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Department of Economics
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Abstract

This study uses heterogeneous panel Granger causality tests to investigate the causal relationships between quality of governance and economic growth at the provincial level in China during the reform era. I find a significant and positive effect of economic growth on subsequent quality of governance, largely driven by growth in the secondary sector, but no significant effect of quality of governance on economic growth. These findings suggest that improvements in formal governance have not been a key factor in China's rapid growth, and support the proposition that governance reforms are often a consequence, rather than a cause, of economic growth.

Keywords: Asia; China; Quality of Governance; Economic Growth

JEL classification: O11; O17; O43; O53; R11

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1. Introduction

China's economic transformation is commonly associated with extensive improvements in its bureaucracy and governance mechanisms. Bureaucratic reforms were initiated as early as 1980 and significant changes to economic policy and governance institutions were undertaken from the early 1980s (Drewry & Chan, 2001; D. D. Li, 1998). Exceptional economic performance followed: China has now experienced almost 9 percent average annual growth in real GDP per capita for more than 30 years (World Bank, 2014), the longest sustained episode of super-rapid economic growth ever recorded (Pritchett & Summers, 2013).

Despite these outcomes, there remains debate on the question of *causality* between governance improvements and economic growth. Some studies point to substantial improvements in the quality of the bureaucracy and in the regulatory environment, from the beginning of the reform era, as the driving force behind the rapid expansion of economic activity (D. D. Li, 1998; Naughton, 1995; Qian, 2000). Others argue that the role of government was limited to relaxing the communist stranglehold on the economy, creating a space in which economic activity could take place, but that it failed, at least in the early stages of liberalization, to provide effective formal governance (Tsai, 2002). Early economic growth relied instead on informal norms and interpersonal networks (Y. Peng, 2004; Xin & Pearce, 1996), and improvements in governance then followed as a result of economic development (Nee & Oppenheimer, 2012).

While China's governance reforms have been discussed extensively, especially through detailed case studies of specific reform efforts (e.g. Liu, 1992; Tong, 1989; Walder, 1995; Watson, 1988), there are few previous studies that attempt to quantitatively test the effect of overall quality of governance on economic growth in China, and to my knowledge, none that test the reverse causality. Using provincial-level panel data, two studies found a

positive effect of governance on foreign direct investment (Cole, Elliott, & Zhang, 2009) and on economic growth (Hasan, Wachtel, & Zhou, 2009). Another study, using firm-level data, found that managers' perceptions of the quality of governance are positively associated with reinvestment decisions (Cull & Xu, 2005). None of these studies considered possible causality from economic activity to quality of governance.

In this paper, I test both directions of causality between formal governance and economic growth at the provincial level in China, using an annual panel dataset of all provinces covering the core of the reform period (from 1985-2005). The use of provincial data is motivated by two considerations. First, provincial governments have held an important position in China's system of governance throughout the reform period, and have been argued to have played a key role in supporting economic activity in the transition from communism (Jin, Qian, & Weingast, 2005; Montinola, Qian, & Weingast, 1995). Second, using the province as the unit of analysis allows the use of panel data methods that are more powerful than single time-series methods, especially in the short time period available for the present study.

This study builds on a large literature of cross-country empirical studies that have confirmed a strong association between quality of governance and economic performance (e.g. Acemoglu, Johnson, & Robinson, 2001; Hall & Jones, 1999; Knack & Keefer, 1995; Olson, Sarna, & Swamy, 2000; Rodrik, Subramanian, & Trebbi, 2004). However, given the limited time coverage of available cross-country data and the limited variation over time in quality of governance for most countries, these studies have been unable to demonstrate a causal link from changes in quality of governance to subsequent changes in economic outcomes (or vice versa). The rapid development in both governance institutions and economic activity in China during the reform era provides a way to directly test this hypothesized link. In addition, restricting attention to a single country avoids many of the

issues of unobservable confounding variables that affect cross-country studies. The different provinces in China share a common set of national institutions, and a common culture, language, ethnicity, and history, allowing the analysis to focus on the temporal relationship between governance and growth only.

The remainder of the paper proceeds as follows: Section 2 discusses China's governance reforms over the past several decades, paying particular attention to the role played by provincial governments; Section 3 presents the theoretical discussion concerning the relationship between governance and economic growth, and develops the hypotheses to be tested; Section 4 introduces the data and empirical methods used in the paper; Section 5 presents and discusses results; Section 6 concludes.

2. Background

Local government has long held an important position in China's political system. Even prior to economic reforms, provincial and lower level governments had considerable responsibility and autonomy in planning and implementing economic production and redistribution under the socialist economic system (Lyons, 1990; Wong, 1987). In the early 1980s, state owned enterprises (SOEs) subordinate to the central government accounted for only between one-fifth and one-third of total industrial output, with the remainder produced by small- and medium-sized SOEs operated by provincial and county governments, and collective enterprises owned and administered by cities, townships, and villages (Qian & Xu, 1993; Wong, 1987).

The importance of local government was further strengthened by early reforms that decentralized authority over many areas of economic governance to the provincial, prefectural, and county level, and the implementation of a system of fiscal contracting that gave local governments strong interests in increasing their revenue-gathering capacity (Qian

& Xu, 1993; Wong, 1992). While the fiscal contracting arrangements varied over time and across provinces, the basic outline remained relatively constant: the provincial government would agree a transfer of revenues to the centre, with the province retaining all or most of its revenues above this target. By closely linking retained revenue with economic performance, the system of fiscal contracting gave provincial governments strong incentives to improve economic governance and promote economic development within their jurisdiction (Jin et al., 2005; Qian & Xu, 1993). A key feature of this decentralization of power lay in its ability to induce competition between provincial governments. The free movement of goods, and to a lesser extent factor inputs, between provinces meant that local governments that did not improve their governance—relative to neighbouring jurisdictions—risked falling behind economically and losing fiscal revenue (Montinola et al., 1995; Qian & Weingast, 1997; Weingast, 1995).

Complementing political and economic decentralization, changes were also made to the system of reward and promotion within the bureaucratic and political hierarchy (Whiting, 2000; Xu, 2011). Reforms introduced as early as 1980 replaced the socialist patronage- and ideology-based system with a formal recruitment and evaluation system throughout the bureaucracy (D. D. Li, 1998). This system emphasized the targets of increasing government revenue and improving the delivery of public goods, and tied these targets closely with officials' salary and prospects for promotion. Local officials whose regions experienced strong economic growth were more likely to be promoted to more prestigious positions at higher levels of government, and less likely to lose their position through dismissal, demotion, or forced retirement (Maskin, Qian, & Xu, 2000).

