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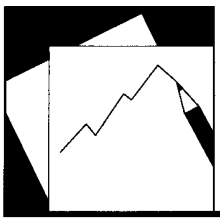

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Das (Wasted) Kapital: Firm Ownership and Investment Efficiency in China

David Dollar and Shang-Jin Wei

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Prepared by David Dollar and Shang-Jin Wei[1]

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Abstract

Based on a survey that we designed and that covers a stratified random sample of 12,400 firms in 120 cities in China with firm-level accounting information for 2002-2004, this paper examines the presence of systematic distortions in capital allocation that result in uneven marginal returns to capital across firm ownership, regions, and sectors. It provides a systematic comparison of investment efficiency among wholly and partially state-owned, wholly and partially foreign-owned, and domestic privately owned firms, conditioning on their sector, location, and size characteristics. It finds that even after a quarter-of-century of reforms, state-owned firms still have significantly lower returns to capital, on average, than domestic private or foreign-owned firms. Similarly, certain regions and sectors have consistently lower returns to capital than other regions and sectors. By our calculation, if China succeeds in allocating its capital more efficiently, it could reduce its investment intensity by 5 percent of GDP without sacrificing its economic growth (and hence deliver a greater improvement to its citizens' living standard).

JEL Classification Numbers: O11, O16

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Author(s) E-mail addresses: DDollar@worldbank.org; swei@imf.org

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[1] David Dollar, Country Director for China and Mongolia, World Bank; Shang-Jin Wei, Assistant Director and Chief of Trade and Investment Division, Research Department, International Monetary Fund. The authors wish to thank Jahangir Aziz, Chong-en Bai, Marcos Chamon, Chang-Tai Hsieh, Cui Li, Anil Kashyap, Yingyi Qian, Raghu Rajan, and seminar/conference participants at the NBER and IMF, especially Galina Hale, for helpful comments, and Yuanyuan Chen, Chang Hong, Xuepeng Liu, and Eric von Uexkull for excellent research assistance.

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I. INTRODUCTION

It is widely observed that the breakneck growth rate of the Chinese economy is in large part driven by capital accumulation. The country's investment to GDP ratio at 40 percent in 2005 (even after the denominator was revised up by 17.8 percent by the government) is high compared with the world average, and even higher than most other East Asian countries which are also known for relying on capital accumulation for their growth. How efficient is the Chinese investment? Is it systematically related to its unfinished reforms in which state-owned firms continue to suck in a sizable chunk of new investment? The purpose of the paper is to assess the efficiency of capital allocation in China, including whether the country has succeeded in removing the bias in favor of state-owned firms after nearly three decades of economic reforms.

We do so by using a firm-level data set. One problem of usual official firm surveys is that ownership classification tends to rely on firm registration. Yet, many firms' ownership may have evolved faster than what is recorded on the registration. We designed a survey of firms in China in early 2005 and carried it out during July-November, 2005. It covered 12,400 firms in 120 cities located all across China. We asked the firms to report actual breakdown of ownership (private, state, etc), and found that about 15 percent of the firms in the sample (169 out of 1122) that were still registered as state-owned had already become fully privately owned according to the actual breakdown of ownership. This suggests that it is important to reclassify ownership based on actual ownership information rather than the firm label at the time of its registration.

Our paper is related to the literature on the role of financial sector in China's growth. Allen, Qian and Qian (2005) suggest that the high rates of GDP growth must imply that the informal financial sector has sufficiently made up for the shortcomings of the formal financial system dominated by state-owned banks. Boyreau-Debray and Wei (2005), on the hand, provide evidence that capital mobility is low across Chinese regions, and households' ability to engage in consumption risk sharing is also low in the 1990s. Hsieh and Klenow (2006) provide evidence of unequal returns to capital across firms within the same sector in China and India, but do not investigate systematic allocative efficiency across ownership or locations. Dobson and Kashyap (2007) discussed the problems associated with China's gradualist strategy in reforming its banks.

As a preview of the main findings, we will report strong evidence that state-owned firms have lower (marginal and average) returns to capital than either domestic private or foreign firms. In addition, there is also systematic dispersion in the returns to capital across locations and sectors. Based on these econometric estimates, we calculate that China could drastically reduce its investment-to-GDP ratio and raise its consumption without sacrificing its growth rate by improving the returns to capital on the stock of capital currently employed by state-owned firms.

The rest of the paper is organized as follows. Section 2 describes a simple model that helps to interpret the subsequent econometric estimates. Section 3 is the meat of the empirical analysis. It starts by describing the survey from which we extract the data for the analysis, and then provides a sequence of estimations and analyses. Section 4 concludes.

II. CONCEPTUAL FRAMEWORK

In this section, we use a simple model to generate a prediction on the relationship between observed returns to capital (or labor), and distortions on capital, labor, and output. It also motivates the econometric specifications that we will employ in the subsequent analysis.

Firm's Problem

Consider a representative firm j in sector s that is a price-taker in both output and input markets. Let π_j, y_j, K_j and L_j be firm j's profit, output, capital usage, and labor usage respectively. Firm j aims to maximize its profit:

$$\text{Max } \pi_j = p_j Y_j - r_j K_j - w_j L_j \tag{1}$$

where p_j, r_j, and w_j denote the output price, gross interest (rental cost of capital), and wage rate faced by firm j, respectively. The firm subscript is used to stress the point that distortions in the output and factor market could be firm specific (or at least ownership specific) and make the firm's effective output price and input costs deviate from the market prices. We suppress sector subscript for simplicity. Specifically, let

$$p_j = p\,(1-d^j_Y) \tag{2}$$

$$r_j = r\,(1+d^j_K) \tag{3}$$

$$w_j = w\,(1+d^j_L) \tag{4}$$

Where p, r, and w are the output price, rental cost of capital and wage rate common to all firms in the same sector and location. d^j_Y summarizes all output distortions the firm faces, expressed in the form of a tax that it proportion to its output. d^j_K summarizes all distortions on the cost of capital. For example, if private firms face systematic discrimination by local banks, or face greater hurdle in getting listed in local stock markets, that could be represented by a high (and positive) d^j_K for them. As another example, if state-owned firms receive subsidized credit, then their d^j_K would be negative. d^j_L represents all distortions on the cost of labor. For example, if a firm is not allowed to freely dismiss workers, then its d^j_L would be high.

On the production function side, we assume that all differences across firms in the same sector occur at the TFP level only:

$$Y_j = A_j\, f(K_j, L_j) \tag{5}$$

Where A_j represents firm-specific total factor productivity. For simplicity, we assume f(., .) takes a Cobb-Douglas functional form:

$$f(K_j, L_j) = K_j^{\alpha} L_j^{1-\alpha} \tag{6}$$

Where α denotes the capital share in output and is the same for all firms in the same industry.

The first order conditions of the profit maximization problem yield the familiar conditions that the marginal revenue product of capital (MRPK) and marginal revenue product of labor (MRPL) should be equal to (firm-specific) interest rate and wage rate:

$$MRPK_j \equiv p_j A_j f'_K(K_j , L_j) = r_j \quad (7)$$

$$MRPL_j \equiv p_j A_j f'_L(K_j , L_j) = w_j \quad (8)$$

By the virtue of the Cobb-Douglas production function, marginal revenue products of capital (MRPK) and labor (MRPL) are also proportional to their average revenue product counterparts:

$$ARPK_j \equiv p_j Y_j / K_j = (1/\alpha)\, MRPK_j \quad (9)$$

$$ARPL_j \equiv p_j Y_j / L_j = [1/(1-\alpha)]\, MRPL_j \quad (10)$$

Researcher's Problem

As not all distortions faced by the firm are observable by an economic researcher, we cannot measure average and marginal revenue products directly. Instead, our observed average revenue product of capital, denoted by $ARPK_j^o$, is given by,

$$ARPK_j^o \equiv p Y_j / K_j \quad (11)$$

Making use of (2), (3), (7), and (9), together with (11), we have

$$ARPK_j^o = p_j Y_j / [(1-d^j_Y) K_j] = ARPK_j / (1-d^j_Y) = [r (1+d^j_K)] / [\alpha (1-d^j_Y)] \quad (12)$$

A log approximation of (12) gives a convenient linear expression:

$$\ln ARPK_j^o \approx \ln(r/\alpha) + d^j_K + d^j_Y \quad (13)$$

This indicates that the deviation of log observed average revenue product of capital from the common component in any sector, $\ln(r/\alpha)$, reflects a combination of firm-specific distortions on capital cost and output.

