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Abstract:

Despite the "growth miracle" of recent decades, labor's share, i.e., the share of total labor compensation in GDP, has decreased in China. Labor's share is an important indicator of the primary distribution of national income, and its fall has drawn significant attention from researchers and policymakers. As China's many regions have different development levels and economic structures, it is very likely that labor's share will differ across regions. Thus, it is important to examine the regional disparity of labor's share. In this paper, we develop a conceptual framework based on existing theories to identify the factors that influence labor's share. We, then, use Chinese provincial data from 1997 to 2007 to describe the regional differentials in labor's share and its evolution over the 10-year period and to explain regional disparity in labor's share. We take into consideration spatial correlations across regions and employ spatial cross-sectional and panel models in the empirical analysis. We found that industrial composition and ownership structure were the two key factors that influence labor's share. We also found that the average labor income was lower but labor's share was higher in western areas compared to eastern areas. The higher levels of labor's share in western provinces may be explained by a higher share of agricultural industries and state-owned enterprises, as agriculture and state-owned sectors tend to distribute more income to labor than to capital.

Key words: labor share; income distribution; regional disparity

JEL codes: J24 J30 R11

1. Introduction

Despite the recent growth miracle experienced in China, labor's share, i.e., the share of GDP income attributed to labor, has decreased. Labor's share is an important indicator of the primary distribution of national income. Previous research has indicated that the recent widening of income inequality in China is related to the primary distribution of national income and, specifically, a low labor share (Li et al., 2009). Moreover, China has recently attempted to transform its economy from an investment- and export-led system toward a consumption-driven structure. Increasing labor's share and hence raising domestic consumption levels are crucial if China wishes to successfully transform its economy. Therefore, it is not surprising that since 2005, China's falling labor's share has drawn significant attention from both researchers and policymakers (Li S., 2007; Cai, 2005, 2006; Li D., 2007).

While several studies have examined the decrease in labor's share in China at a national level (Bai et al., 2009a; Li et al., 2009), there is little research on regional disparity regarding labor's share. As China's regions display varying levels of development and economic structure, it is likely that labor's share will also vary among regions. Thus, it is important to examine the regional disparity in labor's share to develop regional-specific policies.

First, using provincial panel data from 1997 to 2007, we describe the regional differentials in labor's share and its evolution over the 10-year period. We created spatial maps for each year and our results show that despite the lower levels of labor income, labor's share was high in western provinces from 1997 to 2007. Second, we attempt to explain regional disparity in labor's share. We estimated cross-sectional spatial regression models and spatial panel models. We found that industrial structure and ownership structure are the two main factors that influence labor's share. The higher levels of labor's share in the western provinces are significantly related to a higher share of agricultural industries and state-owned enterprises.

The structure of this paper is as follows: In Section 2, we review empirical studies on labor's share in the international literature and in China. Section 3 presents a conceptual framework to explain the driving forces of labor's share, and discusses why they are relevant in the context of China. Section 4 explains the data source and describes regional disparity regarding labor's share and its evolution from 1997 to 2007. Section 4 presents spatial models and empirical results. Section 5 summarizes and discusses the results.

2. Related studies

2.1 Review of international studies on labor's share

The stability of labor's share has been labeled as a "stylized fact of growth" by David Ricardo (Kruger, 1999). However, researchers have surprisingly found a downward trend of labor share from the 1970s to early 2000, yet the absolute value and the change in labor share were quite different across Euro zone countries (De Serres et al., 2001; Moral and Genre, 2007). In the U.S., although studies suggest that from the 1960s to 1990s, the share of labor's income in U.S. GDP had been relatively stable or even slightly increased (Poterba, 1997; Raffalovich et al., 1992), this increase was mostly attributed to the expansion of workers' non-cash benefits, while wage share had fallen by three percentage points. This pattern was also a result of the two offsetting effects: on the one hand, the share of labor income in the manufacturing sector had decreased sharply; on the other hand, labor share in the service industry had increased (Young, 2006).

With regard to the factors that influence labor's share, technology progress, and labor bargaining power have been found to be important explanatory variables of labor's share

(Bentolila and Saint-Paul, 2003; Blanchard et al., 1997; Rafflaovich et al., 1992). In addition, labor's share has been shown to be highly correlated with the sectoral composition of the economy (Young, 2006; De Serres et al., 2001; Moral and Genre, 2007). Measurement errors and the different methods used to calculate employee compensation may also contribute to the different labor shares reported across countries (Gollin, 2002; Krueger, 1999). Other factors proposed by researchers to explain labor share include globalization and international trade (Harrison, 2002).

2.2 Review of studies on China's labor share

Empirical studies in China concerning labor's share are relatively new. Cai (2005, 2006) was amongst the first to notice the falling trend in China's labor share. Most of the existing studies believed that the declining labor share in China was driven by economic forces, whereas Bai and Qian (2010) argued that measurement issues were behind a significant proportion of the decline in China's labor share, and that the reported fall in labor share was largely overstated.

The main explanations for the declining labor share in China, proposed by previous studies, include: (1) the shift in the industrial composition from agriculture to non-agriculture (Bai and Qian, 2010; Li et al., 2009); (2) privatization, restructuring of SOEs, and the change in the ownership structure of the economy (Bai and Qian, 2010; Bai et al., 2008; Luo and Zhang, 2009; Zhou et al., 2010); (3) foreign direct investment (Luo and Zhang, 2009; Shao and Huang, 2010). Other factors, such as relative price changes, the factor input ratio, and biased technology progress, are generally insignificant in explaining the falling labor share (Bai and Qian, 2010).

In contrast to most of the studies that have been focused on the falling of the labor share, Li et al. (2009) proposed a U-shaped pattern regarding the movement of labor's share in China. The explanation they gave for the U-shaped pattern is related to the shift in the sectoral composition. They built a theoretical model to show that as labor moves from agriculture to non-agriculture, labor's share will first decline than increase.

Although there are several studies, as mentioned above, that have analyzed China's labor share, most of these studies have used data at either country or firm-level.[1] Compared to the country level studies, the provincial or firm level studies could utilize more variation to examine the causes of the falling labor share. To date, the few provincial-level studies have not considered the spatial correlation in economic variables between provinces, nor have they specifically addressed the regional disparity in labor's share in China. Since spatial externality is very likely to exist in the provincial data, it is necessary to use spatial econometric models in the estimation. For example, Tian et al. (2010) demonstrated the externality in economic growth between regions in China.

Moreover, China is a country with vast territory. Different regions have different levels of economic and social development. Regional economic disparity has been intensively discussed. The previous studies have examined regional disparity regarding economic growth and regional wage differentials (Jian et al., 1996; Fleisher and Chen, 1997; Wang and Yao, 2001; Cai et al., 2002; Tian et al., 2010; Démurger et al., 2012), but not in terms of the primary distribution of national income and labor's share.

Our study attempts to contribute to the existing literature by first demonstrating the regional differences in labor's share and, second, by using spatial econometric models to explain regional disparity. Our study provides a robustness check to the prior studies that

[1] The studies at the country level include Bai and Qian (2010), while those using firm data are Bai et al. (2008), Li et al. (2009), and Zhou et al. (2010). Bai and Qian (2010) had a section in their paper, using the firm data to estimate the labor's share equation.

use OLS models to analyze provinces' labor share. We also consider the explanatory variables that have not been examined by previous provincial-level studies, such as international trade, patents, and human capital.

3. Conceptual framework

In this subsection, we provide a conceptual framework for understanding the factors that influence labor's share. To guide the empirical analysis, we focus on the factors that are included in our later empirical model, specifically, industrial composition, state ownership, technology progress, international trade, and human capital. Rather than proposing new theories, we apply the existing theories to develop the conceptual framework.

In the neoclassical economic theory, the constant factor share is a stylized fact. Under perfect competition, the total wage bill will adjust at the same rate as the productivity of labor, and the labor's share in the total output will be constant. However, different industries and countries could have different production elasticities and hence different labor shares. Solow (1958) demonstrated a significant variation in labor's share across industries and the change in the labor share within an industry, while Douglas (1976) showed a variation in labor's share across countries. [2] The fact that a country's aggregate labor share is relative stable could be due to the counter-shift in the weight of the sector when the sectoral labor share shifts, e.g. the low-share industry gaining in weight when the sectoral labor share rises (Solow, 1958). The later studies showed that a shift towards industries with a lower labor share has been the most important underlying force driving the downward trend in the labor share in Europe (de Serres et al, 2001; Arpaia et al., 2009).

[2] Douglas (1976) studied factor shares in Australia, the UK, Canada, South Africa, and New Zealand in the 1920s through 1940s.

In China, provinces have different industrial compositions. Some provinces are still traditional agricultural provinces, while others have developed a large industrial sector. The industrial composition is also moving in different directions for different provinces: the less-developed provinces are shifting from agriculture to manufacturing, while the more developed areas are moving towards a service economy. The regional disparity in industrial composition could contribute to the regional disparity in the level and trend of labor's share.