The effect of these reforms is reflected in China's rise in many international measures of institutional and governance quality throughout the 1980s-2000s (before a slight fall in recent years), as shown in Table 1. Although not shown in the table, variation across

provinces is also reported in some of these measures. For example, a special edition of the World Bank's *Doing Business* report series, in 2008, investigated the regulatory and governance environment at the provincial level in China, and documented a wide variation between provinces, especially in the areas of starting a business, registering property, and enforcing contracts (World Bank, 2008). The IMD World Competitiveness Yearbook 2005 included separate measures for Zhejiang, a fast-growing coastal province, giving it a ranking of 20th (of 60 countries and sub-national regions), 11 places ahead of China as a whole (IMD, 2005).

< Table 1 >

3. Theory

(a) *The governance-growth hypothesis*

Both potential directions of causality between quality of governance and economic performance have support in the prior theoretical and empirical literature. Looking first at the effect of governance on economic growth, there are several potential channels through which causality may operate. Professionalization of the bureaucracy provides bureaucrats with predictable, merit-based career paths within the civil service, creating stability and longer time horizons that encourage investment in public infrastructure with long-term payoffs rather than present consumption (Rauch, 1995). The bureaucratic coherence attained through systematic rule-based decision-making should also increase the effectiveness of major infrastructure projects that involve collaboration between different government agencies (Evans & Rauch, 1999). A stable and trusted bureaucracy can promote long-term investment

by private businesses, by reducing the perceived risk associated with changing government policies and bureaucratic turnover (Evans & Rauch, 1999). Bureaucratic professionalization reduces opportunities for corruption, encouraging productive investment (Campos, Lien, & Pradhan, 1999; Dahlström, Lapuente, & Teorell, 2012; Mauro, 1995; Shleifer & Vishny, 1993). From an institutional and policy perspective, laws and regulations that—together with their effective enforcement by an impartial system of governance—support investment and innovation provide an environment conducive to economic growth (North, 1990).

Significant legislative and bureaucratic changes over the past few decades have improved China's quality of governance in many of these aspects. Early bureaucratic reforms were successful in replacing ideologically motivated cadres of the revolutionary era with younger bureaucratic technocrats (Lee, 1984) and increasing the role played by educational attainment, rather than party loyalty, in recruiting and promoting public officials (Zhou, 2001). Nominally independent regulatory agencies have been established to oversee key industries; although the autonomy of these agencies is still constrained by the broader institutional context and they remain subject to political interference, they nonetheless represent an important movement toward the global benchmark (Pearson, 2005). The role of the legal system in resolving commercial disputes also increased dramatically. Clarke, Murrell, and Whiting (2008) identified more than 40 major pieces of legislation and constitutional amendments passed between 1979 and 2004 governing economic activity, and documented that businesses' reliance on—and trust in—the court system has concomitantly increased substantially: the number of economic contract disputes handled by Chinese courts increased on average by 27 percent annually from 1983 to 1998, while the total value of such disputed contracts increased by an average of 44 percent per year over the same period.

These findings, together with the theoretical considerations discussed above, motivate the first hypothesis to be tested in this paper:

Hypothesis 1: Improvement in the quality of governance causes a subsequent increase in the rate of economic growth

(b) *The growth-governance hypothesis*

Turning to the reverse direction of causality, several mechanisms have been proposed through which improvements in economic performance may lead to changes in a country's quality of governance. First, comprehensive governance reform is an expensive and technically demanding proposition, and many developing countries lack the financial resources and administrative capabilities to successfully develop and implement such a reform package (Rodrik, 2007). Advocates of a programme of "good enough governance" (a proposed alternative to the "good governance" approach of the multilateral development agencies) argue that growth can often be sparked by relatively minor reforms that encourage investment (Hausmann, Pritchett, and Rodrik, 2005), and that such growth can allow developing countries the time and resources to establish higher quality governance institutions at a later stage of economic development (Grindle, 2004, 2007).

Institutional theory also suggests that the relative payoff to investments in formal governance, rather than reliance on informal mechanisms, may increase with a country's level of economic activity. When economic exchange is small-scale and localized, cooperation can often be efficiently sustained through personal ties and repeated interactions (Dixit, 2004). Economic development, by increasing the complexity and scale of trade, may enhance the relative efficiency of formal governance mechanisms (Dixit, 2003; Greif, 1994; J. S. Li, 2003), creating stronger incentives for public investments in improved governance institutions.

Another channel through which growth may cause improvements in governance is through creating a constituency of businesses and consumers with the interest and ability to

demand such improvements. In many developing countries, especially those experiencing transition from a planned to a market economy, large, protected, and inefficient state-owned firms occupy a central position in the economy (S. Li & Xia, 2008; Roland, 2000; Spenner, Suhomlinova, Thore, Land, & Jones, 1998). These firms have strong incentives to oppose reforms that would tighten their soft budget constraints and expose them to competition from new, more efficient private enterprises. In such a setting, growth in the non-state sector—largely supported by informal, network-based forms of governance in place of missing or ineffective formal institutions—may be required to give private economic interests the economic and political power to effectively advocate governance reform (Aghion & Blanchard, 1994; Nee & Oppen, 2012; M. W. Peng, 2003).

A number of historical case studies support the hypothesis of causality from economic growth to improvements in governance. Chang (2003), for example, investigated the historical development of several aspects of governance in the now developed countries of Western Europe and North America. Many of these features of good governance—including a professional bureaucracy, effective corporate regulation, an impartial and independent judiciary, consistent and impersonal enforcement of contracts and protection of property rights, efficient broad-based tax collection, and modern social welfare institutions—were shown to have been implemented in the most advanced countries only in the late 19th century (or in many cases well into the 20th century), by which time these countries had already enjoyed half a century or more of industrialization and sustained economic growth. Goldsmith (2007) reported similar findings for the United States, Argentina, Mauritius, and Jamaica. These results suggest that quality of governance, at least in the modern sense, was not required to support economic growth in the early stages of development; improvements in governance may, instead, have been a consequence of economic growth.

This discussion motivates the second hypothesis to be tested in this paper:

Hypothesis 2: Improvement in economic performance causes a subsequent improvement in the quality of governance