The relationship between the observed average revenue product of labor and the distortions can be derived similarly:

$$ARPL_j^o \equiv p Y_j / L_j = ARPL_j / (1-d^j_Y) = [w (1+d^j_L)] / [(1-\alpha) (1-d^j_Y)] \quad (14)$$

and

$$\ln ARPL_j^o \approx \ln[w/(1-\alpha)] + d^j_L + d^j_Y \quad (15)$$

The dispersion of the log observed average revenue product of labor across firms within a sector reflects a dispersion in the combined labor and output distortions. From equations (13) and (15), it is clear that output distortion affects both $ARPK_j^o$ and $ARPL_j^o$. On the other hand, capital (labor) distortion only affects $ARPK_j^o$ ($ARPL_j^o$).

So far, we have assumed that the firm is a price-taker in both the output and input markets. Suppose we let the firm produce a differentiated product, and face a downward-sloping demand curve as described by

$$Y_j^d = Y_s \{p_j /[(1-d^j_Y)P_s\}^{-\sigma} \quad (16)$$

where Y_s and P_s are the aggregated demand for output in sector s and the aggregated price index for sector s, respectively, and σ is the elasticity of substitution between different varieties in sector s[2]. As a reminder, all firm-specific variables also can have a sector s subscript but omitted for simplicity.

Since the firm's profit equation is no longer homogeneous of degree one in capital and labor, the optimal levels of capital and labor can be worked out. However, for our purpose, we note that there are still relationship similar to equations (13) and (15) between $ARPK_j^o$ or $ARPL_j^o$ and the various distortions. The only changes are the two constant terms. More precisely, with a differentiated product framework, we would have

$$\ln ARPK_j^o \approx \ln (r/\alpha) + 1/\sigma + d^j_K + d^j_Y \quad (13)'$$

and

$$\ln ARPL_j^o \approx \ln[w/(1-\alpha)] + 1/\sigma + d^j_L + d^j_Y \quad (15)'$$

Econometric Specifications

When we turn to the data, we are especially interested in finding out how the output, capital and labor distortions vary by firm ownership types, conditioning on sector and location characteristics of the firms. We will classify all firms into several ownership types, and create a set of dummies for them. In the subsequent empirical investigation, we will implement the following panel regressions (for which time-subscripts are added where appropriate):

$$\begin{aligned} \ln ARPK_{j,t}^o = & \sum \beta_i \, ownership_{i,j} + \sum year\text{-}dummies + \sum sector\text{-}dummies \\ & + \sum location\text{ -}dummies + other\ controls + error_{j,t} \end{aligned} \quad (17)$$

For a given firm j, at most one ownership dummy would take the value of one, and all others would take the value of zero. In the case of a domestic private firm (the benchmark case), all seven ownership dummies take the value of zero. With this specification, the coefficient β_i

[2] See Hsieh and Klenow (2006) for a discussion.

should be interpreted as measuring the capital and output distortions for ownership type i relative to those for domestic private firms, holding sector, location, year, and other firm characteristics constant. For example, if wholly state owned firms receive subsidized loans but private firms do not, or if private firms face more hurdles in obtaining a bank loan than state firms, or a combination of the two, then the β_i coefficient for wholly state ownership should take a negative value in the econometric estimation.

We implement a comparable specification for the observed average revenue product of labor:

$$\ln ARPL_{j,t}^{o} = \sum \gamma_i \, ownership_{i,j} + \sum year\text{-}dummies + \sum sector\text{-}dummies + \sum location\text{-}dummies + other\ controls + error_{j,t} \quad (18)$$

III. DATA

The survey was conducted during July-November, 2005. It covers 12,400 firms in 120 cities, located in all provinces, autonomous regions, and directly administrated cities, with the exception of Tibet. In each city, a random sample of firms stratified along sector and size (sales) was chosen. The local sample size was 200 firms each in Beijing, Chongqin, Shanghai, and Tianjin (four "super cities" or central government directly administrated cities), and 100 firms each in the rest of cities.

We make use of two parts of the survey. The first is three-year (2002-2004) accounting data on sales, material, capital and labor, filled out by chief account and head of human resources. The second part is information on the general business environment faced by the firm filled out by the chief executive of the firm. The survey was pilot tested by World Bank staff with firms in Beijing before it was rolled out nationwide. In September and November 2005, we also visited some of the data points in our sample—three firms in the north and three more in the south, interviewing the chief executive officers and the chief financial offers of these firms. At each of the firms, we went through a selection of the survey questions, and checked if the respondents understood the questions in the way we intended. In the process, we discovered that some firms made careless mistakes in recording their information for some survey questions, though a majority of the questions appear to be correctly answered. This suggests the usefulness of applying some filters to exclude possible outliers in the subsequent estimation.

Definitions of Ownership

As we will investigate possible allocative inefficiency across firm ownership, especially possible preferential access to financing by state firms and policy-induced liquidity constraint faced by private firms, we need to have a reliable way to define firm ownership. One complication is that, due to rapid changes in the economy, there can be serious mis-matches between firms' actual and notional (registered) ownership. Our survey asks for firm ownership with two different questions. First, it asks (in the section to be filled out by firm chief executives) the ownership type according to the current firm registration form. Second, it asks the firm (in the section to be filled out by chief financial officers and heads of human resources) to break down ownership shares by owners' types (state, collective, legal person, private individual, and foreign investors).

It is clear from the responses that the actual ownership does not always correspond to the ownership type on a firm's business registration. For example, 169 firms that are registered as state-owned firms (out of a total of 1122) and 208 firms that are registered as collectives (out of 869) are already wholly owned by domestic private capital by the time the survey took place. For our analysis, we classify all firms into eight mutually exclusive ownership types based on the actual ownership information. The ownership types are defined in the following way:

(a) Wholly state-owned if state share = 100 percent;
(b) Majority state-owned if 50 percent ≤ state share < 100 percent;
(c) Minority state-owned 0 < state share < 50 percent;
(d) Wholly foreign-owned if foreign share = 100 percent;
(e) Majority foreign-owned if 50 percent ≤ foreign share < 100 percent (and no state shares);
(f) Minority foreign-owned if 0 < foreign share < 50 percent (and no state shares);
(g) Collectively owned if registered as a collective, still with collective share > 50 percent;
(h) Domestic privately owned = all the rest.

Note that our category of "domestic privately owned firms" is relatively broad, capturing not just *de nova* private firms, privatized formerly state or collectively owned firms. It also captures some of the so-called "round-tripping" foreign direct investment, namely firms that are registered as foreign invested firms (including those from Hong Kong, Macao and Taiwan) but that the chief financial officers know are actually owned by domestic private investors. In addition, some of the firms in this category could include state shares (but reported as legal person shares). The last possibility can reduce the estimated difference in returns to capital between partially state-owned and private firms.

Out of the 12,400 firms in the survey, three are registered as majority privately-owned but are reported to have a state share in excess of 50 percent. Under the assumption that it is unlikely for the country to have nationalized formerly privately owned firms during this period, we choose to exclude them from our analysis.

Variable Definitions

The key variables to be explained are the observed average returns to capital and labor ($ARPK_j^o$ and $ARPL_j^o$). For each firm in a given year, we define value added, $VA_{j,t}$, as

$$VA_{j,t} = \text{value of output}_{j,t} - \text{value of raw material}_{j,t} \quad (19)$$

Then, the observed average revenue product of capital is simply the ratio of value added to capital:

$$ARPK_{j,t}^o = VA_{j,t} / K_{j,t} \quad (20)$$

Similarly, the observed average revenue product of labor is value added divided by total labor,

$$ARPL_{j,t}^o = VA_{j,t} / L_{j,t} \quad (21)$$

Filtering Out Data Entry Errors and Extreme Values

The raw data may contain recording errors by the respondents at the firm level or data entry errors by the staff of local statistical bureaus that are not captured by their checks or those of the national bureau. In addition, missing values for certain variables (e.g., firm revenue) would render it impossible to compute the variables of interest. Therefore, we devise a number of filtering rules to minimize the influence of outliers and to exclude observations with missing key information.