Labor institutions, such as unions, could affect labor's share through the effect on labor's bargain power. Blanchard et al. (1997) incorporated firm and employee bargaining power in the model to explain a country's movement in labor's share. Rafflaovich et al. (1992) did not find evidence that a tight labor market increased labor income shares by increasing the bargaining power of labor. In the empirical analysis, the power of labor, relative to that of capital, cannot be directly measured. However, in firms with different ownership structures, the collective power of labor may be different. Azmat et al. (2007), in their theoretical model, linked the worker's bargaining power to privatization, and then to labor's share. Privatization and state ownership are also important in the context of China. Presumably in the state sector, workers may have a greater voice than those in private and foreign sectors. If a region has a larger state sector, we predict that labor's share is higher.

Technology progress is another important driving force of the movement of labor's share. Bentolila and Saint-Paul (2003) pointed out that when capital and labor were highly substitutable, technical progress, specifically a capital-augmenting technical progress, will negatively influence labor's share, because capital-augmenting technical improvements would increase the marginal productivity of capital rather than that of labor. Lawless and Whelan (2011) suggested that the change in technology be an important underlying factor behind the declining labor share in many industrial sectors in Europe.

Globalization is believed to be an influential factor of labor share movement in developing countries. Openness to trade is often associated with a fall in the protection of domestic labor-intensive goods (e.g., agricultural products), and is thus expected to lower labor's share (Harrison, 2002). Using cross-country data, Harrison (2002) found that the trade share had indeed a significantly negative effect on labor's share.

Finally, human capital may be an explanatory factor of labor's share. According to the existing studies, human capital has two opposing effects on labor's share. On the one hand, a higher labor share may be found for regions with a more educated workforce, as in these regions a higher share of labor compensation would go to high-skilled workers, and the wages of high-skilled workers are generally higher. On the other hand, a higher share of high-skilled workers is often associated with greater capital intensity and advanced technology, and thus a lower labor share. Evidence from Poland appears to support the second hypothesis (Growiec, 2009).

In China, technology progress, international trade, and human capital, are all relevant factors in explaining regional disparity in labor's share. Regardless of the indicator used, patents, R&D investment, or productivity efficiency, provinces all displayed a significant variation in technology progress. Moreover, despite the overall trade surplus, some provinces had large net imports while others had net exports.[3] The human capital level also varied significantly across provinces. For example, in Beijing, college-educated

[3] For example, in 2007, Guangdong had a net export of 94 billion U.S. dollars, while Inner Mongolia a net import of 2 billion. Source: China Statistical Yearbook 2008

workers accounted for 34% of the labor force in 2007, while they accounted for only 3% in Anhui. [4] All these three factors could explain a portion of the variation in the labor's share across provinces, and thus should be included in the empirical analysis, in addition to industrial composition and state ownership.

4. Data

4.1 Data source

Data used in this study are sourced from China Statistical Yearbooks, China Labor Statistical Yearbooks and China Statistical Yearbooks on Science and Technology, from 1997 to 2007.[5] Total labor compensation, GDP, total outputs from the agricultural, industrial, and service sectors, net export, size of labor force, the number of employees working for enterprises of different ownership type, fixed-capital investment, foreign direct investment,[6] and provincial patent applications are selected from the China Statistical Yearbooks. Since 1996, the educational attainment of workers has been reported in Labor Statistical Yearbooks. The R&D investment data is drawn from the China Statistical Yearbooks on Science and Technology. In Appendix, the mean and standard deviation of key variables are reported.

A spatial coordinate matrix for spatial regression models is generated using X-Y coordinates obtained from the fundamental geographic information system in the National Geomatics Center of China (NGCC). The fundamental geographic information system was built by NGCC to provide basic geographic information including geographic coordinates,

[4] Source: China Labor Statistical Yearbook, 2008

[5] In 1997, Chongqing became the fourth municipal city directly under central government. The other three cities are Beijing, Tianjin, and Shanghai. From 1997, Chongqing began reporting data separately from Sichuan province. As estimating spatial models requires a geographic matrix that consists of a fixed number of sub-areas, and despite the fact that workers' educational attainments have been available since 1996, we chose to use data from 1997 to meet the requirement for a fixed number of sub-areas. China Statistic Yearbooks did not report labor compensation for 2004 or 2008.

[6] FDI was no longer reported after 2003.

provincial boundaries, administrative areas, rivers, and roads.

4.2 Regional disparity in labor share

We follow previous studies and calculate labor's share as the share of the total labor compensation in national income. The total labor compensation, sourced from National Statistical Yearbooks, is defined as "all the compensation paid to labor for their productive activities." In this definition, labor's compensation contains all forms of wages, bonuses, and allowances. For self-employed workers, due to difficulty in distinguishing labor compensation and operation profit, both are classified as labor compensation. [7] Gollin (2002) stated that an incorrect measurement of self-employed income represented the majority of bias in the calculation of labor share. By including the operation profit of self-employed workers, we tend to overestimate labor share in China. Even with a positive bias, the estimated labor share is still relatively low compared to such countries as the US and Japan.

We calculate the average labor compensation for each province by dividing the total labor compensation by total employment. Total employment is defined by the National Bureau of Statistics of China as "the population above 16 years of age who are engaged in work and earn labor income and operating income." It includes both urban and rural workers. In Table 1 we show the average labor compensation and labor's share for 31 provinces and municipal cities for selected years. Shanghai, the most developed city in China, had the highest average labor compensation (28.6 thousand Yuan per year per worker), but the lowest labor share for 1997–2007. In contrast, labor's shares for Guangxi and Tibet were greater than 0.6, indicating that over 60% of provincial GDP was

[7] In China Statistical Yearbooks, total employment includes self-employed workers. The registered self-employed units are required to report their net income of business to the Statistical Bureau, which is included in the calculation of the total labor income in GDP.

distributed to labor, rather than to capital and government. In these two provinces, the average labor compensation was relatively low.

To show the movement of labor share in different regions, we select five provinces and municipal cities from five major regions in China, Beijing (representing northern China), Liaoning (northeast China), Shanxi (central China), Guangdong (southeast China), and Chongqing (western China). The labor shares for the five provinces and municipal cities are plotted for 1997–2007. Figure 1 suggests that not only are the levels of labor's share different across the regions, but also the movement of labor's share. Generally speaking, the five provinces all experienced a decrease in labor share between 1997 and 2007. However, the magnitude and timeline of the decrease is different for different provinces. Beijing shows that labor's share was in decline prior to 2003 and then increased after that date.

Figures 2 and 3 show the spatial maps of the average labor compensation and labor's share of provinces. Each year provinces are classified into five quantiles based on the average labor compensation (Figure 2) or labor's share (Figure 3). The maps show five shades of blue from light to dark, corresponding to the five quantiles. As shown in Figure 2, there exists a large variation in the average labor compensation across the country. The coastal areas had significantly higher average labor compensation than central and western areas. Guangdong, Fujian, Jiangsu, Shanghai, and Liaoning had the highest average labor compensation levels, and their leading positions have not changed over time.

Compared with Figure 2, the spatial maps in Figure 3 show the different patterns of labor's share across the regions. While the coastal provinces had relatively high average labor compensation, they had lower labor share compared with western provinces. Sichuan and Guangdong clearly demonstrate this contradiction. Figure 3 also captures the movement of spatial distribution regarding labor's share. After 2003, as a whole, China experienced a decrease in labor share. However, the most significant fall in labor share occurred in the north and northeast areas. Take Inner Mongolia as an example—it was in the first tier of provinces in terms of labor share from 1998 to 2003, and then fell to the bottom in the following 5 years.

5. Spatial regression results

5.1 Estimation of cross-sectional models

In geographical data, neighboring areas often share more common characteristics than those that are far apart due to the interaction and spillover effects between regions. Traditional OLS regressions assume that observations are independent and uncorrelated. Spatial dependence clearly violates these assumptions, thus rendering conventional OLS analysis invalid. Therefore, a spatial econometric method is required in regional studies (Anselin, 1988; Baltagi et al., 2003; Anselin et al., 2008).

China is a country with an extensive land area. Economic variables such as GDP, employment, and fixed-capital investment are likely to be subject to spatial dependence (Tian et al., 2010). The spatial maps in Figure 3 already suggest the spatial dependence of labor's share between neighboring regions. To further justify the adoption of spatial regressions, we calculate Moran's I for labor's share and other key explanatory variables for 1997 to 2007. Moran's I is commonly used to test the presence of spatial dependence. It is calculated as follows:

$$Moran's\ I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(Y_i - \bar{Y})(Y_j - \bar{Y})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} ,$$

where $S^2 = \frac{1}{n}\sum_{j=1}^{n} W_{ij}(Y_j - \bar{Y})$, and $\bar{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i$. Y_i represents the observation of province *i*; *n* represents the total number of provinces. W_{ij} denotes the binary spatial weight matrix, which defines the adjacent relationship between provinces *i* and *j*. W_{ij} equals one if two provinces have a common border line and zero otherwise. As shown in Table 2, Moran's *I* is significant for most variables. These results suggest that labor's share and other major explanatory variables are all significantly spatially correlated. Therefore, we use spatial regressions, including cross-sectional models and panel models, to estimate the regional disparity of labor's share.