4. Methods and Data

(a) *Methods*

This paper uses annual data from 1985 to 2005 on the quality of governance and economic growth at the provincial level to test for Granger causality both from governance to economic performance and from economic performance to governance. An important issue to consider in specifying and interpreting the empirical model used for these tests is the potential for the causal relationships to differ across provinces, for example due to differences in industrial structure or the history of private sector development and private-state interactions. To allow for this potential cross-provincial heterogeneity, I consider the following heterogeneous panel vector autoregressive (VAR) model, for provinces $i = 1, \dots, N$ and time $t = 1, \dots, T$:

$$\begin{aligned} (\text{GDP})_{i,t} &= \alpha_{1,i} + \sum_{k=1}^{K_i} \gamma_{1,i}^{(k)} (\text{GDP})_{i,t-k} + \sum_{k=1}^{K_i} \beta_{1,i}^{(k)} (\text{Governance})_{i,t-k} + \varepsilon_{1,i,t}, \\ (\text{Governance})_{i,t} &= \alpha_{2,i} + \sum_{k=1}^{K_i} \gamma_{2,i}^{(k)} (\text{Governance})_{i,t-k} + \sum_{k=1}^{K_i} \beta_{2,i}^{(k)} (\text{GDP})_{i,t-k} + \varepsilon_{2,i,t}, \end{aligned} \tag{Eq. 1}$$

where $(\text{GDP})_{i,t}$ and $(\text{Governance})_{i,t}$ are stationary variables, as discussed below, α_i are province-level effects, and $\varepsilon_{i,t}$ are independently and normally distributed error terms with mean zero and finite heterogeneous variances $\sigma_{\varepsilon,i}^2$. Cross-provincial heterogeneity is incorporated in the model by allowing the coefficients $\gamma^{(k)}$ and $\beta^{(k)}$, and the lag length K_i , to

vary across provinces. The two null hypotheses to be tested are that the coefficients $\beta_{1,i} = (\beta_{1,i}^{(1)}, \dots, \beta_{1,i}^{(K_i)})'$ and $\beta_{2,i} = (\beta_{2,i}^{(1)}, \dots, \beta_{2,i}^{(K_i)})'$, respectively, are zero for all provinces, against the alternative that $\beta_{1,i}$ (respectively $\beta_{2,i}$) is non-zero for at least one province. Finding a significant effect in this model, therefore, should be considered as evidence for the presence of the corresponding causal relationship in *at least one province* in the sample.

To estimate the model in Equation 1 and test these two hypotheses, I use the heterogeneous panel Granger causality tests introduced by Dumitrescu and Hurlin (2012). This approach consists of conducting Granger causality tests for each cross-section unit independently, and constructing test statistics based on the average of the resulting Wald statistics. For each hypothesis, two test statistics are reported. The first is the approximated standardized average Wald statistic. This statistic converges to the standard normal distribution as the number of cross-section units N approaches infinity (although simulations show that it also performs well in small samples), and p -values are reported based on this asymptotic distribution. The second test is based on the (unstandardized) average Wald statistic, and reports p -values from a block bootstrap procedure suggested by Dumitrescu and Hurlin to allow for potential cross-sectional dependency. Simulations show that these tests have good statistical properties, performing especially well relative to single time-series approaches when the time dimension is short (Dumitrescu & Hurlin, 2012).

While there are strong reasons to expect heterogeneity in the causal relationship across provinces, and therefore to allow for this possibility in the model specification, it is also informative to consider a pooled test in which the parameters are constrained to be equal in all provinces. This homogeneous causality approach has at least two advantages relative to the heterogeneous causality tests that provide the main results in this paper. First, and most directly, it tests the alternative hypothesis that the same causal relationship operates in all provinces, providing a useful complement to the test of whether a causal relationship operates

in any province. Second, by reducing the number of independent parameters to be estimated, the pooled model can be estimated on shorter sub-periods of the whole sample to test for time-varying effects. Given the rapid changes in China's economic structure over the sample period, it is important to consider the possibility that the relationship between growth and governance may have changed over time.

To estimate the pooled model, I use the Blundell-Bond dynamic panel data estimator (Blundell & Bond, 1998), with heteroskedasticity-robust standard errors (Arellano & Bond, 1991). The model to be estimated in this case is identical to that in Equation 1, with the restriction that the coefficients $\gamma^{(k)}$ and $\beta^{(k)}$ and the lag length K are constrained to be equal across provinces. The moment conditions used to estimate this model are valid only if there is no serial correlation in the errors $\varepsilon_{i,t}$. To test this assumption, I use the residual autocorrelation test of Arellano and Bond (1991), which tests for second-order serial correlation in the first-differenced errors.¹

For both methods, two initial tests are required to determine the model specification. First, since all variables are required to be stationary, the order of integration of each variable is established, using the Im-Pesaran-Shin panel data unit-root test (at the 5 percent level of significance). The governance index is found to be stationary, as is primary industry GDP, while the remaining economic activity variables are all integrated of order one. For primary industry GDP, however, individual province unit root tests indicate that stationarity is found only in a small number of provinces. (The IPS test has as its alternative hypothesis that the time-series for at least one cross-section unit is stationary.) First differences of all economic activity variables are therefore taken to ensure all variables in the VAR are stationary, while the governance index is used in levels. Second, the lag length for each province is chosen by

¹ The Sargan test of overidentifying restrictions, another common test of the validity of the moment conditions, is not used here as it has been shown to substantially over-reject in the presence of heteroskedasticity (Arellano & Bond, 1991).

sequential F -tests (again, using the 5 percent level of significance), starting with a maximum lag of three.² For the heterogeneous causality model, these tests are conducted independently for each province, allowing the maximum lag length to differ across provinces.

One weakness of the heterogeneous causality tests used here is the difficulty in interpreting significant test statistics, which indicate only that there is some significant relationship in at least one province in the sample. To provide an indication of the nature of each effect, I also report in all tables in the following section the estimated sign of each effect. Given the possibility of heterogeneous effects across provinces and the use of multiple lags of the explanatory variables (which means that the sign may be ambiguous even within provinces), it is not obvious how these signs should be determined. In the spirit of the causality tests above, the approach chosen here is also based on aggregating tests conducted at the individual province level. For each province, I conduct one-sided t -tests of the hypothesis that the sum of the β -coefficients is equal to or less than (respectively greater than) zero against the alternative that the sum of coefficients is strictly positive (negative). The p -values from these tests are then combined using Fisher's inverse chi-square statistic to test for an overall positive (negative) effect. As for the heterogeneous causality tests, block-bootstrapped p -values are calculated to allow for potential cross-sectional dependency. Note that this approach tests for only cumulative directed effects; nevertheless, the tests are able to identify the sign of the causal effects in most cases. For the homogeneous panel model, in which there is only one set of estimated coefficients across all provinces for each causal relationship, the reported signs are based on visual inspection of the corresponding impulse response functions.

² Overall results are largely unchanged if the lag length is chosen with AIC or BIC instead, with one exception discussed in Section 5.

(b) *Data*

Data on governance come from the Chinese National Bureau of Statistics' *China Regional Competitiveness Development Report* (National Bureau of Statistics, 2004, 2005). This report provides a composite index of the quality of provincial governance based on measures of fiscal probity, the quality of public administration and provision of public services, and the maintenance of security and protection of property rights. The component measures of the governance index are presented in more detail in Table A1 in the appendix. The index ranges between 0 and 100, and is normalized to have a cross-provincial mean of 50 in each year, so provides a measure of the relative quality of provincial administration compared to the national average. The measure is available for all 31 provinces of China; however, two provinces (Hainan in 1988 and Chongqing in 1997) were awarded provincial status during the time period considered in the current study. To maintain a balanced panel, these two provinces are excluded from the analysis, and the sample therefore consists of the remaining 29 provinces for which data are available for the full period from 1985–2005.³ This index represents to my knowledge the only comprehensive measure of the quality of governance at the provincial level in China available for an extended time period throughout the reform era. To investigate the validity of the index as a measure of quality of governance, I have compared it with some alternative measures that are available only for limited time periods. These comparisons are summarized in Table 2. There is a strong correlation between the governance index used here and these alternative measures, giving confidence that this measure is accurately capturing important aspects of governance quality.