We filter out firm-years in which (a) either the firm revenue or the value of intermediate inputs is missing; (b) the annual growth rate of either the value of intermediate inputs, value added, or the ratio of value added to the value of intermediate inputs exceeds 500 percent in absolute value.

For regressions involving $ARPK_{j,t}^o$, we further exclude observations for which (c) the annual growth rate of capital in absolute value exceeds 500 percent, and (d) measured $ARPK_{j,t}^o$ exceeds 1,000 percent in absolute value. For regressions involving $ARPL_{j,t}^o$, we further exclude observations for which (e) the annual growth rate of labor in absolute value exceeds 500 percent, and (f) measured $ARPL_{j,t}^o$ exceeds 600,000 yuans (about US$75,000) in absolute value. As a robustness check, we increase the threshold in (b), (c) and (e) from 500 percent to 1,000 percent, and the threshold in (d) from 1,000 percent to 10,000 percent. The changes do not change the qualitative results of the analysis.

These rules are designed to filter out extreme outliers. The remaining sample could still contain recording errors. So when we turn to regressions, we will also employ an additional robustness check by trimming out certain percentage of the smallest and the largest values for each ownership type.

IV. STATISTICAL RESULTS

We start with some raw, or unconditional returns to capital across different ownership types. We then move to account for the influence of sectors and locations on the returns to capital using a regression framework.

Different Sources of Financing Across Ownership

It is commonly noted that private firms have a harder time than state-owned firms to obtain financing from local banks in China. An Enterprise Survey conducted by the International Finance Corporation, a part of the World Bank Group, supplies evidence consistent with this notion. The IFC survey measures the perceptions of business managers and other senior staff about the main obstacles faced by their company in a number of countries[3]. The China portion of the survey, conducted in 2002 and 2003, comprises a sample of 3948 registered businesses. Two questions are particularly useful for our purpose: one asks firms to report a breakdown of the sources of financing for their working capital, and the other asks for a breakdown of the sources of financing for investment.

Table 2 lists the sources of financing for working capital as reported by firms of various ownership. While domestic private firms report to derive 22 percent of their working capital from Chinese banks, state-owned firms are 50 percent more likely to rely on local banks, deriving 36-38 percent of their working capital from them. In contrast, family and friends are an important source (8 percent) of working capital for private firms but not at all for state-owned firms.

Table 3 tabulates the sources of financing for investment. The same basic patterns emerge. In particular, state-owned firms are much more likely to rely on domestic banks for financing than private firms (or foreign firms), though the magnitude of the difference is moderately smaller than for working capital. Private firms continue to rely on family and friends (8.7 percent) for investment financing while state-owned firms do not.

The Chinese security regulatory agency also favors state-owned firms over private firms in its approval of initial public listings; this is reflected in the overwhelming share of listed companies that are majority state-owned. Therefore, it is reasonable to conclude that state-owned firms have relatively easy access to the formal financial system in China. Indeed, this is well known in the literature. However, how much difference in the cost of capital this actually translates into is not known. The rest of the paper aims to fill this void.

Dispersion in Returns to Capital Across Firm Ownership: Summary Statistics

Table 4 reports the summary statistics on the ratio of value added (VA) to capital stock by firm ownership. The mean average revenue product of capital is 99 percent for wholly state-owned firms, and 151 percent for private firms. In other words, the average return to capital

[3] More information on the survey methodology can be found at http://www.enterprisesurveys.org/Methodology.

is more than 50 percentage points higher for private firms than for wholly-state owned firms. In fact, foreign-owned and domestic private owned firms have comparably high average returns to capital (148-158 percent). Interestingly, the average returns decline progressively from foreign or domestic private owned firms, to minority state-owned (133 percent), majority state-owned (124 percent), and wholly state-owned firms (99 percent). This suggests that state ownership is systematically associated with lower returns to capital. On the other hand, collectively owned firms appear to have high returns to capital (172 percent), perhaps resulting from as severe discrimination in access to financing and other distortions in much the same way as domestic private firms.

The average returns may appear high in absolute values for all types of ownership. This could be due to outliers in the sample (in addition to policy distortions to cost of capital and output). We consider two reduced samples that trim out additional possible outliers. Specifically, for each ownership type, we exclude the top and the bottom 5 percent (or 10 percent) of the firms in terms of the average returns. The resulting means for these two trimmed samples are reported in the next two columns in Table 4. The average returns do become lower for each ownership type as we trim out more extreme values. Interesting, the order of the returns by ownership is preserved, namely, wholly state-owned firms always have the lowest average return, followed by majority state-owned and minority state owned firms.

Another reason for the high returns may result from under-valued capital stock. In particular, the value of capital stock on the firms' book may not fully reflect (potentially higher) market value. This could make the ratio of VA/K artificially high. Of course, firms may not take enough depreciation on their capital stock, which could result in over-valued capital stock. If these measurement errors are not systematically related to ownership (though related to sector classification), then they should not affect the order the estimated returns to capital across ownership. Arguably, state-owned firms are more likely not to take enough depreciation (i.e., keeping some "dead" capital on the book). As a result, the true discrepancy in the returns to capital between state-owned and privately owned firms is likely to be even larger than reported in Table 3.

Another way to look at "typical" returns by ownership that are less affected by extreme values is median return. By this measure, again, the same pattern of relative returns across ownership is exhibited. Specifically, wholly-state owned, majority state-owned, and minority state-owned firms have the three lowest median returns (57 percent, 71 percent, and 78 percent, respectively). Foreign-owned and domestic privately owned firms have returns, between 91-100 percent, or 20-40 percentage points higher than state-owned firms. The collectively owned firms are recorded to have the highest median returns.

Regression Approach to Control for Sector, Year, and Size Effects

The average returns to capital recorded in Table 4 do not take into account possible return differences across sectors, times or regions. For example, let us assume that state-owned firms do not have intrinsically lower returns. If they happen to be over-represented in those sectors that, due to temporarily large negative shocks, experience relatively low returns, then

this sector shock might give the misleading impression that state-owned firms have lower returns. As another example, let us assume that the source of inefficiency lies in regional differences in returns to capital. If state-owned firms happen to be over-represented in those regions with more depressed returns, then we might incorrectly conclude that capital allocation is biased in favor of state-owned firms if we do not correct for the regional effects. In this sub-section, we employ a regression framework that explicitly decomposes return differentials into ownership, region, and sector/year components.

We regress value added over capital (VA/K) on the seven ownership type dummies (with domestic private firms being the omitted benchmark type), industry–year fixed effects, and region fixed effects. The result is reported in the first column of Table 5. Even after accounting for year-specific sector shocks and location differences, the returns to capital are found to be statistically lower for state-owned firms than for domestic private firms, suggesting that private firms face greater capital and output distortions than state-owned firms. Wholly foreign-owned firms also exhibit lower returns than domestic private firms. On the other hand, collectively owned firms may face even greater capital and output distortions as they show higher returns than private firms.

In addition to working with the full sample, we also trim out 5 percent (or 10 percent) of the extreme values on both ends for each ownership type. The new regression results with the trimmed samples are reported in Columns 2 and 3 of Table 5. The qualitative results are similar as before, except that the return to wholly foreign-owned firms is no longer lower than domestic private firms once we exclude 10 percent outliers on both ends. Taken together, these three regressions suggest that after accounting for region and sector shocks, wholly state owned and majority state-owned firms still have 45 percent and 22 percent lower returns, respectively, than domestic private and foreign firms. Collectively owned firms, on the other hand, continue to appear to face even more grave distortions.