The commonly used spatial regression models are Spatial Lag Model (SLM) and Spatial Error Model (SEM). The difference between SLM and SEM lies in whether spatial dependence is modeled by the spatially lagged dependent variable or introduced in the disturbance term. We estimate both models with SEM defined as:

$$\begin{aligned} & ls = \beta_1 + \beta_2 X + \varepsilon \\ & \varepsilon = \lambda W \varepsilon + \mu \\ & \mu \sim N(0, \sigma^2) \end{aligned} \quad (1)$$

,

and SLM as:

$$\begin{aligned} & ls = \rho W ls + \beta_1 + \beta_2 X + \varepsilon \\ & \varepsilon \sim N(0, \sigma^2) \end{aligned} \quad (2)$$

.

ls: labor share, which is the ratio of the total labor compensation to GDP in a province. Since the ratio lies in the interval [0, 1], we apply the logistical transformation to it. X

refers to the factors that influence labor share.

Xs include the following variables: (1) $Industry$ represents the economic structure of a province, which is measured by the share of the outputs of the agricultural, industrial, and service sectors in GDP; (2) $\ln patent$ is used to measure a province's technology progress. It is calculated as the logarithm of the number of invention patent applications per 10,000 population in a province. We have also used the total R&D investment of a province to indicate investment in technology; (3) $Ownership$ indicates the ownership structure of a provincial economy, which is measured by "*State*" and "*non-state*", representing, the percentages of employees working in state-owned and collectively-owned firms, and those in the non-state-owned, respectively. The non-state-owned enterprises include private, foreign, and joint-stockholding enterprises. (4) *International trade* denotes a province's share of net exports in GDP. (5) *HC* refers to human capital variables. Specifically, we use three measures for human capital, "*Tertiary*", "*Secondary*", *and* "*Primary*", which denote the percentage of workers with tertiary, secondary, and primary educational attainment; (6) $\ln FCI$ is the logarithm of fixed-capital investment in a province in a year, and (7) $\ln employee$ is the logarithm of the number of employees in the labor force. As in previous empirical studies (Bentolila and Saint-Paul, 2003; Li et al., 2009), fixed-capital investment and the size of the labor force are included as control variables in the models.

W is the $n \times n$ spatial weight matrix. The parameter for the spatial error term and the spatially lagged dependent variable is represented by λ and ρ. To ensure the robustness of the results, we use several spatial weight matrices including a contiguity matrix, K-nearest neighbor (KNN) matrix, and spatial coordinate matrix. [8] Estimations using different matrices provide robust results; the result using the KNN matrix is reported.

Table 3 reports both OLS and spatial regression estimates of the impact of industrial composition on labor's share. Columns (1) through (3) document OLS estimates without control variables. The OLS results with control variables are listed in Columns (4) to (6). Columns (7) to (12) report SEM and SLM estimates, respectively, with control variables. Several important findings emerge from Table 3: industrial composition is a crucial factor in explaining the regional disparity of labor's share in China. The coefficient estimates for *agriculture* in the labor's share regression are significantly positive, while those for *industrial* are significantly negative. This result implies that provinces that have a larger share of the agricultural sector and a smaller share of the industrial sector tend to distribute more income to labor than to capital. A further finding is that the effect of the agricultural sector on labor's share has decreased in the last 5 years. We also observe that the impact of the service sector on labor's share increased between 2003 and 2006. As predicted by Bentolila and Saint-Paul (2003), the growth of the service sector, which is a labor-intensive industry, had a positive effect on labor's share.

Comparing spatial estimates to OLS estimates, we find that they are generally similar. However, spatial estimates are more statistically significant for some years. For example, *service* is insignificant in the OLS model in Column (6) for 2003, but is significant at the 5% level in the corresponding SEM model in Column (9). In general, the log likelihood of OLS models is smaller than the log likelihood of the corresponding spatial models. We also conduct Likelihood Ratio (LR) and Breusch-Pagan tests to compare the different

[8] The spatial matrices are constructed using software GeoDa. To build the distance weighted matrix and the KNN matrix, we obtain the coordinate data of the center point of each province from NGCC.

models more rigorously. The results show that for recent years such as 2006 and 2007 spatial models significantly outperform OLS models, and that SLM models are more significant than SEM models.

Table 4 reports the effect of ownership structure on labor's share. The coefficient estimates are generally positive, indicating that a larger state sector is associated with a higher labor share, which supports the theory purported earlier. However, the estimate was only significant for 1999–2003, and after 2005 the estimate declined significantly. This may be due, in part, to the decline of labor's bargaining power and/or increase in both technology and capital intensity in the state sector.[9] The comparison of different models suggests that spatial models perform better than OLS in terms of the log likelihood and the differences are statistically significant for several years based on the LR test. Between the two spatial models, SLM seems to be better, as the LR test for SLM is significant in more number of years than SEM.

Besides the ownership structure, the FDI inflow could also demonstrate significant regional disparity. As shown in Appendix Table B, after controlling for the effect of FDI, the share of the state sector still has a significantly positive impact on labor's share for 1999–2003. FDI has a negative effect on labor's share, which is similar to the finding of Shao and Huang (2010). The regressions are also conducted for the effect of human capital, technology progress, and international trade on labor share. For brevity, the cross-sectional results are not reported. The results are generally consistent with the theory.

Since GDP is the denominator of both the dependent variable, labor's share, and

[9] State-owned enterprises increasingly hire contract workers who have less bargaining power than formal employees, resulting in the decline of the overall bargaining power of employees in SOEs. The capital intensity of SOEs has also increased: annual fixed-capital investment of SOEs increased by 79% from 2003 to 2007, while it only increased by 31% from 2000 to 2003 (calculations based on China Statistical Yearbooks 2003–2008).

several key explanatory variables that are measured as the ratios to GDP, such as *agriculture*, *industrial*, *service*, and *international trade*, we adopt the method used in Barro (1991) to correct for this potential simultaneous bias. We include GDP per capita in 1988 in the spatial regressions to control for the effect of the initial income level. Appendix Table C shows that with the inclusion of GDP per capita in 1988, the effect of *agriculture*, *state, patent* and *international trade* becomes smaller and insignificant, while the effect of *industrial* remains negative and significant. These findings suggest that the simultaneous bias does affect the estimate to a certain extent, but the effect of the industrial sector on labor's share is not impacted.

Finally, we consider potential endogeneity in the spatial cross-sectional model. The endogeneity problem may be less serious in the fixed effect specification because the fixed effect model controls for unobserved time-invariant provincial characteristics that affect labor's share. The cross-sectional model, however, is subject to the endogeneity bias because explanatory variables may be correlated with the error term. Correcting for endogeneity in the cross-sectional model is difficult because of the lack of proper instrumental variables. To test endogeneity in our model, we employ the spatial 2SLS method proposed by Kelejian and Prucha (1999). Following Dall'erba and Le Gallo (2008), we use two kinds of IVs. One is the spatial lag of all the explanatory variables; and the other is defined by the 3-group method, where the IV for an endogenous variable takes the value of 1, 0, and -1 based on whether the value of the original variable is in the top, middle, or bottom third of its ordinal ranking. By construction, this IV is correlated with the endogenous variable. In addition, Fingleton and Le Gallo (2008) proved that this kind of IV is relatively independent from the error term in spatial models.

We estimate spatial 2SLS models for each year from 1997-2007. However, for brevity, we report the estimates only for 1997, 2003, and 2007 in Table 5. For each year, the first column uses the spatial lag of all the explanatory variables as IVs, and the second column uses the IVs defined by the 3-group method. Table 5 shows that the sign of coefficient estimates of spatial 2SLS models are, in general, consistent with OLS, SEM, and SLM estimates. However, spatial 2SLS estimates are smaller and statistically less significant.

5.2 Estimation with panel data models

Panel data are viewed as being more informative than cross-sectional or time-series data. With more variation and less collinearity among variables, panel data models often provide more efficient estimates (Hsiao, 1986). Elhorst (2003) developed panel models for spatial regression. Based on different decompositions of error terms, panel spatial models can be divided into fixed-effect and random effect models. Baltagi (2001) pointed out that if the data are limited to specific samples (such as the 31 provinces in this study), fixed-effect models are usually the better choice. We built a fixed-effect spatial error model, which included all the explanatory factors used in the cross-sectional estimation. In this model, the unobserved spatial fixed effects are controlled for. Spatial fixed-effects refer to the effects that vary across regions but do not change over time, for example, factor endowment.

$$ls_{it} = \beta_1 X_{it} + \eta_i + \mu_{it} \qquad (3)$$

$$\mu_{it} = \lambda W \mu_{it} + v_{it},$$

where η_i represents the spatial fixed-effects for sub-area i. W is the neighboring weighted matrix.

The estimates of the fixed-effect spatial error model are reported in Table 6. Controlling the spatial fixed-effects, the model can well explain the movement of labor's share in China. The fixed-effect estimates are consistent with the cross-sectional spatial estimates, indicating that a province's higher agricultural and state sector share is associated with a higher labor share. Compared with provinces that have a larger share of primary level educated workers, provinces with more college-educated workers have a lower labor share when patents or R&D is not controlled for, but have a higher labor share when patents, R&D, and FCI is included in the regression. This result supports Growiec (2009), who argued that higher human capital is complementary to capital and technology, and thus is more likely to be associated with a lower labor share when capital or technology is not controlled for. But when the regression controls for capital and technology specifically, the effect of the higher human capital level on labor's share is positive.