< Table 2 >

³ The exclusion of these provinces means that the sample mean values for each year are slightly different from 50; I subtract this difference in each year to maintain a constant average as in the original data.

Figure 1 shows five-year averages of the quality of governance index for all provinces. There is a clear variation across provinces, with the more economically developed coastal provinces enjoying, in general, better governance than the poorer inland provinces. Changes in the relative quality of governance over time can also be seen here: many of the northern inland provinces made significant improvements in governance in the 1990s compared to the 1980s, before falling back slightly toward the end of the sample period, and the rapidly industrializing south-eastern provinces of Guangdong and Fujian saw substantial governance improvements in the early 2000s.

< Figure 1 >

To measure economic performance, I use data on provincial GDP retrieved from the China Data Online portal of the All China Data Center (All China Marketing Research Co., 2014). The original source for these data is the *China Statistical Yearbook* (various years). The available data report levels of nominal GDP and growth of real GDP, for each province and year. I use 2005 nominal GDP levels and annual real GDP growth rates to construct an annual measure of provincial real GDP, in province-specific 2005 prices.

For comparability with the available measure of governance—as discussed above, this is a measure of the relative quality of governance across provinces, holding the cross-provincial mean constant in each year—I construct a measure of relative GDP, by taking the natural logarithm of provincial real GDP, and subtracting the sample mean in each year.⁴ To see if the results are driven by particular sectors I also consider the decomposition of GDP

⁴ Recall that first differences of this relative GDP measure are taken to provide a stationary variable for the analysis; this is equivalent to applying the normalization directly to the provincial growth rates to obtain relative real GDP growth rates.

into production in the primary, secondary, and tertiary industries.⁵ In each case, the same normalization as for total GDP is made to construct measures of relative economic performance compared to the national average.

The sample period included in the estimations excludes the first three years, to allow for the maximum of three lags used in the VAR, and therefore covers the period 1988-2005, giving a total sample size of 522 observations. (The Blundell-Bond estimator used for the pooled model is based on first differenced variables; one additional time period for each province is therefore dropped in these models, giving a total of 493 observations.) Summary statistics for all variables are reported in Table A2 in the Appendix.

5. Results and Discussion

The main results are presented in Table 3. Columns 1 and 2 report results for the full sample of 29 provinces, while Columns 3 and 4 report results for a restricted sample excluding five provinces designated as “autonomous regions.”⁶ These regions are governed differently than other provinces, having a higher proportion of a particular ethnic group, and being given greater political autonomy. They may therefore contradict one of the primary motivations for using provincial data in this study: to hold background characteristics, such as national institutions and a common history and culture, constant across provinces.

As shown in the top panel of Table 3, in both samples GDP growth is found to have a significant positive effect on quality of governance, while there is no evidence of an effect of quality of governance on overall GDP growth. These overall results are supportive of Hypothesis 2—indicating a causal effect of growth on governance—but not of Hypothesis 1.

⁵ In China’s statistical reporting, these are defined as follows: primary industry refers to agriculture, forestry, animal husbandry, and fishery, and services in support of these industries; secondary industry refers to mining and quarrying, manufacturing, production and supply of electricity, water, and gas, and construction; tertiary industry refers to all other economic activities.

⁶ The autonomous regions are Inner Mongolia, Guangxi, Tibet, Ningxia, and Xinjiang

Results from the sectoral decomposition of GDP, presented in the second panel of Table 3, are consistent with these overall findings, but introduce some additional qualifications. The GDP growth-to-governance effect is generally positive across all three sectors, but is driven by the secondary industry, where it is significant at the 1 percent level in both samples. There is also strong evidence of a negative effect of quality of governance on primary industry growth, and, for the sample excluding autonomous regions, a positive effect of governance on tertiary industry growth.⁷

< Table 3 >

The results in Table 3 are suggestive of a process of economic growth and governance change consistent with Hypothesis 2, and only partially consistent with Hypothesis 1. Rapid growth in the secondary sector, which does not seem to have been driven by changes in the quality of governance, is found to have helped promote improvements in provincial governance. Governance improvements, in turn, supported a process of economic transition in which production was shifted away from the low value-added primary sector into the tertiary sector (at least in the sample excluding the autonomous regions), although there is no evidence of an effect on overall GDP growth.

These results contradict the majority of previous cross-country studies (e.g. Acemoglu et al., 2001; Evans & Rauch, 1999; Knack & Keefer, 1995; Rodrik et al., 2004), which have generally interpreted a positive association between governance and growth as evidence in favour of Hypothesis 1. They are consistent, however, with the small number of studies that

⁷ The effect of governance on tertiary industry growth is, however, not robust to the method used to choose the lag length. When the lag length is chosen by AIC instead of sequential F-tests, this result is significant in both samples, with a negative effect in the full sample and with both negative and positive effects found in the sample excluding autonomous regions. These differences appear to be driven solely by Shandong province, where a much stronger negative effect is estimated using AIC (which selects 2 lags) than when using F-tests (which select 1 lag). Using the BIC to choose the lag length, the effect is not significant in either sample.

have explicitly considered the temporal variation in governance and growth (e.g. Glaeser, La Porta, Lopez-De-Silanes, & Shleifer, 2004; Kurtz & Schrank, 2007), which also emphasized causality running from economic growth to changes in governance and formal institutions.

The importance of the secondary sector in driving the GDP-to-governance effect in China is also supported by previous studies. In the absence of effective formal governance institutions at the outset of economic reform, entrepreneurs in the booming light industrial sector were forced to rely on personal networks and the development of “adaptive informal institutions” to secure access to credit, enforce contracts, and protect their economic property rights (Tsai, 2002, 2006). In many cases these adaptive informal institutions provided the basis for subsequent changes in formal governance institutions, as political actors recognised and formalized adaptations that had proven effective in supporting economic activity (Nee & Oppen, 2012).

One important implication of the heterogeneous causality approach to testing used here is that significant results may be driven by strong effects in only a small number of provinces. To test for this possibility, I re-estimate the model excluding various groups of provinces that have different economic and political characteristics compared to others. The results, shown in columns 1 to 4 of Table 4, remain largely unchanged with these exclusions.