We also regress log of VA/K on the ownership type dummies, sector/year and region fixed effects. This specification corresponds to equation (13), allowing us to interpret the coefficients on the ownership dummies as reflecting relative capital and output distortions in percentage terms (tax equivalent). Parallel to the previous set of equations, we implement the regression on two trimmed samples as well as the whole sample. It turns out that the results are qualitatively similar to the earlier regression with un-logged dependent variables. Specifically, the combination of capital and output distortions is equivalent to giving wholly state-owned firms a subsidy of 54 percentage points relative to foreign and domestic private firms. Majority and minority state-owned firms are also found to face less distortions than private firms, which in tax equivalent terms, are on the order of 20 and 10 percentage points, respectively. We have also added a measure of firm size (total employment) to the regressions to see if the return to capital varies systematically with size (reported in Table 6). The answer turns out to be no.

To summarize, the data strongly suggest that the ARPK is substantially lower for wholly and partially state-owned firms than for foreign and domestic private firms by as much as 11-54 percentage points. If all firms in the same industry have the same Cobb-Douglas production (but may differ in their levels of TFPs), then the marginal return to capital, or MRPK, (which

is proportional to ARPK), is also substantially lower for state-owned firms than for foreign and domestic private firms.

Alternative Calculation of Marginal Returns to Capital

Instead of inferring marginal revenue product of capital (MRPK) from estimated average revenue product of capital (ARPK), one can also compute it directly. Specifically, we can Compute

$$MRPK_{j,t}^{o} = (VA_{j,t} - w_{j,t} L_{j,t})/ K_{j,t} \quad (22)$$

The advantage of this approach is to avoid the need to assume that the production function is Cobb-Douglas and that the capital share for different firms within a sector is identical. But the advantage comes with a cost, which is to assume that wage payment is accurately observed.

Table 7 presents the summary statistics of raw $MRPK_{j,t}^{o}$. Both the mean and the median marginal returns line up in the same way across ownership as for the average returns reported earlier. In particular, the marginal returns are substantially lower for the three types of state-owned firms than for either domestic private or foreign-owned firms. The median value of marginal returns to capital for private firms (at 0.63) is 26 percentage points higher than the median value of marginal return for wholly state-owned firms (at 0.37).

The raw distributions in Table 7 do not take into account sector or location composition of the firms which could bias the comparison of the returns across ownership (e.g., state-owned firms could happen to be over-represented in sectors that have lower returns). In Table 8, a set of regressions are run that include sector*year fixed effects as well as location fixed effects. All regressions consistently show that returns are lower for state-owned firms than for private or foreign-owned firms. For example, in Column 3 of Table 8, where the dependent variable is $MRPK_{j,t}^{o}$, and the sample is trimmed for 10 percent biggest and smallest returns for each ownership type, the marginal returns to capital for wholly state-owned, majority state-owned, and minority state-owned firms are 36, 15, and 12 percentage points lower than that of private firms within the same sector and in the same city. All three coefficients are statistically significant at the 1 percent level.

In Column 6 of Table 8, where the dependent variable is $\ln(MRPK^{o})$, and the sample is also trimmed for 10 percent biggest and smallest returns for each ownership type, only the coefficients for wholly and majority state-owned firms are negative and statistically significant at the five percent level. As explained earlier, the coefficients can be interpreted as the added cost of capital and output distortions faced by state-owned firms relative to those faced by domestic private firms. By these point estimates, wholly state-owned and majority state-owned firms face lower costs of capital (and/or less output distortions) on the order of 50 and 18 percentage points, respectively. In other words, the constraints on private firms' ability to access financing (or other constraints that prevent them from taking advantage of the high marginal returns to capital) are severe.

Table 9 repeats the regressions in Table 8 with the addition of a measure of firm size by employment. The results suggest that marginal returns to capital tend to be higher in firms with more employment. After accounting for this, the conclusion regarding the return differentials across ownership remains the same: state-owned firms have systematically lower marginal returns to capital than domestic private or foreign-owned firms.

Dispersion of Factor Returns across Regions and Sectors

Under the null hypothesis of optimally allocated capital with no distortions and no risk, marginal returns to capital should also be equalized across regions and sectors. The regressions reported in Tables 5-6 and 8-9 also include city and sector fixed effects, allowing us to directly check for evidence of allocative distortions by regions and sectors.

We extract all the city fixed effects from Tables 5 and 8, and order them from the lowest to the highest. It is clear that the city fixed effects vary widely across locations. To see if the cross-city differences in returns to capital reflect systematic inefficiency in the capital allocation system rather than sample variations or measurement errors, we also implement the regressions year by year with separate city fixed effects for each year. The results are reported in Appendix Table 1. The scatter plots of the 2004 estimates against those of 2003, and the 2003 estimates against those of 2002 are presented in Figures 1 and 2. The pairwise correlations for these fixed effects are 0.79 and 0.75, respectively, between 2002 and 2003, and between 2003 and 2004. The persistence in the cross-city differentials in the MRPKs suggests that they likely reflect systematic biases in China's capital allocation in favor of certain regions against others.

The Chinese government has a policy on the book to support development in the inland. This raises the possibility that capital is systematically channeled to the inland even though the returns may be lower there. It is also possible that provincial capitals and four super-cities (Beijing, Chongqing Shanghai, and Tianjin,) receive special treatment in capital allocation. To check if the capital allocation distortions are systematic, we implement a set of regressions that include dummies for provincial capitals, super-cities, and a set of dummies that correspond to the government's official classification of the country into either three or seven zones. The results are reported in Table 10. There is no evidence that returns to capital in the provincial capital or the super-cities are systematically different from other cities. However, in the three-zone classification (used in official documents such as in China's seventh five-year plan), cities in Eastern China (coastal area) are found to have higher marginal returns than those in Middle China (near coast) by 9 percentage points, which in turn have higher marginal returns than the Western China by 8 percentage points.

Using a seven-zone classification (used in some documents such as those of the 8th National People's Congress in 1996), similar patterns emerge. In particular, the benchmark region (Northwest China, encompassing Gansu, Ningxia, Qinhai, Shanxi, Xinjing, and Inner Mongolia) has the lowest marginal returns to capital. The middle group, the Central region (Anhui, Henan, Hubei, Hunan, and Jiangxi), Northeast (Heilongjiang , Jilin, and Liaoning), Southwest (Guangxi, Guizhou, Sichuan, Tibet, and Yunnan), and Southeast (Fujina, Guandong, and Hainan) have higher marginal returns by 12-21 percentage points. The Bohai

Circle (Beijing, Hebei,Tianjin, Shandong, and Shanxi) and the Yangzi Delta (Jiangsu, Shanghai, and Zhejiang) have the highest marginal returns in the country, about 30-49 percentage points higher than the benchmark region. We have also collected city fixed effects from regressions with the average revenue product of capital as the dependent variable. Regressing these city fixed effects on the same set of regional dummies as in Table 10 produces very similar results (not reported to save space). This suggests that the Chinese authorities' effort in channeling capital into the inland may have resulted in a loss in efficiency.

The sector fixed effects (from separate regressions of ln[VA-wL)/K] in different years) are reported in Table 11. Similar to the city fixed effects, the ranking of the sectors by the size of the fixed effects is also relatively stable over the three years. Printing and copying, wood processing and products, and non-metallurgical products have among the lowest marginal returns to capital. On the other hand, black metallurgical refinery and processing, and tobacco products have among the highest returns to capital. In principle, some reallocation of capital from the lower return sectors to the higher return ones could improve efficiency. Some qualifications are needed, however. First, capital allocation to some sectors may be discouraged by policies because of considerations of negative externality. Tobacco products are an example. Restrictions on investment in that sector (through a high output or profit tax) can be socially efficient if the negative externality is sufficient high. One has to have information on the size of the externality to make an informed judgment on whether equating the return to capital in that sector with those of others would improve efficiency. Second, for many sectors, the sector fixed effects are not statistically significant for any year (relative to the benchmark of agriculture products and processing). This suggests that capital mis-allocation across sectors is limited to a small number of sectors. For these reasons, we will not focus our attention on the dispersion in the marginal returns across sectors.

Returns to Labor

We also compute average revenue product of labor (ARPL = VA/L) and report the summary statistics in Table 12. It is clear that wholly state-owned and collective firms have the lowest ARPL among all ownership groups. On the other hand, foreign firms and partially state-owned firms have the highest ARPL. Domestic private firms are somewhere in between. We also use a regression approach to control for possible differences across sectors, years, and locations, and report the results in Table 13. The same qualitative pattern is repeated here. We also add a measure of firm size (log of employment) and obtain the same results (not reported to save space).