The negative impact of international trade on labor's share is shown in the spatial fixed-effect estimates, which confirms Harrison (2002), but the estimates are not statistically significant. Ln*patent* and ln*R&D*, which measures the extent of technology progress in a province, have a significantly negative coefficient estimate. It provides some supporting evidence to the theory that capital-augmenting technology progress is associated with a lower labor share. Ln*FCI* has a negative effect on labor's share. Finally, the estimate for the spatial autocorrelation coefficient is also reported in Table 6. It is significant for all the specifications, which justifies the use of the spatial fixed-effect models.

We further introduced the lagged dependent variable into the spatial fixed effect model.

Appendix Table D demonstrates that the one-year lagged labor share has a significantly positive coefficient estimate, suggesting a high degree of persistence in a province's labor share. The estimates for other explanatory variables are similar to those in Table 6, except that the estimate for *patent* and *R&D* is less significant and that the effect of *tertiary* becomes positive for all the models.

In the fixed effect models, the simultaneous bias stemming from the fact that GDP is the common denominator of both labor's share and several key explanatory variables is less severe, because the provincial fixed effect captures all the unobserved province-specific and time-invariant factors that affect the province's labor share. The effect of the level of GDP would be incorporated in the provincial fixed effect and would be dropped out in the fixed effect estimation.

5. Conclusions

This paper addressed the important issues of the pattern and determinants of regional disparity in labor's share in China. Although there have been many studies on regional income disparity in China, few have considered regional disparity regarding the primary distribution of income between labor and capital. With respect to labor's share in China, further regional level studies are still required. Our study used detailed provincial data and spatial econometric methods to estimate the effect of industrial composition, ownership structure, and other provincial economic factors on labor's share.

Empirical analysis identified several important findings. First, despite the lower average labor compensation, labor's share in western and central areas was high. In contrast, coastal areas with higher GDP and average labor incomes had lower labor shares. As labor's share is an important proxy for the primary distribution of national income, this finding implied that the distribution of aggregate output in underdeveloped areas is weighted more toward labor than capital.

Second, we examined the factors that explain the regional disparity and movement of labor's share, and found that the industrial composition and ownership structure of a province are the two most important factors. The higher labor share in western provinces is strongly related to the greater share of agricultural industry and the state sector. Moreover, a lower trade share and less-advanced technology may also contribute to the higher labor share in the western provinces. We also drew the important conclusion that an increase in an economy's share of the service sector will have a positive effect on labor's share.

Our finding of a higher labor's share in the less developed provinces in China stands in contrast to the stylized fact in the international literature that poor countries usually have a lower labor share than rich countries. A plausible explanation is still related to industrial composition. The developed countries usually have a large share of the service sector, while the service sector, as suggested by our results, leads to a higher labor's share. In contrast, the more developed area in China typically has a large concentration of the industrial sector while the less developed provinces are mostly agricultural. Our results indicate that the agricultural sector tends to distribute more to labor than the industrial sector. With a large share of agriculture in the local economy, the less developed provinces tend to have a higher labor share than the more developed provinces in China.

Based on these empirical results, we predict that as industrialization and trade openness increase and technology advances in less-developed western regions, these regions may first experience the same downward trend in labor's share that eastern and northern regions have experienced. To avoid a falling labor's share, while maintaining rapid economic growth, western regions may, rather than following the traditional path of development from agriculture to manufacturing and then to service, take measures to boost the service sector, especially regarding high-waged professional services, as the service sector has a positive effect on labor’s share.

References:

[1] L. Anselin, Spatial Econometrics: Methods and Models, Dordrecht Kluwer Academic, 1988.
[2] L. Anselin, J.Le Gallo, H.Jayet, Spatial Panel Econometrics, Springer Berlin Heidelberg, 2008.
[3] A. Arpaia, E. Pérez, K. Picheimann, Understanding labour income share dynamics in Europe, European Economy, Economic paper 379. 5, 2009.
[4] G. Azmat, A. Manning, J. Van Reenen, J. Britain, Privatization, entry regulation and the decline of labor's share of GDP: a cross-country analysis of the network industries, CEP discussion paper No807. 2007.
[5] C.E. Bai, Z.J. Qian, Factor income share in China: The Story behind the Statistics, Economic Research Journal. 3(2009) 27-41 (Chinese).
[6] C. E Bai, Z.J. Qian, The factor income distribution in China: 1978-2007, China Economic Review. 21(4) (2010) 650-670.
[7] C.E. Bai, Z.J. Qian, K.P. Wu, Determinants of factor shares in China's industrial sector, Economic Research Journal. 8 (2008) 16-28 (Chinese).
[8] B.H. Baltagi, Econometric Analysis of Panel Data (Second Edition).John Wiley & Sons, Chichester, United Kingdom,2001.
[9] B.H. Baltagi, S.H. Song, K. Won, Testing panel data regression models with spatial error correlation, Journal of Econometrics. 117 (2003) 123–150.
[10] R. J. Barro, A Cross-Country Study of Growth, Saving, and Government, the chapter in B. Douglas Bernheim & John B. Shoven, "National Saving and Economic Performance,"NBER Books, National Bureau of Economic Research, Inc,. (1991) 271-304.
[11] S. Bentolila, G. Saint-Paul, Explaining movements in the labor share, the B.E. Journal of Macroeconomics, Contributions to Macroeconomics. 3(1) (2003) Article 9.
[12] O. Blanchard, J. Nordhaus, D. William Phelps, Edmund S. The medium run, Brookings Papers on Economic Activity. 2(1997) 89-158.
[13] F. Cai, D. Wang, Y. Du, Regional disparity and economic growth in China: The impact of labor market distortions, China Economic Review. 13 (2002) 197-212.
[14] F. Cai, Exploring the fair distribution mechanism in accordance with economic development, People's Forum, 17th Oct (2005) (Chinese).
[15] F. Cai, Maximum Employment is the economic base of social harmony, Wen Wei Po, 24th Oct (2006) (Chinese).
[16] S. Dall'erba, J. Le Gallo, Regional convergence and the impact of European structural funds over 1989-1999: A spatial econometric analysis. Papers in Regional Science. 87(2) (2008) 219-244.
[17] S. Démurger, S. Li, J. Yang, Earnings differentials between the public and private sectors in China: Exploring changes for urban local residents in the 2000s, China Economic Review. 23 (1) (2012)138-153.
[18] A. De Serres, S. Scarpetta, C. De la Maisonneuve, Falling wage shares in Europe and the United States: How important is aggregation bias? Empirica. 28 (2001) 375-400.
[19] P. H. Douglas, The Cobb-Douglas production function once again: its history, its testing, and some new empirical values, The Journal of Political Economy. 84(5) (1976)903-915.
[20] J.P. Elhorst, Specification and estimation of spatial panel data models, International Regional Science Review. 26 (2003) 244-268.
[21] B. Fingleton, J. Le Gallo, Final sample properties of estimators of spatial models with autoregressive, or moving average disturbances and system feedback. Annals of Economics and Statistics. 87/88 (2008) pp. 39-62.
[22] B. Fleisher, J. Chen, The coastal non-coastal income gap, productivity, and regional economic policy in China, Journal of Comparative Economics. 25 (1997) 220-236.
[23] J. Growiec, Determinants of the labor share: evidence from a panel of firms. National bank of Poland working paper, 69 (2009).
[24] D. Gollin, Setting income shares right, Journal of Political Economy. 110 (2) (2002) 458-474.
[25] A.E. Harrison, Has globalization eroded labor's share? Some cross-country evidence, mimeo, University of California, Berkeley, 2002.
[26] C. Hsiao, Analysis of Panel Data, Cambridge University Press, Cambridge, 1986.

[27] T. Jian, J. Sachs, A. Warner, Trends in regional inequality in China, China Economic Review. 7(1) (1996) 2-21.
[28] H.H. Kelejian, I.R. Prucha. A generalized moments estimator for the autoregressive parameter in a spatial model. International Economic Review. 40(1999) 509-534.
[29] A.B. Krueger, Measuring labor's share, American Economic Review. 89(2) (1999) 45-51.
[30] M. Lawless, K. T. Whelan, Understanding the dynamics of labor shares and inflation, Journal of Macroeconomics. 33(2) (2011) 121-136.
[31] D.K. Li, Labor's share in GDP has gradually decreased, Caijing Magazine. 2nd July, (2007) http: \\finance1jrj1com1cn\news\ 2007207202\0000023819751.html.
[32] D.K. Li, L.L. Liu, H.L. Wang, The U curve of labor share in GDP during economic development, Economic Research Journal. 1(2009) 70-82 (Chinese).
[33] S. Li, The balance of growth and sharing in China, China Finance News. 28th Augest (2007) http: \\ news.xinhuanet.com\fortune\2007204\28\content - 6038867. html.
[34] C.Y. Luo, J. Zhang, The economic explanation of decrease of labor share-the empirical analysis based on China's provincial panel data, Management World. (05) (2009) 25-35 (Chinese).
[35] E. Moral, V. Genre, Labor share developments in the Euro area, Economic Bulletin, Banco de Espaňa, July (2007).
[36] J.M. Poterba, The rate of return to corporate capital and factor shares: new estimates using revised national income accounts and capital stock data, NBER Working Paper #6263 (1997).
[37] E.L. Raffalovich, T.K. Leicht, M. Wallace, Macroeconomic structure and labor's share of income: United States, 1950 to 1980, American Sociological Review. 57(2) (1992) 243-258.
[38] M. Shao, J.L. Huang. Foreign investment and the labor share in China: an empirical study based on industrial level panel data, China Economic Quarterly. (4) (2010) 1189-1210 (Chinese).
[39] R. M. Solow, A skeptical note on the constancy of relative shares, The American Economic Review. 48(4) (1958) 618-631.
[40] L. Tian, H. H. Wang, Y. Chen, Spatial externalities in China regional economic growth, China Economic Review. 21(2010) S20-S31.
[41] Y. Wang, and Y.D. Yao, Sources of China's economic growth, incorporating human capital accumulation. WBI Working Paper, the World Bank. 19 (2001) 52-99.
[42] A.T. Young, One of the things we know that aren't so: Why US labor's share is not relatively stable, University of Mississippi Mimeo, August, 2006.
[43] M.H. Zhou, W. Xiao, X.G. Yao, Firm heterogeneity, ownership structure and labor income share, Management World.(10) (2010) 24-33 (Chinese).

