Human capital				
CEO education	0.004	0.063***	0.065***	0.067***
	[0.004]	[0.021]	[0.019]	[0.020]
CEO tenure	0.000	0.000	0.001	0.001
	[0.002]	[0.008]	[0.008]	[0.008]
Deputy CEO previously	-0.022	0.046	0.009	0.021
	[0.016]	[0.069]	[0.070]	[0.072]
Political capital				
Government cadre previously	-0.065	0.189	0.160	0.116
	[0.055]	[0.182]	[0.172]	[0.177]
Party member	-0.018	-0.032	-0.080	-0.052
	[0.019]	[0.070]	[0.072]	[0.073]
Government appointed CEO	0.006	-0.253**	-0.237**	-0.246**
	[0.022]	[0.103]	[0.109]	[0.112]
Enterprise characteristics				
Enterprise size	0.012	0.128***	0.143***	0.141***
	[0.008]	[0.041]	[0.034]	[0.038]
Enterprise age	-0.008	-0.444***	-0.456***	-0.454***
	[0.013]	[0.064]	[0.065]	[0.066]
Private ownership percentage	0.007	0.175	0.175	0.183
	[0.033]	[0.127]	[0.130]	[0.136]
Skilled labor ratio	0.023	1.947***	2.027***	1.973**
	[0.148]	[0.697]	[0.731]	[0.767]
Industry characteristics				
Industry dummies	Yes	Yes	Yes	Yes
City characteristics				
City dummies	Yes	Yes	Yes	Yes
Constant	1.493***	3.190***	6.472***	3.779***
	[0.107]	[0.508]	[1.048]	[0.975]
Tests				
Relevance tests				
Anderson canonical correlations LR statistic	[44.08]***	-	-	-
Cragg-Donald Chi-statistic	[55.30]***	-	-	-
Weak instrument tests				
Shea partial R^2	0.0392	-	-	-

Cragg-Donald F-statistic	[53.29]	-	-	-
No. of observations	1369	1369	1456	1369
Impact of property rights protection[2]	-	0.426	-	-

Notes:

1. Standard errors, clustered at the industry-city level, are reported in the bracket; *, **, *** represent significance at 10%, 5%, and 1%, respectively.
2. Impact as measured by a one standard deviation increase in *Property Rights Protection*.

Table 5. GMM estimates, II

	(i)	(ii)	(iii)	(iv)
Second Stage: Dependent Variable: Labor productivity				
Property rights protection	4.787***	4.193***	4.105***	3.590***
	[1.487]	[1.265]	[1.407]	[1.107]
Losses due to theft		19.958	20.284	21.856
		[16.591]	[16.982]	[16.103]
Clustering of suppliers			-0.509	-0.804
			[1.265]	[1.164]
Local protectionism				0.820
				[0.674]
Controls				
Enterprise characteristics	Yes	Yes	Yes	Yes
CEO characteristics	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Logarithm of GDP per capita	Yes	Yes	Yes	Yes
Impact of property rights protection[2]	1.532	1.342	1.314	1.149
First Stage: Dependent Variable: Property rights protection				
Logarithm of population in 1918-19	0.044***	0.050***	0.046***	0.063***
	[0.015]	[0.015]	[0.014]	[0.012]
Losses due to theft		-4.304	-3.840	-6.263*
		[3.287]	[3.229]	[3.268]
Clustering of suppliers			-0.388**	-0.322*
			[0.161]	[0.172]
Local protectionism				-0.560***
				[0.155]
Controls				
Enterprise characteristics	Yes	Yes	Yes	Yes
CEO characteristics	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Logarithm of GDP per capita	Yes	Yes	Yes	Yes
Tests				
Relevance tests				
Anderson canonical correlations LR statistic	[14.61]***	[18.52]***	[15.85]***	[24.78]***
Cragg-Donald Chi-statistic	[14.87]***	[19.10]***	[16.29]***	[27.49]***
Weak instrument tests				
Shea partial R^2	0.0114	0.0148	0.0127	0.0215
Cragg-Donald F-statistic	[14.46]	[18.56]	[15.81]	[26.67]
No. of observations	1268	1247	1234	1234

Notes:

1. Standard errors, clustered at the industry-city level, are reported in the bracket; *, **, *** represent significance at 10%, 5%, and 1%, respectively.
2. Impact as measured by a one standard deviation increase in *Property Rights Protection*.