The joint patterns of ARPKs and ARPLs suggest something interesting. Wholly-owned state firms have the lowest returns to both capital and labor, suggesting low TFPs in these firms. On the other hand, partially state-owned firms have lower ARPKs than either private or foreign firms, but an intermediate level of ARPL that is between those of domestic private and foreign firms. If partially state-owned firms also have an intermediate level of TFP, face greater constraint in laying off redundant workers than private firms, but are partially compensated by preferential access to financing (as wholly state-owned firms), this pattern can be rationalized.

We note, however, that the results on returns to labor are not as reliable as those on returns to capital. One reason is that labor is more heterogeneous than capital. In particular, it may make sense to differentiate skilled and unskilled labor. As the current survey lacks information on this, the results on returns to labor should be regarded as tentative.

Efficient Reallocation of Capital: An Illustrative Calculation

China can improve its resource allocation through a number of ways, either by privatizing state-owned firms, simultaneously reallocating capital from the state to the private sector and removing the distortions faced by private firms, or changing the incentives faced by the management of the state firms. Partial privatization, converting a wholly state-owned firm to a partially state-owned firm, or converting the state share from a majority to a minority, would also raise the return to capital, though not as much as full privatization or reallocation of capital from state to private firms. We do not have the data to do an evaluation of the relative gains across the full menu of reform options. Instead, we can examine the efficiency gains associated with removing the dispersion in marginal returns to capital from state-owned to private firms.

Let Chinese GDP in a given year to be the sum of value added from the state firms and the value added from the private firms:

$$GDP = Y_s(K_s , L_s) + Y_p(K_p , L_p) \tag{23}$$

Consider a thought experiment of moving X yuans from the state firms to the private firms, but leaving the labor (and other input) allocation fixed. This would result in a percentage change in GDP given by:

$$\text{percent increase in GDP} = [Y_s(K_s\text{-}X, L_s)+Y_p(K_p+X, L_p)]/ [Y_s(K_s , L_s)+Y_p(K_p , L_p)]\text{-}1 \tag{24}$$

Subject to the equilibrium constraint that the average (and marginal) returns to capital are equalized between state and private firms after the reallocation:

$$Y_s(K_s\text{-}X, L_s)/ (K_s\text{-}X) = Y_p(K_p+X, L_p)/(K_p+X) \tag{25}$$

From the regression tables, we can infer the relative cost of capital distortions faced by firms of different ownership types:

$$[Y_s(K_s, L_s)/ K_s] / [Y_p(K_p, L_p)/K_p] = d_s/d_p \tag{26}$$

It can be verified that the optimal reallocation of the capital as a share of the original capital stock employed by state-owned firms is given by:

$$X / K_s = \frac{\frac{K_p}{K_s}\left[(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}} - 1 \right]}{1 + \frac{K_p}{K_s}(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}}} \tag{27}$$

Where α is the capital share in the Cobb-Douglas production function. The increment in GDP (in percent) as a result of the capital reallocation is:

$$\%\Delta GDP = \frac{(1 + \frac{K_p}{K_s})^{\alpha}\left[1 + (\frac{K_p}{K_s})^{1-\alpha}(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}} \right]}{1 + \frac{K_p}{K_s}(\frac{d_p}{d_s})} \tag{28}$$

We perform a set of simulations on the percentage increment in GDP due to an optimal reallocation of capital as a function of some basic parameters. Three parameters are key to the simulations.

(a) The capital share in the production function. Under the assumption that both the ARPKs in Table 2 and the MRPKs in Table 5 are valid, we can infer the capital share by the ratio of MRPK/ARPK. As the median MRPK and median ARPK for the whole sample are 0.61 and 0.88, respectively, the capital share implied by the ratio of the two is 0.69. If we use the values for the domestic private firms, we obtain the same implied capital share. Using trimmed means or median values for other ownership types would yield an implied capital share in the range of (0.64, 0.74). It is possible that the wage payment in our data does not capture all labor compensation. Using labor compensation in the national income statistics, Hsieh and Klenow (2006) estimated the capital share in China in the neighborhood of 0.6. In our simulation, we vary the capital share, α, at 0.5, 0.6, and 0.7.

(b) The ratio of the capital stock employed by non-state firms to that employed by state-owned firms, K_p/ K_s. While the share of state-owned firms in total industrial output has declined to about 1/3 in recent years, state-owned firms tend to be larger and more capital-intensive on average than private firms. We therefore vary K_p/ K_s at 1, 1.5, and 2.

(c) The ratio of the distortions to cost of capital faced by private firms relative to those faced by state-owned firms, d_s/d_p. This ratio can be inferred from the regression coefficients reported in Tables 3 and 4. Specifically, the coefficients for the state-owned firms in the last three columns of Table 3 are effectively $\ln(d_s/d_p)$. We vary d_p/d_s at 1.5, 1.8, and 2.

The simulation results are reported in Table 14. The projected percentage increase in GDP after an optimal reallocation of capital ranges from 2-11 percent of GDP. The central case ($\alpha = 0.6$, $K_p/ K_s=1.5$, and $d_p/d_s =1.8$) yields an increase in GDP by 5 percent. To accomplish this, 2/3 of the capital currently employed by state-owned firms needs to be "liberated" for more efficient use. Taking the central case literally, it implies that China could drastically reduce its physically investment by 5 percent of GDP (say from the current 40 percent of

GDP to 35 percent) without sacrificing its GDP growth. This in turn means that the same growth rate could translate into a much bigger improvement in the living standard for households in China.

A few comments are in order. First, the above calculation has not taken into account the gains from eliminating the dispersion in marginal returns to capital across regions and sectors. Second, it has not included the gains from reallocating labor either. So the true efficiency gains are likely to be larger than the simulations indicate. Third, as a counter argument, removing all policy distortions that generate the differentials in the marginal returns to capital may not be the relevant policy counterfactual to consider. In particular, if the government ceases the policy of granting preferential access to finance to state-owned firms, the unemployment rate would have risen and budgetary outlays in the form of unemployment payment would have risen. In other words, perhaps the subsided financing to state forms is a form of disguised unemployment payment. As a critique to the last point, one needs to realize that private firms would have expanded had their financing constraint been relaxed, and the expansion would have absorbed the labor released from state-owned firms. The temporal cost of the unemployment benefit during the transition period is unlikely to outweigh the foregone value added due to a long-lasting inefficient allocation of capital needed to sustain the state-owned firms.

V. CONCLUSION

Using a survey of a stratified random sample of firms in China, we provide evidence that capital allocation is inefficiently allocated. The degree of inefficiency is economically and statistically significant. In particular, we show that wholly and partially state owned firms have lower average returns to capital than private or foreign firms by 11-54 percentage points. A set of simulations illustrates the magnitude of the inefficiency for the economy: If China can raise the returns to capital on the stock of capital currently employed by state firms, then the country can reduce its very high investment rate by 5 percent GDP without an adverse effect on its growth rate and, as a result, can raise its consumption and deliver greater improvement in living standards.

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Table 1. Firm Classification by Actual Ownership Versus Registration

All sample

a4	Registered Type	State100	State_majority	State_minority	Foreign100	Foreign_majority	Foreign_minority	Collective	Private	Total
1	SOE	900	33	20	0	0	0	0	169	1,122
2	Collective	18	9	18	6	2	13	595	208	869
3	Joint stock	6	17	16	5	5	9	0	307	365
4	Limited Co.	171	185	214	6	26	58	0	3,913	4,573
5	Stock Ltd.	40	149	172	10	16	61	0	807	1,255
6	Private	0	0	13	8	4	13	0	1,634	1,672
7	HMT	0	36	24	430	164	283	0	53	990
8	FIE	0	39	37	618	361	313	0	30	1,398
9	Other	4	13	10	4	16	15	0	91	153
Total		1,139	481	524	1,087	594	765	595	7,212	12,397

Note: Three firms are dropped due to inconsistency between their self-declared ownership type (privately owned) and reported capital composition structure (wholly or majority state owned).