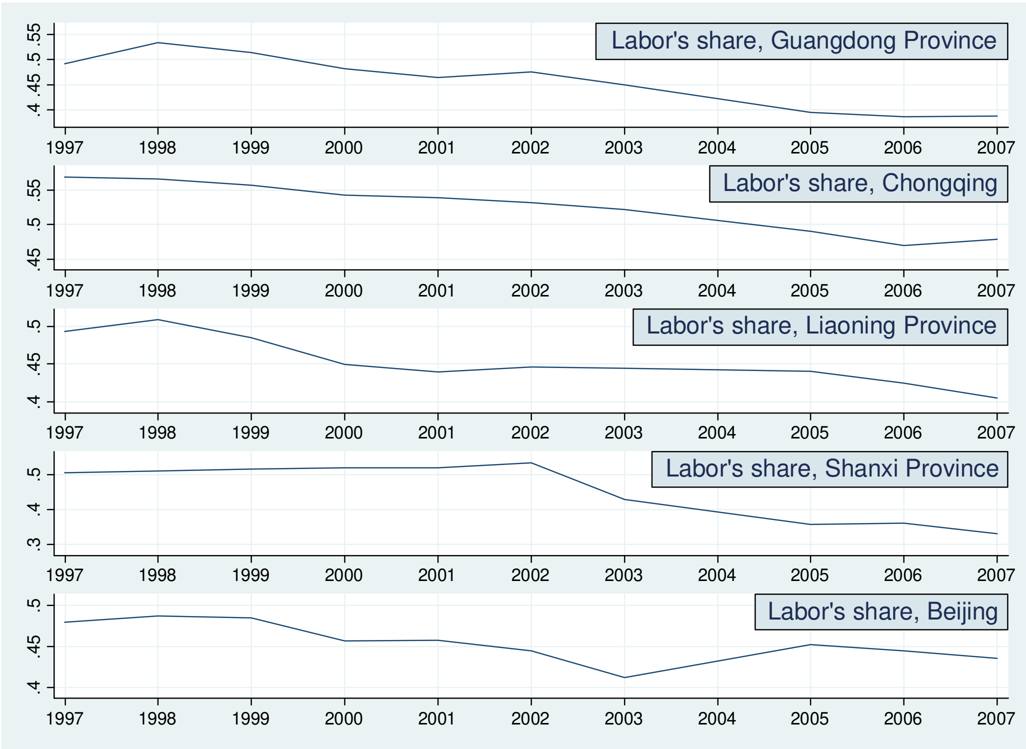
Table 1: The average labor compensation and labor's share of 31 provinces in China, 1997-2007

	Labor's share					The average labor compensation (10,000 Yuan per year)				
	Mean	1997	2000	2004	2007	Mean	1997	2000	2004	2007
Shanghai	0.35	0.35	0.35	0.29	0.35	2.86	1.52	2.37	2.68	4.86
Heilongjiang	0.40	0.48	0.43	0.39	0.36	1.02	0.78	0.85	1.28	1.55
Tianjin	0.43	0.51	0.47	0.36	0.31	2.32	1.28	1.88	2.50	3.67
Shandong	0.43	0.45	0.48	0.38	0.35	1.08	0.64	0.88	1.20	1.73
Zhejiang	0.45	0.48	0.49	0.39	0.40	1.34	0.82	1.10	1.42	2.06
Liaoning	0.45	0.49	0.45	0.39	0.40	1.41	0.83	1.16	1.37	2.16
Beijing	0.46	0.48	0.46	0.35	0.44	2.23	1.31	1.82	1.69	3.66
Guangdong	0.46	0.49	0.48	0.38	0.39	1.48	0.95	1.20	1.42	2.28
Shanxi	0.46	0.51	0.52	0.35	0.33	0.77	0.50	0.60	0.71	1.23
Yunnan	0.46	0.47	0.44	0.39	0.45	0.50	0.34	0.38	0.48	0.81
Jiangsu	0.47	0.51	0.50	0.40	0.37	1.53	0.92	1.20	1.64	2.29
Fujian	0.48	0.52	0.48	0.42	0.42	1.36	0.96	1.14	1.40	1.96
Hebei	0.48	0.53	0.53	0.39	0.38	0.96	0.62	0.78	1.00	1.47
Gansu	0.50	0.53	0.59	0.41	0.44	0.52	0.35	0.49	0.48	0.86
Anhui	0.50	0.49	0.54	0.43	0.44	0.59	0.40	0.48	0.60	0.90
Xinjiang	0.52	0.56	0.50	0.44	0.44	1.29	0.86	1.02	1.31	1.96
Shaanxi	0.52	0.60	0.60	0.45	0.37	0.66	0.44	0.55	0.69	1.06
Chongqing	0.53	0.57	0.54	0.44	0.48	0.68	0.45	0.53	0.70	1.10
Hubei	0.54	0.61	0.59	0.46	0.41	1.07	0.78	1.01	1.13	1.38
Sichuan	0.54	0.56	0.56	0.47	0.46	0.64	0.40	0.51	0.68	1.01
Hainan	0.55	0.60	0.58	0.50	0.42	1.01	0.74	0.90	1.04	1.24
Inner Mongolia	0.55	0.58	0.63	0.49	0.34	1.19	0.60	0.86	1.31	1.94
Jiangxi	0.55	0.64	0.61	0.45	0.45	0.75	0.53	0.63	0.77	1.12
Henan	0.55	0.64	0.60	0.47	0.41	0.71	0.52	0.56	0.75	1.07
Ningxia	0.56	0.60	0.59	0.48	0.45	0.76	0.49	0.57	0.74	1.30
Guizhou	0.56	0.64	0.61	0.47	0.45	0.35	0.26	0.30	0.35	0.54
Jilin	0.57	0.62	0.57	0.55	0.41	1.30	0.72	0.97	1.46	1.98
Qinghai	0.57	0.65	0.61	0.49	0.45	0.83	0.56	0.67	0.87	1.29
Hunan	0.58	0.66	0.62	0.50	0.46	0.76	0.55	0.66	0.78	1.14
Guangxi	0.61	0.70	0.64	0.51	0.46	0.66	0.58	0.52	0.64	1.00
Tibet	0.62	0.75	0.68	0.53	0.51	0.79	0.48	0.65	0.83	1.14

Source: China Statistical Yearbooks, 1997-2007, author's own calculation

Note: "Mean" is the average value from all years. "The average labor compensation" is calculated as the total labor compensation divided by the total employment of each province. "Labor's share" is the share of labor compensation in GDP of each province.

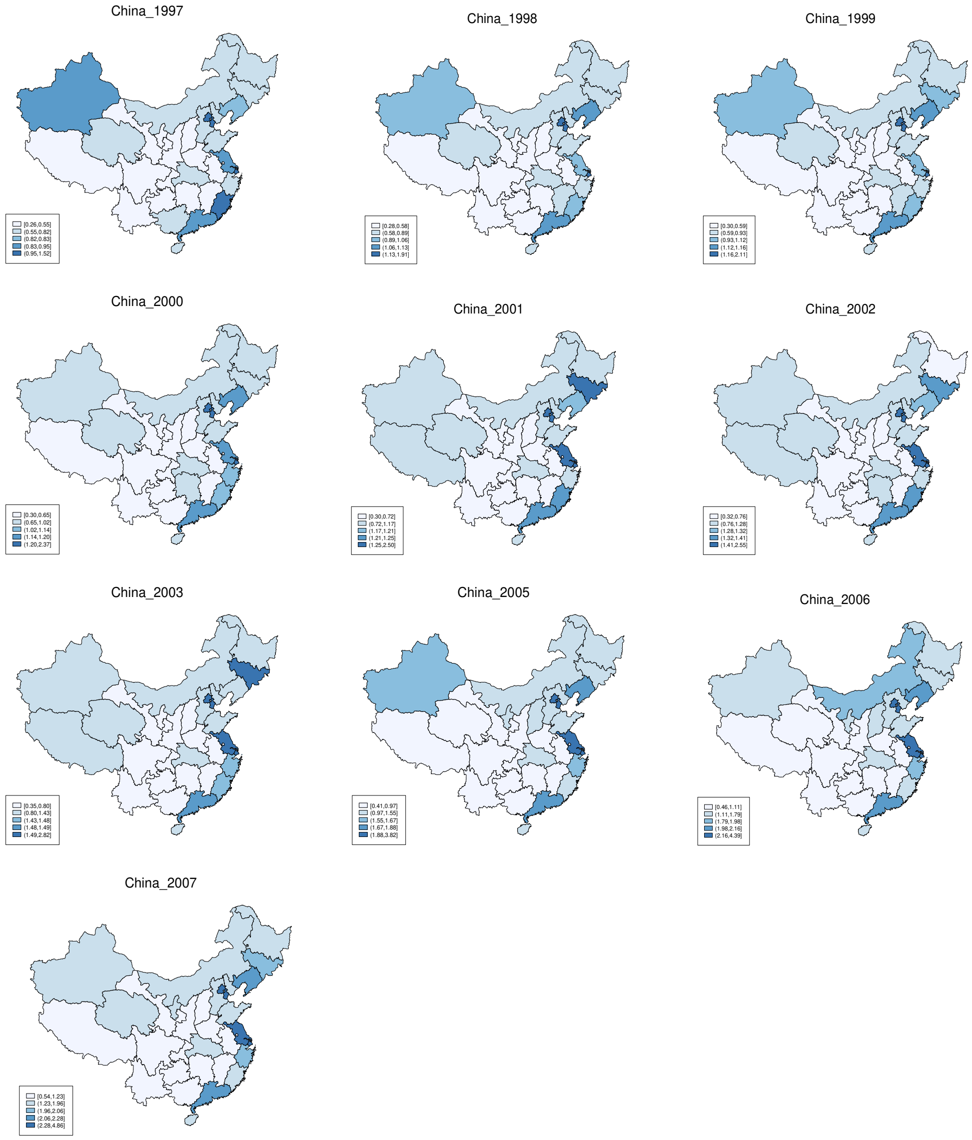
Figure 1: The movement of the labor's share for five representative provinces, 1997-2007