The first two columns of Table 4 present results for the sample excluding the three provincial-level cities,⁸ which have higher income per capita, a smaller primary sector and rural population, and a closer relation with the central government than other provinces. These results are largely consistent with those reported in Table 3, although the estimated weak effect of governance on tertiary industry growth is now found to be negative. Columns 3 and 4 of Table 4 report results excluding the two provinces (Guangdong and Sichuan) that

⁸ There are currently four provincial-level cities in China: Beijing, Tianjin, Shanghai, and Chongqing. As noted in Section IV, Chongqing is already excluded from the sample as it only received provincial status in 1997.

had boundary changes during the sample period.⁹ The main findings are again largely unchanged, while the estimated effect of governance on tertiary industry growth becomes more significant, with both positive and negative signs across provinces.

< Table 4 >

The results reported in columns 5 and 6 of Table 4 address possible non-stationarity in the governance index. The Im-Pesaran-Shin test used to determine the order of integration for each variable has as its alternative hypothesis that at least one cross-section unit is stationary. One may therefore be concerned that, while the governance index is stationary for at least some provinces, it may still be non-stationary in others. The KPSS unit root test (Kwiatkowski, Phillips, Schmidt, & Shin, 1992), applied to the individual province data, finds evidence of non-stationarity for five provinces.¹⁰ For these provinces, the model is re-estimated with an additional lag included in the VAR to account for potential non-stationarity (Todo & Yamamoto, 1995), with the standard Wald test then conducted on the first K_i lags as usual. The previous findings are all confirmed here, with the exception of the (previously weak) effect of governance on tertiary industry GDP, which is no longer found to be significant.

Next, I complement the heterogeneous causality tests already reported with tests of homogeneous causality, in which the coefficients are constrained to be equal across provinces. The findings are generally similar for this model, although there are notable differences in some of the results for the sectoral decomposition of GDP.

I first test for autocorrelation in the error terms, using the Arellano-Bond serial

⁹ These changes occurred when Hainan (which split from Guangdong in 1988) and Chongqing (which split from Sichuan in 1997) received full provincial status. In both cases, the continuing province of the same name retained the majority of both population and economic activity from the joint province after the split, and these are therefore each included as a single province in the main analysis.

¹⁰ These are Beijing, Liaoning, Jilin, Anhui, and Fujian.

correlation test, to ensure the validity of the moment conditions used in the estimation. In all cases except the governance-to-tertiary GDP model, the test is unable to reject the hypothesis of no autocorrelation, indicating that the moment conditions generating these estimates are valid. For the governance-to-tertiary GDP model, however, there is evidence of significant second-order autocorrelation in the first differenced residuals (at the 5 percent level), suggesting that the moment conditions are invalid. I therefore re-estimate this model with the shortest lags of the dependent variable excluded from the instrument set.¹¹ When these restrictions are imposed, there is no evidence to reject the validity of the moment conditions. Results based on these restrictions are therefore presented for the governance-to-tertiary GDP model; results using the full set of valid instruments are reported for all other models.

Results are presented in Table 5. With the exception of the effects of sectoral GDP growth on governance (discussed further below), the previous findings are supported in this model, although with a lower level of significance in most cases (as would be expected if cross-provincial heterogeneity is present). The positive effect of overall economic growth on governance is confirmed, while the effect of governance on GDP growth is now also significant (at the 10 percent level only). The latter effect has ambiguous sign: the initial response of GDP growth to an improvement in governance is estimated to be negative, but the longer-run effect is found to be positive. The effect of governance on sectoral growth rates is also consistent with the results above: good governance has a negative effect on growth in the primary sector, but a positive effect on growth in the tertiary sector.

< Table 5 >

¹¹ If it is assumed that the significance of the Arellano-Bond test is due to the error terms following a first-order moving average process, then the moment conditions will be valid when the instrument set is restricted to include only the third and higher lags of the dependent variable in the first difference equation, and only the second lag in the level equation.

For the tests of causality from sectoral GDP growth to quality of governance, however, there are notable differences between the heterogeneous and homogeneous models. For the homogeneous causality model presented in Table 5, the effect of economic growth on governance is found to be driven by the primary sector, with no effect of secondary sector growth; for the heterogeneous causality model shown in Table 3, the effect was found to be driven by the secondary sector, with no effect of primary sector growth. This suggests that the effect of primary sector growth, while weak in each province individually, is consistent across provinces; the effect of secondary sector growth, by contrast, seems to be heterogeneous across provinces: there is a strong effect in some provinces, but a weak (or negative) effect in others, and when homogeneity is imposed these effects cancel each other out.

Some suggestive evidence on this heterogeneity can be obtained from the individual province-level regressions. While these tests have low power given the short time period of the data, and should therefore be interpreted with caution, they are nevertheless supportive of the hypothesis that the effect of secondary industry growth on governance is heterogeneous across provinces. The estimated effect of secondary industry growth on governance is highly statistically significant in the heterogeneous causality model, with a *p*-value of less than 0.001 (Table 3). The individual province-level tests, however, reveal that this result is driven by significant positive effects (at the 5 percent level) in only six of the 29 provinces in the sample. There is also a significant negative effect in one province, while for the remaining provinces there is no evidence that secondary sector growth affects subsequent quality of governance.¹²

The heterogeneous effect of secondary sector growth may be explained at least in part

¹² The provinces with significant positive effects are Hebei (1 percent level), Shanxi, Anhui (1 percent level), Yunnan (1 percent level), Gansu, and Ningxia. The significant negative effect is found in Heilongjiang (1 percent level). There is also evidence at the 10 percent level only of negative effects in Inner Mongolia and Fujian.

by the highly politicized nature of the sector. Developments in the secondary sector are of great importance for local governments in China, through the reliance of many governments on revenues provided by industrial SOEs, and through the potential for informal institutional adaptations, created and sustained through densely connected social networks of entrepreneurs, predominantly in the industrial sector, to challenge existing formal governance institutions. The response of governance to changes in the secondary sector may therefore differ between provinces based on local differences in the ownership structure of the sector, the extent to which informal governance mechanisms threaten existing formal structures, and the relationship between government officials, private entrepreneurs, and SOE managers (Nee, Oppen, & DellaPosta, in press).

Primary sector production, by contrast, is geographically dispersed in small-scale farming under the household responsibility system established in the early 1980s, and is less connected to the provincial-level political environment. Growth in the primary sector is therefore less likely to involve the kind of political pressures that accompany secondary sector growth. There is still likely to be an income effect, however, as economic growth provides revenue for local governments and increases their capacity to implement economic reform. This effect is likely to be relatively homogeneous across provinces, as all provincial governments in China have been budget constrained throughout the reform era and therefore relied on local economic growth to provide fiscal resources.

Lastly, the pooled model is also used to test for the presence of variation over time in the relationships between governance and growth. Only for the effect of overall GDP growth on quality of governance is there evidence (at the 5 percent level) of any time-varying effects. For this model, significant breaks in the estimated coefficients are identified in both the early and late 1990s. In the early 1990s, breaks are found at 1992, 1993, and 1994. I treat these as representing a single break point, and report results for the strongest break year only, in 1993.