Table 2. Sources of Financing for Working Capital by Ownership Type

Ownership	Percentage of Working Capital Obtained from: local banks	foreign-owned banks	internal/ret. earnings	family, friends	Other
State_whole	36.20	0.00	8.26	1.27	54.27
State_Majority	37.34	0.00	13.18	0.00	49.48
State_Minority	38.00	0.00	19.12	0.59	42.30
Foreign_whole	19.07	0.23	9.63	1.13	69.94
Fore_Majority	29.15	0.43	17.76	0.70	51.96
Fore_Minority	30.29	0.69	16.82	3.71	48.50
Private	22.46	0.16	13.81	8.13	55.44
Total	26.26	0.16	13.06	5.72	54.81

Total reports mean over entire sample; every firm is counted only once, data are for 2001 or 2002, depending on the year in which the firm was surveyed

Table 3. Sources of Financing for Investment by Ownership Type

Ownership	Percentage of Investment Obtained from				
	local banks	foreign-owned banks	internal/ret. earnings	family, friends	Other
State_whole	24.72	0.00	11.51	1.25	62.51
State_Majority	36.32	0.00	10.71	0.00	52.97
State_Minority	33.90	0.00	18.30	0.00	47.80
Foreign_whole	13.27	0.00	15.77	2.12	68.85
Fore_Majority	15.57	0.69	20.31	2.24	61.19
Fore_Minority	20.46	0.00	17.21	1.86	60.47
Private	18.26	0.15	15.90	8.71	56.99
Total	20.24	0.12	15.24	5.89	58.51

Total reports mean over entire sample; every firm is counted only once, data are for 2001 or 2002, depending on the year in which the firm was surveyed

Table 4. Summary Statistics of VA/K Ratio

Ownership	**N**	Mean			median	sd	min	max	10th percentile	90th percentile
		whole sample	drop 5% on both ends	drop 10% on both ends						
State_whole	2805	0.99	0.82	0.74	0.57	1.37	-7.56	9.80	0.04	2.42
State_Majority	1236	1.24	1.08	0.97	0.71	1.54	-5.15	9.79	0.07	3.25
State_Minority	1269	1.33	1.13	1.02	0.78	1.61	-3.12	9.91	0.16	3.17
Foreign_whole	2406	1.48	1.31	1.19	0.94	1.72	-7.82	9.93	0.19	3.71
Fore_Majority	1422	1.58	1.38	1.26	0.95	1.76	-4.29	9.93	0.20	4.00
Fore_Minority	1791	1.50	1.33	1.22	1.00	1.67	-9.68	9.80	0.21	3.54
Collective	1311	1.72	1.56	1.43	1.15	1.97	-8.92	9.98	0.18	4.36
Private	16134	1.51	1.32	1.19	0.91	1.76	-7.99	10.00	0.15	3.82
Total	**28374**	**1.45**	**1.26**	**1.15**	**0.88**	**1.72**	**-9.68**	**10.00**	**0.04**	**4.36**

Table 5. Average Revenue Product of Capital and Ownership

Dependent variable	VA/K			ln(VA/K)		
	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends
State_whole	-0.507**	-0.494**	-0.453**	-0.416**	-0.481**	-0.539**
	-0.036	-0.025	-0.02	(0.025)	(0.022)	(0.019)
state_majority	-0.231**	-0.219**	-0.216**	-0.151**	-0.207**	-0.217**
	-0.051	-0.035	-0.028	(0.034)	(0.031)	(0.027)
state_minority	-0.118*	-0.158**	-0.149**	-0.077*	-0.092**	-0.108**
	-0.05	-0.034	-0.028	(0.033)	(0.030)	(0.026)
Foreign_whole	-0.134**	-0.071*	-0.04	-0.042	-0.028	-0.013
	-0.043	-0.03	-0.024	(0.029)	(0.026)	(0.023)
foreign_majority	0.003	0.015	0.031	0.011	0.043	0.054*
	-0.049	-0.034	-0.027	(0.033)	(0.029)	(0.026)
foreign_minority	-0.101*	-0.064*	-0.027	-0.022	0.015	0.029
	-0.043	-0.03	-0.024	(0.029)	(0.026)	(0.023)
collective	0.228**	0.261**	0.242**	0.223**	0.206**	0.200**
	-0.049	-0.034	-0.028	(0.033)	(0.030)	(0.026)
Fixed Effect	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + ci
Observations	28374	25544	22706	27212	25438	22706
R-squared	0.06	0.07	0.08	0.08	0.09	0.10

Standard errors in parentheses * significant at 5 percent, ** significant at 1 percent.

Table 6. Average Returns to Capital: Adding Firm Size [ln(employment)]

Dependent variable	VA/K			ln(VA/K)		
	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends
State_whole	-0.497**	-0.484**	-0.446**	-0.429**	-0.501**	-0.544**
	(0.037)	(0.026)	(0.021)	(0.025)	(0.023)	(0.019)
state_majority	-0.220**	-0.208**	-0.207**	-0.164**	-0.228**	-0.222**
	(0.051)	(0.035)	(0.029)	(0.035)	(0.031)	(0.027)
state_minority	-0.108*	-0.148**	-0.141**	-0.089**	-0.112**	-0.113**
	(0.050)	(0.035)	(0.028)	(0.034)	(0.030)	(0.027)
Foreign_whole	-0.131**	-0.068*	-0.037	-0.046	-0.035	-0.014
	(0.043)	(0.030)	(0.024)	(0.029)	(0.026)	(0.023)
foreign_majority	0.007	0.018	0.034	0.007	0.035	0.052*
	(0.049)	(0.034)	(0.027)	(0.033)	(0.029)	(0.026)
foreign_minority	-0.097*	-0.059*	-0.024	-0.027	0.007	0.026
	(0.043)	(0.030)	(0.024)	(0.029)	(0.026)	(0.023)
collective	0.225**	0.258**	0.240**	0.226**	0.212**	0.201**
	(0.050)	(0.034)	(0.028)	(0.033)	(0.030)	(0.026)
ln(Employment)	-0.009	-0.009	-0.007	0.011*	0.017**	0.004
	(0.008)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
Fixed Effect	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city
Observations	28374	25544	22706	27212	25438	22706
R-squared	0.06	0.07	0.08	0.08	0.09	0.10

Standard errors in parentheses * significant at 5 percent; ** significant at 1 percent

Table 7. Summary Statistics of Marginal Revenue Product of Capital

Ownership	N	Mean			median	sd	min	max	10th percentile	90th percentile
		whole sample	drop 5% on both ends	drop 10% on both ends						
State_whole	2805	0.75	0.61	0.53	0.37	1.28	-8.91	9.03	-0.09	2.09
State_Majority	1236	0.96	0.83	0.73	0.52	1.43	-5.59	9.25	-0.03	2.73
State_Minority	1269	1.04	0.85	0.76	0.56	1.49	-4.10	9.79	0.04	2.68
Foreign_whole	2406	1.09	0.95	0.84	0.63	1.52	-7.90	9.74	0.05	3.00
Fore_Majority	1422	1.29	1.10	0.98	0.74	1.62	-6.52	9.49	0.08	3.45
Fore_Minority	1791	1.19	1.04	0.94	0.75	1.57	-13.20	9.41	0.09	2.96
Collective	1311	1.15	1.05	0.93	0.67	1.80	-9.82	9.72	-0.01	3.52
Private	16134	1.05	0.99	0.88	0.63	9.86	-1227.96	9.98	0.02	3.15
Total	**28374**	**1.05**	**0.94**	**0.84**	**0.61**	**7.50**	**-1227.96**	**9.98**	**-0.09**	**3.52**