Source: China Statistical Yearbooks, 1997-2007, author's own calculation

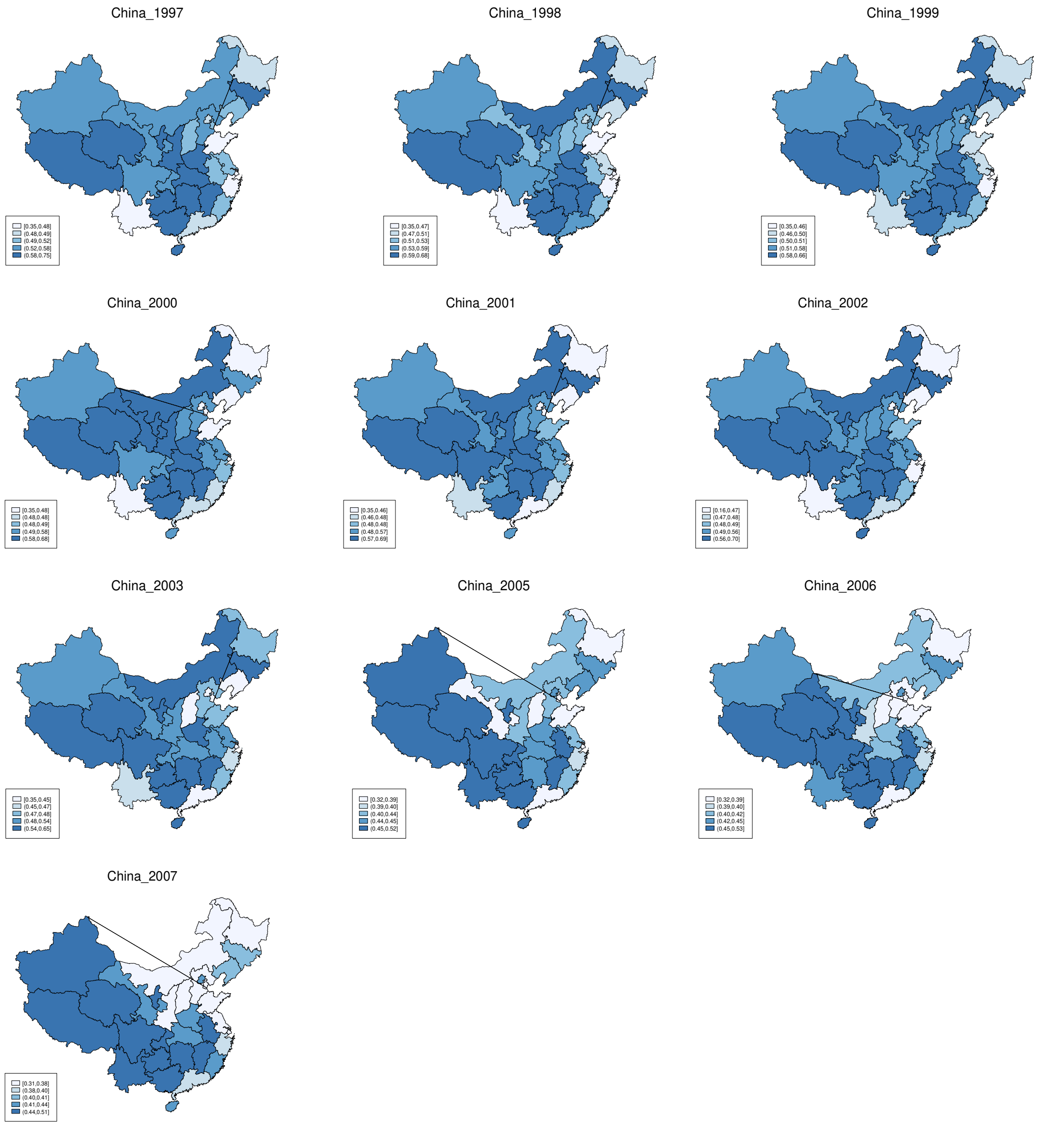
Note: five provinces and municipal cities are selected from five major regions in China, Beijing representing North China, Liaoning Northeast China, Shanxi Central China, Guangdong Southeast China, and Chongqing Western China.

Figure 2: Spatial maps of the average labor companion, 1997-2007



Source: China Statistical Yearbooks, 1997-2007, author's own calculation
Note: Each year provinces are classified into five quantiles based on the amount of average labor compensation. The maps show five shades of blue from light to deep, corresponding to the five quantiles. The map is not drawn for 2004 because labor compensation is not reported in the China Statistical Yearbook for 2004.

Figure 3: Spatial maps of the labor's share, 1997-2007



Source: China Statistical Yearbooks, 1997-2007, author's own calculation

Note: Each year provinces are classified into five quantiles based on the amount of labor's share. The maps show five shades of blue from light to deep, corresponding to the five quantiles. The map is not drawn for 2004 because labor compensation is not reported in the China Statistical Yearbook for 2004.

Table 2: Moran's *I* of variables from year 1997-2007

	Labor's share	Agriculture	SOEs	Tertiary	Intl. trade	Patent
year1997	0.100***	0.131***	0.046	0.095***	0.027	0.106***
year1998	0.075***	0.120***	0.092***	0.077***	0.031	0.102***
year1999	0.091***	0.118***	0.084***	0.069**	0.034	0.096***
year2000	0.101***	0.124***	0.067**		0.033	0.075***
year2001	0.079***	0.117***	0.046	0.073**	0.027	0.070***
year2002	0.095***	0.021	0.046	0.08***	0.033	0.081***
year2003	0.062*	0.122***	0.032	0.070**	0.029	0.082***
year2004		0.117***	0.030	0.063**	0.026	0.080***
year2005	0.132***	0.112***	0.030	0.069**	0.028	0.073***
year2006	0.150***	0.109***	0.026	0.063*	0.031	0.066***
year2007	0.161***	0.107***	0.023	0.066**	0.030	0.066***

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, 1997-2007, author's own calculation

Note:

(1) *, **, and ***, indicate the 10, 5, and 1 percent significance level of Z-value, respectively.

(2) The Moran's *I* of labor share is not calculated for 2004 because labor compensation is not reported for 2004. The Moran's *I* of employees' tertiary education is not calculated for 2000 because employees' educational attainment is not reported for 2000.