In the late 1990s, breaks are found at 1997 and 1998. Again, I treat these as indicative of a single break point and report only the stronger results obtained for 1997. Results are largely unchanged if the other potential break points are used instead.¹³ In both cases the effect of GDP growth on quality of governance is found only in the later period (Table 6).

< Table 6 >

These estimated break dates reflect important changes in China's political economy. The early years of the sample, in the late 1980s and early 1990s, capture the conservative policy stance and relatively centralized power structure of the post-Tiananmen period, when local governments had little ability to shape economic governance. After Deng Xiaoping's celebrated "Southern Tour" of 1992, coinciding with the first break point in Table 6, provincial leaders were encouraged to pursue economic growth through greater policy autonomy, and market liberalization and economic openness were reemphasized as policy goals at all levels of government. This is reflected in the significant positive response of governance quality to economic growth in the post-1993 sample. The later break coincides closely with the Asian Crisis that hit the region in 1997-1998. This crisis exposed severe shortcomings in the "relation-based governance" that underpinned rapid growth in many East Asian economies, and highlighted the need for stronger formal ("rule-based") governance structures (J. S. Li, 2003). This break also aligns with an acceleration of market-oriented reforms undertaken in the late 1990s and early 2000s under the new premier Zhu Rongji, who took power in spring 1998 (Yang, 2004).

¹³ Taking the break at 1992 gives slightly weaker results, but does not change any of the main conclusions of this section. There is a marginally significant positive effect in the first period (1988-1991), with p-value of 0.060, although this effect is estimated on only 3 observations per province. The positive effect in the second period (1992-2005) is significant at the 5 percent level only (p=0.028).

6. Conclusion

Interest in the role of governance in China's recent economic transformation continues a long tradition in the social sciences. Max Weber (1968) identified the professionalization of public administration, in particular the "bureaucratic" organizational form employed in his native Germany in the early 20th century, as the key institutional support necessary for the development of the modern capitalist economy. The importance of such "Weberian" bureaucratic structures for economic growth and poverty reduction has subsequently been supported by cross-country empirical studies (Evans & Rauch, 1999; Henderson, Hulme, Jalilian, & Phillips, 2007). In recent years, economists and economic historians have also begun to emphasize the importance of effective institutions—the "rules of the game" that govern the interactions between economic actors and constrain the potential abuse of political power—in determining a country's prospects for economic growth (North 1990). These arguments are also supported by cross-country empirical evidence (Acemoglu et al., 2001; Hall & Jones, 1999; Rodrik et al., 2004).

The reverse causal direction from economic development to changes in governance has received less attention in the existing literature, although there are several reasons to expect that governance improvements may often follow economic growth. For example, economic growth can provide governments with the resources required to implement potentially expensive governance reforms (Grindle, 2004, 2007; Rodrik, 2007), can increase the relative payoff to investments in better formal governance (Dixit, 2004; Glaeser & Shleifer, 2003), and can help to create a constituency of businesses and citizens with the interest and ability to advocate improvements in governance (Aghion & Blanchard, 1994; Roland, 2000). A smaller empirical literature, using time-series variation in national institutional quality, provides support for this hypothesis (Glaeser et al., 2004; Kurtz & Schrank, 2007).

The analysis reported in this paper contributes to this literature by testing both directions of causality between quality of governance and economic growth, using Chinese provincial-level data covering 20 years of the post-Mao reform era. The results, while showing a positive association between governance and growth, are not supportive of the predominant view that quality of governance is a key determinant of economic performance. Instead, the observed association is found to have been the result of a significant positive effect of economic growth on subsequent quality of governance. This suggests that more attention should be paid to possible reverse causality in cross-country studies of governance and growth.

These findings are consistent with the idea that economic growth, at least from a low initial level of development, is not reliant on the successful establishment of high-quality formal governance structures. When economic freedom is tightly restricted and economic inefficiencies are pervasive, as in pre-reform China, there are so many “big bills left on the sidewalk” that minor economic liberalization may provide sufficient incentives to support a rapid expansion of economic activity even in the absence of good governance institutions. The observed positive effect of GDP growth on quality of governance, however, suggests that provincial governments in China have successfully harnessed the reform opportunities presented by economic growth to improve their local governance institutions. These governance improvements, furthermore, are found to have had a positive effect on the transition into new tertiary sectors, and may therefore become more important as economic modernization continues and the tertiary industry comes to play a larger role in the economy.

The results reported here also address the literature on the determinants of China’s post-reform economic development. Reflecting the uncertainty surrounding many aspects of China’s political and economic development, previous studies have posited a number of different, often contradictory, explanations: informal versus formal governance mechanisms

(Allen, Qian, & Qian, 2005; Y. Peng, 2004), provincial versus central government (Blanchard & Shleifer, 2000; Lin & Liu, 2000; Xu, 2011), or governance as an independent factor versus feedback effects from economic changes (Chen, 2003; Tobin & Sun, 2009; Yao & Yueh, 2009). The findings in this paper emphasize the importance of feedback effects from economic growth to quality of governance at the provincial level. The informal/formal and central/provincial distinctions highlighted in previous work suggest two possible explanations. The first is that informal governance matters: in the absence of reliable and impartial formal mechanisms, economic activity in China has been supported by informal arrangements in the form of social networks, cooperative norms enforced by concern for reputation and expectations of reciprocity, and reliance on personal ties with government officials (Nee & Oppen, 2012; Y. M. W. Peng & Luo, 2000; Xin & Pearce, 2006). A second interpretation consistent with the results in this study, although with less support in the previous literature, is that despite the *de jure* decentralization of power to local governments, the central government may still be the primary actor providing effective economic governance, with provincial governments merely reacting to changes in economic conditions.

A number of limitations of the analysis should be noted. First, the governance index used here, which is to my knowledge the only comprehensive measure of the quality of governance available at the provincial level throughout the reform era, captures only the *relative* quality of governance across provinces, holding the mean constant over time. This means that it is not possible to investigate long-run (cointegrating) relationships between governance and growth, and the analysis focuses only on short-run Granger causality. In addition, the short available time series does not allow testing for time-varying effects in the preferred heterogeneous causality model, although the restricted homogeneous causality model shows some evidence of such variation. The available time-series also excludes the initial years of reform prior to 1985, and may therefore fail to capture the effect of early

changes in governance. However, the time period for which data are available, from 1985-2005, covers the majority of the reform period, including many significant legal and bureaucratic changes at both the national and provincial levels that could be expected to affect economic growth rates.

A further issue is the extent of external validity of the results presented here. China's experience of sustained rapid growth is unprecedented in economic history, and one may be concerned that these findings are of limited relevance for other developing countries. The heterogeneity across provinces found here also supports such a view, indicating that the governance-growth relationship is conditional on the economic, social, and political environment. Nevertheless, the results indicate that, under at least some circumstances, successful economic development can be achieved without reliance on improvements in formal governance institutions, and that such economic growth can in turn support subsequent governance improvements. Identifying the conditions required for these results to hold, and their applicability to other settings, remains an interesting area for further research.