Table 8. Marginal Revenue Product of Capital ($\frac{VA-wL}{K}$) and Ownership

Dependent variable	VA/K			ln(VA/K)		
	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends	Whole Sample	Drop 5 percent outlier both ends	Drop 10% outlier both ends
State_whole	-0.321*	-0.381**	-0.355**	-0.394**	-0.397**	-0.500**
	(0.161)	(0.021)	(0.017)	(0.030)	(0.029)	(0.026)
state_majority	-0.129	-0.149**	-0.149**	-0.084*	-0.082*	-0.184**
	(0.225)	(0.030)	(0.024)	(0.041)	(0.040)	(0.035)
state_minority	-0.018	-0.118**	-0.115**	-0.049	-0.053	-0.052
	(0.221)	(0.030)	(0.024)	(0.040)	(0.039)	(0.034)
Foreign_whole	0.021	-0.046	-0.030	0.023	0.031	0.049
	(0.191)	(0.026)	(0.020)	(0.034)	(0.034)	(0.030)
foreign_majority	0.194	0.095**	0.097**	0.152**	0.167**	0.215**
	(0.217)	(0.029)	(0.023)	(0.039)	(0.038)	(0.034)
foreign_minority	0.052	0.007	0.032	0.069*	0.090**	0.157**
	(0.191)	(0.026)	(0.020)	(0.034)	(0.033)	(0.030)
collective	0.038	0.067*	0.044	0.115**	0.124**	0.015
	(0.221)	(0.029)	(0.023)	(0.040)	(0.039)	(0.034)
Fixed Effect	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city
Observations	28374	25544	22706	25834	24419	22509
R-squared	0.01	0.07	0.07	0.07	0.07	0.08

Standard errors in parentheses * significant at 5 percent; ** significant at 1 percent.

Table 9. Marginal Returns to Capital ($\frac{VA-wL}{K}$)

Adding Firm Size [ln(employment)]

Dependent variable	(VA-wL)/K			ln((VA-wL)/K)		
	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends
State_whole	-0.375*	-0.393**	-0.365**	-0.423**	-0.446**	-0.543**
	(0.165)	(0.022)	(0.018)	(0.031)	(0.030)	(0.026)
state_majority	-0.183	-0.160**	-0.160**	-0.115**	-0.134**	-0.229**
	(0.229)	(0.031)	(0.024)	(0.042)	(0.041)	(0.036)
state_minority	-0.073	-0.129**	-0.124**	-0.078	-0.100*	-0.093**
	(0.225)	(0.030)	(0.024)	(0.040)	(0.039)	(0.035)
Foreign_whole	0.003	-0.050	-0.033	0.014	0.015	0.035
	(0.192)	(0.026)	(0.021)	(0.034)	(0.034)	(0.030)
Foreign_majority	0.173	0.090**	0.093**	0.141**	0.149**	0.199**
	(0.217)	(0.029)	(0.023)	(0.039)	(0.038)	(0.034)
Foreign_minority	0.030	0.002	0.028	0.058	0.071*	0.139**
	(0.192)	(0.026)	(0.020)	(0.034)	(0.033)	(0.030)
collective	0.053	0.070*	0.047*	0.123**	0.137**	0.028
	(0.221)	(0.029)	(0.024)	(0.040)	(0.039)	(0.034)
ln(Employment)	0.048	0.010*	0.009*	0.025**	0.041**	0.036**
	(0.034)	(0.005)	(0.004)	(0.006)	(0.006)	(0.005)
Fixed Effect	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city
Observations	28374	25544	22706	25834	24419	22509
R-squared	0.02	0.07	0.07	0.07	0.07	0.08

Standard errors in parentheses * significant at 5 percent; ** significant at 1 percent

Table 10. Explaining the City Fixed Effects from $\ln(\frac{VA - wL}{K})$

	East, Middle, West Zones		7 Economic Zones	
	whole sample	drop 10% on both ends	whole sample	drop 10% on both ends
province capital	0.02	0.03	0.03	0.03
	(0.04)	(0.03)	(0.03)	(0.03)
super_city	0.12	0.09	0.06	0.06
	(0.08)	(0.06)	(0.07)	(0.07)
Eastern China	0.28**	0.17**		
	(0.04)	(0.03)		
Middle China	0.17**	0.08**		
	(0.04)	(0.03)		
econ_region==Bohai circle			0.30**	0.30**
			(0.05)	(0.05)
econ_region==Middle			0.21**	0.21**
			(0.05)	(0.05)
econ_region==NorthEast			0.19**	0.19**
			(0.06)	(0.06)
econ_region==SouthEast			0.12*	0.12*
			(0.06)	(0.06)
econ_region==SouthWest			0.14*	0.14*
			(0.06)	(0.06)
econ_region==Yangzi			0.49**	0.49**
			(0.06)	(0.06)
Constant	-0.18**	-0.12**	-0.21**	-0.21**
	(0.04)	(0.03)	(0.05)	(0.05)
Suppressed comparison	West		North West	
Observations	357	357	357	357
R-squared	0.14	0.1	0.24	0.24
year fixed effect	y	y	y	Y

Standard errors in parentheses; + significant at 10 percent; * significant at 5 percent; ** significant at 1 percent

Economic Zones: Suggested Division on 3/17/1996, the 8th National People's Representative Conference, the 4th meeting. 1. Yangzi Delta zone: Jiangsu, Zhejiang, Shanghai; 2. South east coastal zone: Guangdong, Fujian, Hainan;3. Circle Bo Sea zone: Beijing, Tianjin, Hebei, Shandong, Shanxi; 4. Northeast zone: Liaoning, Jilin, Heilongjiang; 5. Middle zone: Henan, Hubei, Hunan, Anhui, Jiangxi; 6. Southwest zone: Sichuan, Guizhou, Yunnan, Guangxi, Tibet; 7. Northwest: Shannxi, Gansu, Qinhai, Ningxia, Xinjiang, InnerMongolia

EMW: Division at the beginning of 1980s, the 7th Five-Year Plan. East:Liaoning, Beijing, Tianjin, Hebei, Shandong, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan, Guangxi; Middle: Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Anhui, Jiangxi, Hubei, Hunan; West: Sichuan, Guizhou, Yunnan, Tibet, Shannxi, Gansu, Qinhai, Ningxia, Xinjiang

Table 11. Sector Fixed Effects from Regression $\ln(\frac{VA-wL}{K})$

Rank	Industry Description	coef2002	coef2003	coef2004	coef_avg
1	printing and copying products	-0.32*	-0.37*	-0.13	-0.27
2	wood processing and products	-0.30*	-0.33*	-0.13	-0.26
3	non-metallurgical products	-0.22*	-0.20*	-0.08	-0.17
4	textile manufacturing	-0.13*	-0.20*	-0.15*	-0.16
5	food manufacturing	-0.15	-0.05	0.01	-0.06
6	meters and instruments, office equipment manufacturing	0.04	-0.05	-0.15	-0.06
7	chemical fabrics manufacturing	-0.08	-0.01	-0.02	-0.04
8	medicine manufacturing	0.02	-0.02	-0.08	-0.02
9	rubber manufacturing	-0.18	-0.09	0.23	-0.01
10	general equipment manufacturing	-0.07	-0.07	0.11*	-0.01
11	paper manufacturing	0.09	-0.05	-0.06	-0.01
12	petroleum, refinery, and other gas processing	-0.08	-0.02	0.08	-0.01
13	special equipment manufacturing	-0.01	-0.03	0.04	-0.0003
14	agricultural products & processing **(benchmark)**	0	0	0	0
15	communications, computer and other electronic equipments	-0.09	0.04	0.07	0.01
16	metal products	-0.08	-0.02	0.16*	0.02
17	chemical products and manufacturing	0.01	0.004	0.07	0.03
18	plastic manufacturing	0.03	-0.001	0.07	0.03
19	colored metallurgical refinery and processing	0.12	-0.07	0.12	0.06
20	transportation equipment manufacturing	0.06	0.02	0.09	0.06
21	furniture manufacturing	-0.02	-0.09	0.30	0.06
22	drink manufacturing	0.10	-0.04	0.16	0.07
23	electrical machinery	0.07	0.03	0.14*	0.08
24	garment, shoes, and caps manufacturing	0.002	0.07	0.17	0.08
25	handicrafts manufacturing	0.01	0.21	0.03	0.08
26	stationary and sports equipment manufacturing	0.28	0.03	0.16	0.15
27	leather and allied product manufacturing	0.19	0.19	0.18	0.18
28	black metallurgical refinery and processing	0.18*	0.27*	0.34*	0.26
29	wastes collection and renewable	0.53	0.87	1.04	0.82
30	tobacco products	0.81*	0.81*	0.98*	0.87

Note: * denotes significantly different from zero at the 10 percent level.