Table 3: the impact of economic structure on provincial labor's share, 1997-2007

Dependent Variable: the logarithm of labor's share

	OLS estimates						SEM estimates			SLM estimates		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
year1997												
Agriculture	1.352***			0.772**			0.884**			0.891**		
Industry		-1.335***			-0.870***			-0.868***			-0.875***	
Service			-0.541			0.54			0.743			0.747
Adj.R^2	0.56	0.45	0.01	0.62	0.65	0.56						
Log likelihood	27.49	23.87	14.86	30.67	32.12	28.49	30.91	32.13	28.95	30.91	32.13	28.97
LR							0.48	0.02	0.92	0.48	0.02	0.96
Breusch-Pagan							1.502	1.88	1.646	2.518	1.859	4.361
year1998												
Agriculture	1.240***			0.725*			0.882**			0.892**		
Industry		-1.048***			-0.710**			-0.717**			-0.729**	
Service			-0.694			0.326			0.407			0.411
Adj.R^2	0.51	0.3	0.05	0.53	0.55	0.47						
Log likelihood	28.63	22.86	18.27	30.32	30.75	28.4	30.73	30.77	28.49	30.75	30.79	28.5
LR							0.82	0.04	0.18	0.86	0.08	0.2
Breusch-Pagan							0.987	0.046	2.793	0.598	0.026	2.935
year1999												
Agriculture	1.240***			0.610*			0.730**			0.736**		
Industry		-1.027***			-0.553*			-0.559**			-0.572**	
Service			-0.701			0.108			0.1			0.096
Adj.R^2	0.53	0.3	0.06	0.61	0.61	0.55						
Log likelihood	30.37	24.12	19.48	34.28	34.23	32.17	34.86	34.3	32.17	34.86	34.35	32.17
LR							1.16	0.14	0.002	1.16	0.24	0.003
Breusch-Pagan							1.067	0.055	1.794	0.939	0.098	1.815
year2000												
Agriculture	1.318***			0.499			0.723**			0.726**		
Industry		-0.986***			-0.428			-0.408*			-0.440*	
Service			-0.713			0.214			0.1			0.021

Adj.R^2	0.5	0.26	0.05	0.6	0.61	0.58						
Log likelihood	27.42	21.16	17.29	31.98	32.09	30.94	33.93	32.75	31.49	33.88	32.93	31.52
LR							3.90**	1.32	1.10	3.80*	1.68	1.16
Breusch-Pagan							0.939	0.13	1.157	2.577	0.723	1.553
<u>year2001</u>												
Agriculture	1.416***			0.624			0.699*			0.706*		
Industry		-0.958***			-0.396			-0.398			-0.399	
Service			-0.708			0.12			0.124			0.12
Adj.R^2	0.5	0.22	0.04	0.56	0.55	0.52						
Log likelihood	26.54	19.72	16.63	29.58	29.24	28.36	29.75	29.24	28.36	29.77	29.25	28.36
LR							0.34	0.006	0.006	0.38	0.02	0.001
Breusch-Pagan							2.128	1.181	2.032	3.284	1.191	2.031
<u>year2002</u>												
Agriculture	1.437***			1.028**			1.108***			0.441**		
Industry		-0.813**			-0.407			-0.404			-0.044	
Service			-0.696			-0.29			-0.3			-0.256
Adj.R^2	0.52	0.17	0.06	0.52	0.42	0.4						
Log likelihood	28.52	20.19	18.2	29.66	26.89	26.22	29.86	26.94	26.27	29.97	27.32	26.35
LR							0.40	0.10	0.10	0.62	0.86	0.26
Breusch-Pagan							0.347	0.921	2.812	2.844	2.978	6.619*
<u>year2003</u>												
Agriculture	1.160***			1.075**			1.013***			1.123***		
Industry		-1.021***			-0.909***			-0.880***			-0.4	
Service			0.336			0.504			0.558**			-0.274
Adj.R^2	0.39	0.46	0.01	0.38	0.48	0.28						
Log likelihood	28.52	20.19	18.20	29.66	26.89	26.22	29.90	26.93	26.27	29.91	26.9	26.25
LR							0.24	0.04	0.05	0.25	0.01	0.03
Breusch-Pagan							4.516	0.79	2.403	5.557	0.774	2.448
<u>year2005</u>												
Agriculture	1.043***			0.623*			0.576*			1.002***		
Industry		-0.967***			-0.739***			-0.727***			-0.874***	
Service			0.391			0.537**			0.565***			0.561**

Adj.R^2	0.34	0.49	0.04	0.43	0.6	0.47						
Log likelihood	29.41	31.30	21.88	30.29	33.07	27.91	30.42	33.74	36.82	30.43	33.77	29.34
LR							0.26	1.34	2.6	0.28	1.4	2.86*
Breusch-Pagan							6.301*	5.321	2.377	6.703*	11.731***	3.457
year2006												
Agriculture	1.065***			0.389			0.211			0.571*		
Industry		-0.904***			-0.650***			-0.613***			-0.723***	
Service			0.304			0.471**			0.491***			0.565***
Adj.R^2	0.29	0.37	0.01	0.4	0.55	0.47						
Log likelihood	28.52	30.31	23.37	32.32	36.67	34.27	33.11	37.5	35.96	34.68	40.43	36.9
LR							1.58	1.66	3.38*	4.72**	7.52***	5.26**
Breusch-Pagan							7.209*	5.556	2.556	7.269*	6.768*	4.088
year2007												
Agriculture	0.869***			0.327			0.238			0.208		
Industry		-0.611***			-0.358**			-0.330**			-0.606***	
Service			0.264			0.257			0.278			0.490***
Adj.R^2	0.28	0.3	0.01	0.44	0.51	0.45						
Log likelihood	28.28	28.87	23.34	33.27	35.26	33.52	34	35.98	34.86	33.19	37.51	36.08
LR							1.46	1.44	2.68	0.16	4.5**	5.12**
Breusch-Pagan							2.454	3.886	1.635	2.797	5.817	1.926
Number of observations	31	31	31	31	31	31	31	31	31	31	31	31

Source: China Statistical Yearbooks, 1997-2007, author's own calculation

Note:

(1) The first six columns report OLS estimates while the last six columns report the spatial error model (SEM) and spatial lag model (SLM) estimates. For the OLS regression model, the first three columns report the results without control variables while the last three columns control for the logarithm of fixed asset investment and the logarithm of the size of the labor force. For the spatial models, the results with control variables are reported.

(2) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Due to limited space, standard error estimates are not reported, but available from the authors upon request.

(3) The regressions are not estimated for 2004 because labor compensation is not reported in the China Statistical Yearbook for 2004.

(4) LR and Breusch-Pagan stand for Likelihood Ratio and Breusch-Pagan tests.

Table 4: The impact of ownership structure on provincial labor's share, 1997-2007

Dependent Variable: the logarithm of labor's share

	OLS estimates		SEM estimates	SLM estimates
	(1)	(2)	(3)	(4)
year1997				
State	0.112	-0.473	-0.352	-0.451
Adj.R^2	-0.03	0.39		
Log likelihood	14.22	22.91	23.24	22.99
LR			0.66	0.16
Breusch-Pagan			1.432	1.74
year1998				
State	0.835	0.205	0.325	0.242
Adj.R^2	0.05	0.24		
Log likelihood	18.25	22.19	22.46	22.51
LR			0.54	0.64
Breusch-Pagan			0.171	1.327
year1999				
State	0.932*	0.305	0.425	0.331
Adj.R^2	0.08	0.32		
Log likelihood	19.79	25.15	25.76	25.78
LR			1.22	1.26
Breusch-Pagan			0.084	0.993
year2000				
State	1.045***	0.768**	0.711**	0.697**
Adj.R^2	0.19	0.38		
Log likelihood	19.81	24.63	26.3	26.15
LR			3.34*	3.04*
Breusch-Pagan			0.079	0.015
year2001				
State	1.248***	1.102***	1.077***	1.083***
Adj.R^2	0.27	0.48		
Log likelihood	20.76	26.56	26.62	26.6
LR			0.12	0.08
Breusch-Pagan			0.993	1.333
year2002				
State	1.133*	1.065*	1.087**	0.969*
Adj.R^2	0.09	0.15		
Log likelihood	20.30	21.88	22.83	23.64
LR			1.9	3.52*
Breusch-Pagan			0.717	1.296
year2003				
State	0.849***	0.817***	0.820***	0.821***
Adj.R^2	0.24	0.42		
Log likelihood	21.64	26.40	26.40	26.40
LR			0.0002	0.0001
Breusch-Pagan			3.25	3.264
year2005				
State	0.083	0.118	0.122	0.092
Adj.R^2	-0.03	0.26		
Log likelihood	21.32	24.46	24.96	24.92

LR			1.00	0.92
Breusch-Pagan			0.677	0.409
year2006				
State	-0.001	0.111	0.12	0.128
Adj.R^2	-0.03	0.15		
Log likelihood	22.72	26.28	26.71	30.13
LR			0.86	7.7***
Breusch-Pagan			1.483	1.556
year2007				
State	0.006	0.119	0.13	0.131
Adj.R^2	-0.03	0.16		
Log likelihood	22.72	26.42	26.83	26.66
LR			0.82	0.48
Breusch-Pagan			0.246	0.169
Number of observations	31	31	31	31

Source: China Statistical Yearbooks, 1997-2007, author's own calculation.

Note:

(1) The first two columns report OLS estimates while the last two columns report SEM and SLM estimates. Column (1) does not include any control variables, while Columns (2) (3) and (4) control for the logarithm of fixed asset investment.

(2) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Due to limited space, standard error estimates are not reported, but available from the authors upon request.

(3) The regressions are not estimated for 2004 because labor compensation is not reported for 2004.

(4) LR and Breusch-Pagan stand for Likelihood Ratio and Breusch-Pagan tests.

Table 5: Spatial 2SLS regression estimates, 1997, 2003, and 2007

Dependent Variable: labor's share

	Year1997		**Year2003**		**Year2007**	
	(1) Spatial 2SLS-1	(2) Spatial 2SLS-2	(3) Spatial 2SLS-1	(4) Spatial 2SLS-2	(5) Spatial 2SLS-1	(6) Spatial 2SLS-2
Agriculture	0.238	0.010	0.193	0.016*	0.243	0.009*
Industrial	-0.381	-0.033***	-0.213	-0.010	-0.165	-0.005
State	-0.016	0.006	0.185	0.002	-0.025	-0.004
Secondary	-0.011	0.011	0.164	-0.001	-0.197***	-0.010**
Tertiary	-0.566	-0.012	-0.598	-0.010	-0.051	-0.002
International trade	0.005	0.009	-0.005	0.001	-0.001	0.0003
Ln patent	0.021	0.004	-0.023	-0.003	-0.001	-0.004
Ln R&D	0.011	-	0.007	-	-	-
Ln FCI	-0.052**	-	-0.002	-	0.007	0.001
Spatial autocorrelation	0.0001	-0.0003*	0.0001	-0.0002	-0.00003	-0.0001
Wald test	66.731***	38.801***	51.659***	29.098***	71.920***	48.187***
Number of observations	31	31	31	31	31	31

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, China Statistical Yearbook on Science and Technology; author's own calculation.