Table 6. Difference-in-difference estimates

	(i)	(ii)
Dependent variable	Labor productivity	
Property rights protection	0.253**	0.106
	[0.105]	[0.158]
Number of suppliers (in thousands)	0.094	
	[0.141]	
Property rights protection × Supplier[2]	3.476***	
	[0.845]	
Entry barriers		0.006
		[0.006]
Property rights protection × Entry barriers[3]		-0.036*
		[0.018]
Controls		
Industry dummies	Yes	Yes
City dummies	Yes	Yes
Enterprise characteristics	Yes	Yes
CEO characteristics	Yes	Yes
No. of observations	1337	689
R-squared	0.3430	0.3495
p-value for F-test	0.0000	0.0000
Impact of property rights protection[4]	0.080	0.034

Notes:

1. Standard errors, clustered at the industry-city level, are reported in the bracket; *, **, *** represent significance at 10%, 5%, and 1%, respectively.
2. Number of suppliers was specified as its difference from the sample mean.
3. Entry barriers was specified as its difference from the sample mean.
4. Impact as measured by a one standard deviation increase in *Property rights protection* at the mean value of *Suppliers/Entry barriers*.

Table 7. Robustness checks

	(i)	(ii)	(iii)	(iv)	(iv)
Estimation specification		OLS		Quantile	OLS
Sample		Whole sample			Private firm
Dependent variable	Total factor productivity (fixed effect)	Total factor productivity (LP)			
Property rights protection	0.178**	0.153*		0.263*	0.302**
	[0.085]	[0.083]		[0.141]	[0.130]
Bureaucracy			-0.225***		
			[0.028]		
Controls					
Enterprise characteristics	Yes	Yes	Yes	Yes	Yes
CEO characteristics	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	1205	1205	1420	1369	1120
R^2/Pseudo R^2	0.442	0.3211	0.3420	0.2020	0.3353
p-value for F-test	0.0000	0.0000	0.0000	-	0.0000
Impact of property rights protection /bureaucracy[2]	0.036	0.049	0.213	0.084	0.097

Notes:

1. Standard errors, clustered at the industry-city level, are reported in the bracket; *, **, *** represent significance at 10%, 5%, and 1%, respectively.
2. Impact as measured by a one standard deviation increase in *Property Rights Protection* or *Bureaucracy*.

Appendix A. Geographic difference of property rights protection

	(i) Dependent Variable: Property rights protection
F-tests	
Industry dummies=0	[1.28]
City dummies=0	[15.03]***
Controls	
Enterprise characteristics	Yes
CEO characteristics	Yes
No. of observations	1377
R^2	0.1114

Notes:

Standard errors, clustered at the industry-city level, are reported in the parentheses; *, **, *** represent significance at 10%, 5%, and 1%, respectively.

Appendix B. Population as a proxy for property rights protection

During the late Qing Dynasty (1840-1911), China was defeated in a series of wars against foreign colonial powers, including two Opium wars with Britain, the Sino-Japanese War of 1894-95, and the Boxer Rebellion. In the wake of military defeats, the Qing government was forced to sign unequal treaties, conceding huge amounts of reparations as well as territorial and other concessions. For example, following the Boxer Rebellion, eight colonial powers attacked Beijing and forced the Qing government to sign the Peace Treaty of 1901, which stipulated reparations of 450 million taels of silver (Fan, 1955).

The total amount of reparations over 1840-1911 amounted to about 30 times the annual treasury income in 1840 or around 15 times the annual treasury income in 1890 (Li, Li, Li, Yang, and Gong, 1994). In order to finance the war reparations, the Qing government was compelled to impose levies and taxes on its population, while delegating responsibility for collection to regional governors. Given the right to collect revenues, however, the regional governors seized the opportunity to determine the size of levies and taxes, leading to variations in taxation across China's regions.

In 1911, the Qing Dynasty was overthrown and a republican government was established in Nanjing. The new government enacted statutes providing for the protection of private property (Dong, Zhang, and Jiao, 2000). However, the republican government failed to secure national unity. Following the death of President Yuan Shih Kai in 1916, China split into north and south, with each part further divided into various regions.

The regional authorities were called "warlords" as they maintained their own armies and fought against rivals and one another. The regional wars caused widespread depredation of agricultural and other land. The warlords further increased taxes and levies to finance their expenditures. For instance, in some regions, after 1911, land taxes increased by over 50% (Li, Li, Li, Yang, and Gong, 1994). The incessant fighting and the increasing burden of taxes and levies prompted internal migration of people away from war-ridden regions. This led to the concentration of population and wealth in areas that offered better security of person and property (Wu, 1955).[15]

[15] See Rawski (1989) for the overall economic history of China during the Republican period.

Accordingly, the population of a city in 1918-19 could reasonably reflect the state of property rights at that time, with a larger population indicating better protection of property rights.[16]

[16] Superficially, our argument may appear to differ from that of Acemoglu, Johnson, and Robinson (2002), who argued that high population density in 1500 was correlated with weak property rights institutions. However, the underlying theory is the same. In Acemoglu, Johnson, and Robinson (2002), high population density was a precondition for expropriation. By contrast, we use population to reflect the equilibrium state of property rights.