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Tables

Table 1: Improvement in China's quality of governance

| Index | Year ^a | Score | Percentile rank |
|--|-------------------|-------|-----------------|
| Economic Freedom of the World (Gwartney, Lawson, & Hall, 2013) | 1980 | 3.64 | 8 |
| | 2008 | 6.65 | 42 |
| | 2012 | 6.39 | 25 |
| Corruption Perceptions Index (Transparency International, 2013) | 1995 | 21.6 | 4 |
| | 2013 | 40 | 55 |
| | 2014 | 36 | 43 |
| World Competitiveness Yearbook (IMD, 2014) | 2002 | 52.0 | 38 |
| | 2010 | 80.2 | 71 |
| | 2014 | 73.3 | 63 |

^a The years shown represent the first, peak, and last years for which data are available for each index.

Table 2: Correlation with other provincial governance indices

| Index | Years | Correlation |
|--|-------------------|-------------------|
| Doing Business in China (World Bank, 2008) | 2008 ^a | 0.71 ^b |
| Government efficiency (Cole et al., 2009) | 1998-2003 | 0.72 |
| NERI marketization index (Fan, Wang, & Zhu, 2011) | 1997-2005 | 0.61 |
| NERI legal environment sub-index (Fan et al., 2011) | 1997-2005 | 0.67 |

^a Compared with the current governance index for 2005 (the last available year).

^b The Doing Business in China report does not provide an index score, but gives rankings for each province in four categories. The average of these four rankings is used here as a measure of quality of governance, and compared with the ranking of provinces in the current governance index.

Table 3: Heterogeneous panel Granger causality tests

| | (1) | (2) | (3) | (3) |
|-------------------------------------|--------------------------|--------------------------|------------------------------|--------------------------|
| | All provinces | | Excluding autonomous regions | |
| | Governance-to-GDP | GDP-to-Governance | Governance-to-GDP | GDP-to-Governance |
| GDP | (negative) | (positive) | (negative) | (positive) |
| Approximated Z-statistic | 0.77 (0.221) | 1.96** (0.025) | 0.75 (0.225) | 1.74** (0.041) |
| Average Wald statistic ^a | 1.90 (0.340) | 2.41* (0.063) | 1.97 (0.347) | 2.44* (0.073) |
| Primary industry GDP | (negative) | (positive ^b) | (negative) | (positive ^b) |
| Approximated Z-statistic | 4.50*** (0.000) | 0.73 (0.233) | 3.93*** (0.000) | 1.36* (0.087) |
| Average Wald statistic ^a | 3.66*** (0.002) | 1.99 (0.227) | 3.79*** (0.003) | 2.47* (0.099) |
| Secondary industry GDP | (negative ^b) | (positive) | (negative ^b) | (positive) |
| Approximated Z-statistic | 0.65 (0.259) | 4.19*** (0.000) | -0.15 (0.560) | 3.51*** (0.000) |
| Average Wald statistic ^a | 2.00 (0.390) | 3.59*** (0.004) | 1.49 (0.631) | 3.19*** (0.007) |
| Tertiary industry GDP | (ambiguous) | (positive ^b) | (positive ^b) | (ambiguous) |
| Approximated Z-statistic | 1.45* (0.073) | -0.61 (0.730) | 2.81*** (0.003) | -0.48 (0.684) |
| Average Wald statistic ^a | 2.38 (0.145) | 1.44 (0.702) | 2.64** (0.031) | 1.20 (0.654) |

p-values in parentheses

^a Wald statistic p-values computed with block-bootstrap method^b Sign significant at the 20% level only

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 4: Robustness checks: heterogeneous panel Granger causality tests

| | (1) | (2) | (3) | (4) | (5) | (6) |
|-------------------------------------|-----------------------------|-------------------|---------------------------------|--------------------------|--|--------------------------|
| | Excluding provincial cities | | Excluding Guangdong and Sichuan | | Allowing for possible non-stationary in the governance index | |
| | Governance-to-GDP | GDP-to-Governance | Governance-to-GDP | GDP-to-Governance | Governance-to-GDP | GDP-to-Governance |
| GDP | (negative) | (positive) | (negative) | (positive) | (negative) | (positive) |
| Approximated Z-statistic | 1.00 | 2.90*** | 0.84 | 1.79** | 0.71 | 1.49* |
| | (0.159) | (0.002) | (0.201) | (0.037) | (0.237) | (0.069) |
| Average Wald statistic ^a | 2.20 | 3.10** | 2.09 | 2.53* | 1.89 | 2.23* |
| | (0.283) | (0.019) | (0.305) | (0.069) | (0.331) | (0.094) |
| Primary industry GDP | (negative) | (ambiguous) | (negative) | (positive ^b) | (negative) | (positive ^b) |
| Approximated Z-statistic | 4.29*** | 0.15 | 2.66*** | 1.05 | 4.32*** | 0.66 |
| | (0.000) | (0.442) | (0.004) | (0.146) | (0.000) | (0.255) |
| Average Wald statistic ^a | 3.95*** | 1.90 | 2.60** | 1.92 | 3.60*** | 1.97 |
| | (0.002) | (0.382) | (0.020) | (0.146) | (0.001) | (0.224) |
| Secondary industry GDP | (negative ^b) | (positive) | (ambiguous) | (positive) | (negative ^b) | (positive) |
| Approximated Z-statistic | 0.47 | 3.88*** | 0.49 | 4.22*** | -0.01 | 4.17*** |
| | (0.318) | (0.000) | (0.314) | (0.000) | (0.505) | (0.000) |
| Average Wald statistic ^a | 2.11 | 3.82*** | 2.03 | 3.82*** | 1.71 | 3.61*** |
| | (0.445) | (0.005) | (0.406) | (0.003) | (0.591) | (0.003) |
| Tertiary industry GDP | (negative) | (ambiguous) | (both) | (ambiguous) | (ambiguous) | (ambiguous) |
| Approximated Z-statistic | 1.47* | -0.30 | 3.26*** | -0.52 | 0.03 | -0.86 |
| | (0.071) | (0.619) | (0.001) | (0.699) | (0.486) | (0.806) |
| Average Wald statistic ^a | 2.20 | 1.40 | 3.24** | 1.46 | 1.78 | 1.34 |
| | (0.148) | (0.583) | (0.017) | (0.667) | (0.535) | (0.806) |

p-values in parentheses

^a Wald statistic p-values computed with block-bootstrap method^b Sign significant at the 20% level only