Note:

(1) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Due to limited space, standard error estimates are not reported, but available from the authors upon request.

(2) Columns (1), (3) and (5) use the spatial lag of all the explanatory variables as the instruments. Columns (2), (4) and (6) use the IVs defined by the 3-group method for the explanatory variables including agriculture, industrial, state, secondary, tertiary, international trade, patent, R&D and FCI, and their spatial lag. For certain years, the 3-group variables for patent and R&D are left out due to collinearity.

Table 6: The fixed effect spatial regression estimates on the labor's share, 1997-2007

Dependent Variable: the logarithm of labor's share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Agriculture	1.268***	1.305***	1.177***	1.149***	0.727***	0.850***	0.575***
Industrial	-0.423***	-0.452***	-0.438***	-0.414***	-0.253***	-0.305***	-0.188***
State		0.019*	0.018	0.017	0.109***	0.012	0.116***
Secondary			-0.064	-0.043	-0.117***	-0.067	-0.068*
Tertiary			-0.606***	-0.763***	0.635**	0.381*	0.431*
International trade				-0.098	-0.101	-0.067	-0.044
Ln patent					-0.098***		-0.035***
Ln R&D						-0.214***	
Ln FCI							-0.113***
Spatial autocorrelation	0.178**	0.179**	0.179**	0.178**	0.308***	0.152**	0.345***
Log likelihood	218.54	219.93	231.32	232.19	274.72	261.21	302.99
Number of observations	279	279	279	279	279	248	279

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, China Statistical Yearbook on Science and Technology,1997-2007, author's own calculation.

Note:

(1) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Due to limited space, standard error estimates are not reported, but available from the authors upon request.

(2) The estimation does not use data from 2004 or 2000 because labor compensation is not reported for 2004, and employees' educational attainment not reported for 2000. In Columns (6), the 1997 data is not used because R&D is not reported for 1997.

Appendix Table A: Definition and summary statistics of variables, 1997-2007

Variables	Definition	No. of Obs.	All Years Mean	All Years Std. Dev.	1997 Mean	1997 Std. Dev.	2002 Mean	2002 Std. Dev.	2007 Mean	2007 Std. Dev.
Labor's share	The ratio of labor's compensation to GDP	310	0.492	0.091	0.557	0.084	0.525	0.102	0.414	0.048
Agriculture	The ratio of the agriculture output to GDP	341	0.166	0.094	0.216	0.087	0.181	0.195	0.125	0.062
Industrial	The ratio of the industrial output to GDP	341	0.463	0.127	0.435	0.079	0.475	0.324	0.477	0.081
Service	The ratio of the service output to GDP	341	0.390	0.101	0.350	0.059	0.375	0.258	0.398	0.079
State	The percentage of employees in SOEs in total employment	341	0.658	0.102	0.760	0.054	0.662	0.081	0.577	0.096
Non_state	The percentage of employees in non-SOEs in total employment	341	0.342	0.102	0.240	0.054	0.338	0.081	0.423	0.096
Patent	The number of invention patent applications per 10,000 population	341	2018.5	3944.3	378.1	333.1	1123.1	1303.4	4555.2	6420.2
R&D	R&D investment in million RMB Yuan	310	6228.8	9362.9			4183.5	5066.6	11968.5	13792.5
Intl. trade	The ratio of net exports to GDP	341	0.009	0.150	0.015	0.111	0.003	0.128	0.031	0.174
FDI	Foreign direct investment in million U.S. dollar	217	1560.0	2530.9	1448.4	2349.1	1721.7	2798.0		
Primary	The percentage of workers with primary education in the labor force	310	0.393	0.164	0.466	0.163	0.386	0.157	0.356	0.159
Secondary	The percentage of workers with secondary education in the labor force	310	0.538	0.132	0.490	0.137	0.546	0.128	0.562	0.127
Tertiary	The percentage of workers with tertiary education in the labor force	310	0.070	0.055	0.044	0.036	0.068	0.045	0.082	0.068
Employees	The number of employees in 10,000 people	341	2123.3	1467.0	2053.8	1408.8	2057.4	1435.8	2301.6	1611.1
FCI	Fixed capital investment in 100 million RMB Yuan	341	2186.9	2443.4	779.7	633.6	1356.0	1020.1	4348.2	3181.7

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, China Statistical Yearbook on Science and Technology, 1997-2007, author's own calculation.
Note: Labor compensation is not reported for 2004; employees' educational attainment not reported for 2000; R&D not reported for 1997, and FDI is only available prior to 2003.

Appendix Table B: The impact of ownership structure on provincial labor's share with control for FDI, 1997-2007

Dependent Variable: the logarithm of labor's share

	SEM Estimates						
	year1997	**year1998**	**year1999**	**year2000**	**year2001**	**year2002**	**year2003**
State	0.036	0.580	0.888**	0.930***	1.124***	0.945**	0.818***
	(0.439)	(0.519)	(0.437)	(0.304)	(0.318)	(0.458)	(0.233)
Ln FDI	-0.020***	-0.007	-0.015***	-0.013***	-0.015***	-0.028***	-0.012**
	(0.006)	(0.005)	(0.006)	(0.004)	(0.005)	(0.011)	(0.005)
Log likelihood	21.14	19.27	23.00	24.60	24.82	23.39	24.71
Number of observations	31	31	31	31	31	31	31

Source: China Statistical Yearbooks, 1997-2007, author's own calculation.

Note:

(1) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Standard error estimates are reported in parentheses.

(2) The regressions are not estimated for 2004 or later years because FDI is not reported after 2003. FCI is not controlled in the models because a province's FCI and FDI are usually highly correlated.

Appendix Table C: The spatial regression estimates with an instrumental variable, 2007

Dependent Variable: the logarithm of labor's share in 2007

	SEM Estimates				
	(1)	(2)	(3)	(4)	(5)
GDP per capita 1988	-0.166	-0.680***	-0.803***	-0.762***	-0.735**
	(0.247)	(0.226)	(0.261)	(0.289)	(0.312)
Agriculture2007	0.779*	-0.298	-0.151	-0.159	-0.227
	(0.412)	(0.414)	(0.457)	(0.459)	(0.512)
Industry2007		-0.997***	-0.859***	-0.853***	-0.962***
		(0.219)	(0.255)	(0.255)	(0.337)
State2007			-0.271	-0.251	-0.216
			(0.240)	(0.247)	(0.256)
Ln patent2007				-0.004	-0.005
				(0.011)	(0.012)
International trade2007					-0.058
					(0.108)
Log likelihood	29.227	37.537	38.162	38.215	38.358
Number of observations	31	31	31	31	31

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, 1997-2007, author's own calculation.
Note:
(1) Coefficient estimates are reported. *, **,and ***, indicate the 10, 5, and 1 percent significance level, respectively. Standard error estimates are reported in parentheses.
(2) GDP per capita in 1988 is calculated based on the GDP and population data that are sourced from the China Statistical Yearbook 1989.

Appendix Table D: The fixed effect spatial regression estimates with one-year lagged dependent variable, 1997-2007

Dependent Variable: the logarithm of labor's share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
One-year lagged labor share	**0.819*** **	**0.823*** **	**0.818*** **	**0.819*** **	**0.768*** **	**0.798*** **	**0.730*** **
Agriculture	0.177***	0.224***	0.239***	0.242***	0.207***	0.193***	0.215***
Industrial	-0.098***	-0.124***	-0.115***	-0.117***	-0.105***	-0.100**	-0.117***
State		0.010**	0.011**	0.011**	0.031***	0.023***	0.042***
Secondary			-0.037	-0.039	-0.053*	-0.044	-0.055*
Tertiary			0.093	0.109	0.338**	0.203	0.371**
International trade				-0.007	-0.009	-0.016	-0.012
Ln patent					-0.021***		-0.009
Ln R&D						-0.012*	
Ln FCI							-0.032***
Spatial autocorrelation	0.731***	0.733***	0.738***	0.732***	0.724***	0.732***	0.697***
Log likelihood	302.683	304.434	305.372	305.386	310.050	315.713	314.555
Number of observations	248	248	248	248	248	217	248

Source: China Statistical Yearbooks, China Labor Statistical Yearbooks, China Statistical Yearbook on Science and Technology, 1997-2007, author's own calculation.

Note:

(1) Coefficient estimates are reported. *, **, and ***, indicate the 10, 5, and 1 percent significance level, respectively. Due to limited space, standard error estimates are not reported, but available from the authors upon request.

(2) The estimation does not use data from 2004 or 2000 because labor compensation is not reported for 2004, and employees' educational attainment not reported for 2000. In Column (6), the 1997 data is not used because R&D is not reported for 1997.