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 5: Homogeneous panel Granger causality tests

| | (1) | (2) |
|-------------------------------|--------------------------|--------------------------|
| | Governance-to-GDP | GDP-to-Governance |
| GDP | (ambiguous) | (positive) |
| Chi-squared statistic | 7.70* (0.053) | 7.22* (0.065) |
| Primary industry GDP | (negative) | (positive) |
| Chi-squared statistic | 5.95* (0.051) | 11.79*** (0.003) |
| Secondary industry GDP | (ambiguous) | (negative) |
| Chi-squared statistic | 1.09 (0.580) | 0.55 (0.761) |
| Tertiary industry GDP | (positive) | (positive) |
| Chi-squared statistic | 6.15** (0.046) | 1.31 (0.519) |

p-values in parentheses

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Table 6: Time-varying effects, overall GDP growth to quality of governance

| | (1) | (2) | (3) |
|-----------------------|-----------------|---------------------|---------------------------------|
| | Before | After | Equality of coefficients |
| Break year: | | | |
| 1993 | (ambiguous) | (positive) | |
| Chi-squared statistic | 1.99 (0.369) | 22.19*** (0.000) | 19.19*** (0.000) |
| 1997 | (positive) | (positive) | |
| Chi-squared statistic | 2.07 (0.559) | 11.84*** (0.008) | 8.22** (0.042) |

p-values in parentheses

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Figures

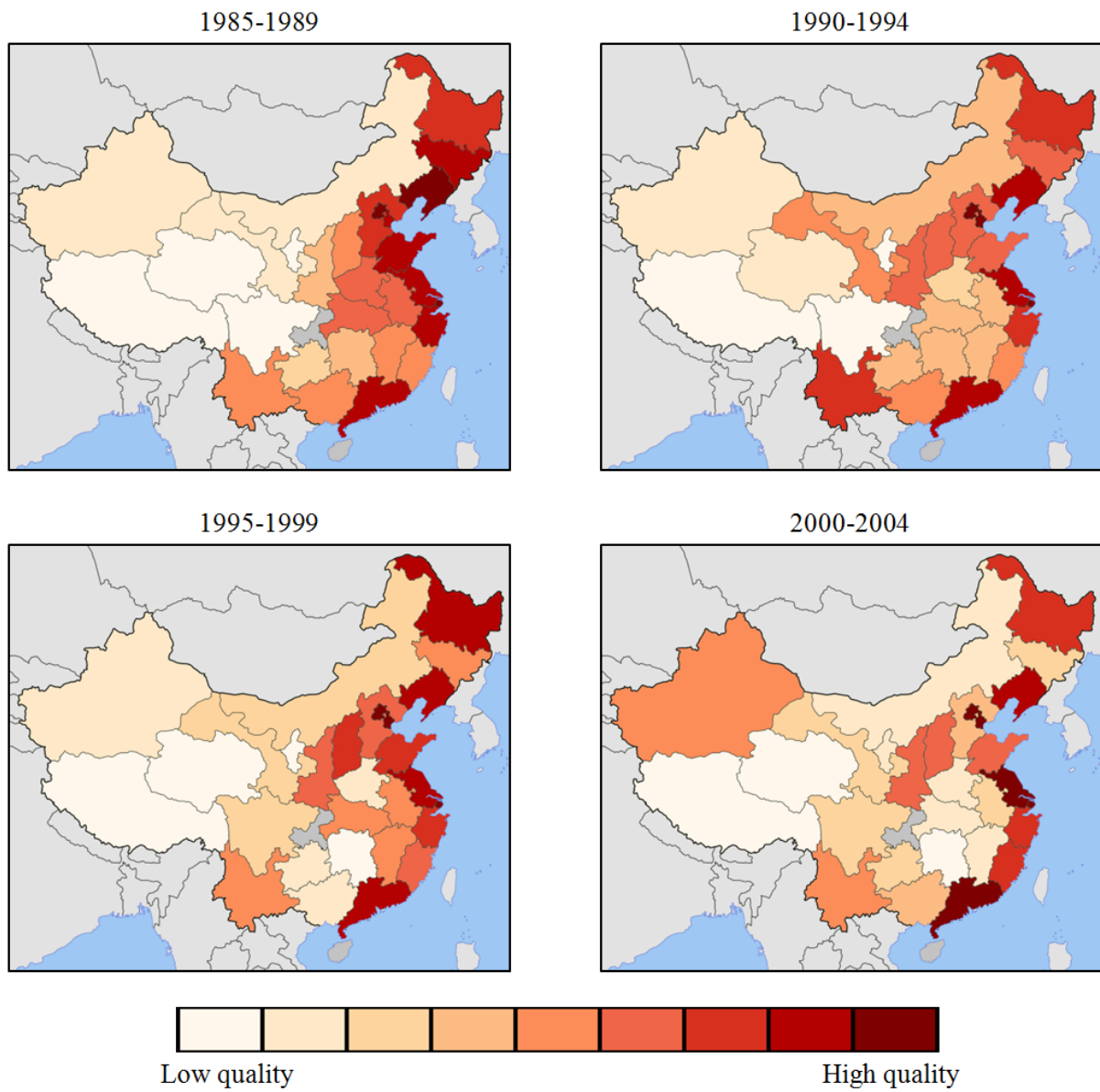


Figure 1: Provincial quality of governance, 5-year averages

Appendix

Table A1: Components of the governance index

The governance index used in the paper is constructed from 15 separate measures, aggregated into four categories as detailed below.

| | | |
|--------------------------------|-----|--|
| Government spending | 1. | Government budget surplus/deficit as a share of GDP |
| | 2. | Management of public finances |
| | 3. | Government expenditure as a share of GDP |
| Taxation | 4. | Fiscal revenue as a share of GDP |
| | 5. | Personal income tax as a share of GDP |
| | 6. | Goods and services tax as a share of GDP |
| | 7. | Social insurance contributions by employers as a share of GDP |
| Government efficiency | 8. | Implementation of economic policy |
| | 9. | Legislative activities |
| | 10. | Adaptability of political system to changing economic conditions |
| | 11. | Provision of public services |
| | 12. | Government subsidies as a share of GDP |
| Fairness & security | 13. | Social justice |
| | 14. | Personal and property security |
| | 15. | Social cohesion |

Table A2: Summary statistics

| Variable | Count | Mean | S.D. | Min | Max | Order of Integration |
|----------------------------|-------|------|-------|-------|------|----------------------|
| Governance index | 522 | 50 | 15.60 | -0.21 | 99.6 | I(0) |
| ln(GDP) | 522 | 0 | 0.981 | -3.12 | 1.59 | I(1) |
| ln(Primary industry GDP) | 522 | 0 | 1.022 | -2.35 | 1.37 | I(0) |
| ln(Secondary industry GDP) | 522 | 0 | 1.121 | -4.27 | 1.70 | I(1) |
| ln(Tertiary industry GDP) | 522 | 0 | 0.978 | -3.18 | 1.67 | I(1) |