Table 12. Summary Stat of VA/L
(unit: thousand yuans)

Ownership	N	Mean			median	sd	min	max	10th percentile	90th percentile
		whole sample	drop 5% on both ends	drop 10% on both ends						
State_whole	2511	47.07	41.43	37.81	27.48	56.96	-166.07	299.98	1.60	126.07
State_Majority	1059	61.70	57.14	52.96	44.20	65.44	-213.02	296.08	3.83	151.33
State_Minority	1110	68.67	64.17	59.96	49.19	66.55	-183.40	288.40	8.83	169.62
Foreign_whole	1983	64.07	60.41	56.48	45.07	65.23	-288.52	297.66	8.69	160.91
Fore_Majority	1032	81.17	78.82	75.22	64.82	76.08	-279.79	298.66	10.43	192.45
Fore_Minority	1443	71.37	66.29	62.10	51.20	67.07	-239.65	298.65	10.58	170.40
Collective	1242	38.85	34.03	30.62	23.22	47.29	-156.48	298.33	5.05	98.47
Private	14850	50.91	45.65	41.82	32.80	56.59	-285.32	299.90	6.64	127.66
Total	**25230**	**54.61**	**49.65**	**45.81**	**35.25**	**60.07**	**-288.52**	**299.98**	**1.60**	**192.45**

Table 13. Average Revenue Product of Labor

	VA/L			ln(VA/L)		
	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends	Whole Sample	Drop 5% outlier both ends	Drop 10% outlier both ends
State_whole	-2.526*	-3.975**	-4.518**	-0.070**	-0.132**	-0.218**
	(1.278)	(0.948)	(0.801)	(0.024)	(0.022)	(0.019)
state_majority	10.388**	9.837**	9.326**	0.242**	0.193**	0.179**
	(1.846)	(1.367)	(1.155)	(0.034)	(0.031)	(0.027)
state_minority	15.959**	16.186**	16.532**	0.304**	0.315**	0.337**
	(1.794)	(1.330)	(1.124)	(0.032)	(0.030)	(0.026)
Foreign_whole	14.787**	16.101**	15.662**	0.314**	0.299**	0.323**
	(1.603)	(1.193)	(1.014)	(0.029)	(0.027)	(0.024)
foreign_majority	28.130**	31.146**	31.859**	0.507**	0.507**	0.555**
	(1.894)	(1.405)	(1.191)	(0.034)	(0.031)	(0.028)
foreign_minority	18.339**	19.051**	19.290**	0.332**	0.380**	0.397**
	(1.603)	(1.188)	(1.005)	(0.029)	(0.027)	(0.024)
collective	-11.098**	-11.141**	-11.431**	-0.259**	-0.292**	-0.321**
	(1.723)	(1.277)	(1.079)	(0.031)	(0.029)	(0.025)
Fixed Effect	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city	Industry*year + city
Observations	25230	22714	20188	24130	22595	20188
R-squared	0.12	0.15	0.17	0.15	0.15	0.16

Table 14. Gains from an Optimal Reallocation of Capital

K Share	Ratio of Private to State K Stock	Ratio of Distortions by Private vs. State Firms	percent of State K Transferred	percent change of GDP
(α)	(Kp/Ks)	(dp/ds)	(X/Ks)	**($\%\Delta Y$)**
0.5	2	2	0.67	0.04
0.5	1.5	2	0.64	0.05
0.5	1	2	0.60	0.05
0.5	2	1.8	0.60	0.03
0.5	1.5	1.8	0.57	0.03
0.5	1	1.8	0.53	0.04
0.5	2	1.5	0.45	0.02
0.5	1.5	1.5	0.43	0.02
0.5	1	1.5	0.38	0.02
0.6	2	2	0.76	0.06
0.6	1.5	2	0.74	0.07
0.6	1	2	0.70	0.08
0.6	2	1.8	0.69	0.04
0.6	**1.5**	**1.8**	**0.67**	**0.05**
0.6	1	1.8	0.63	0.06
0.6	2	1.5	0.54	0.02
0.6	1.5	1.5	0.51	0.03
0.6	1	1.5	0.47	0.03
0.7	2	2	0.86	0.08
0.7	1.5	2	0.84	0.09
0.7	1	2	0.82	0.11
0.7	2	1.8	0.80	0.06
0.7	1.5	1.8	0.79	0.07
0.7	1	1.8	0.75	0.09
0.7	2	1.5	0.66	0.03
0.7	1.5	1.5	0.63	0.04
0.7	1	1.5	0.59	0.04

Notes:

$$\frac{A_s K_s^{\alpha} L_s^{1-\alpha}}{K_s} = d_s \ , \qquad \frac{A_p K_p^{\alpha} L_p^{1-\alpha}}{K_p} = d_p, \qquad Y = A\, K^{\alpha} L^{1-\alpha}$$

$$X / K_s = \frac{\frac{K_p}{K_s}\left[(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}} - 1 \right]}{1 + \frac{K_p}{K_s}(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}}}$$

$$\%\Delta GDP = \frac{(1 + \frac{K_p}{K_s})^{\alpha}\left[1 + (\frac{K_p}{K_s})^{1-\alpha}(\frac{d_p}{d_s})^{\frac{1}{1-\alpha}} \right]}{1 + \frac{K_p}{K_s}(\frac{d_p}{d_s})}$$

$$MRPK_s(K_s - x) = MRPK_p(K_p - x)$$

Figure 1. Scatter Plot of City Fixed Effects of ln(VA/K) on Eight Ownerships

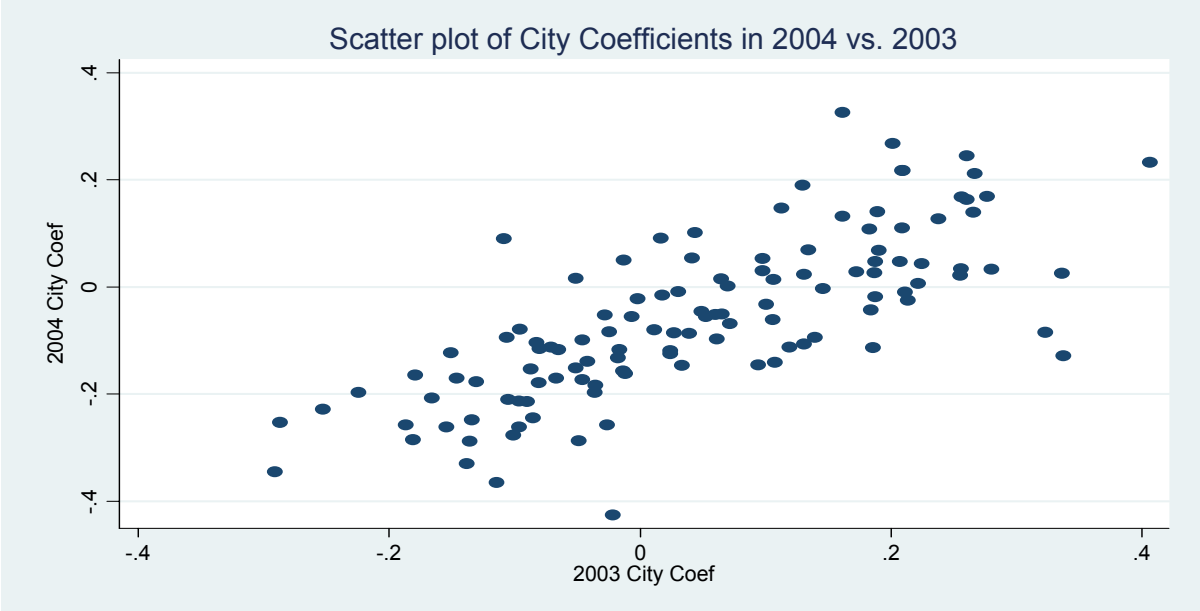


Figure 2. Scatter Plot of Sector Coefficients of ln(VA/K) on Eight Ownerships

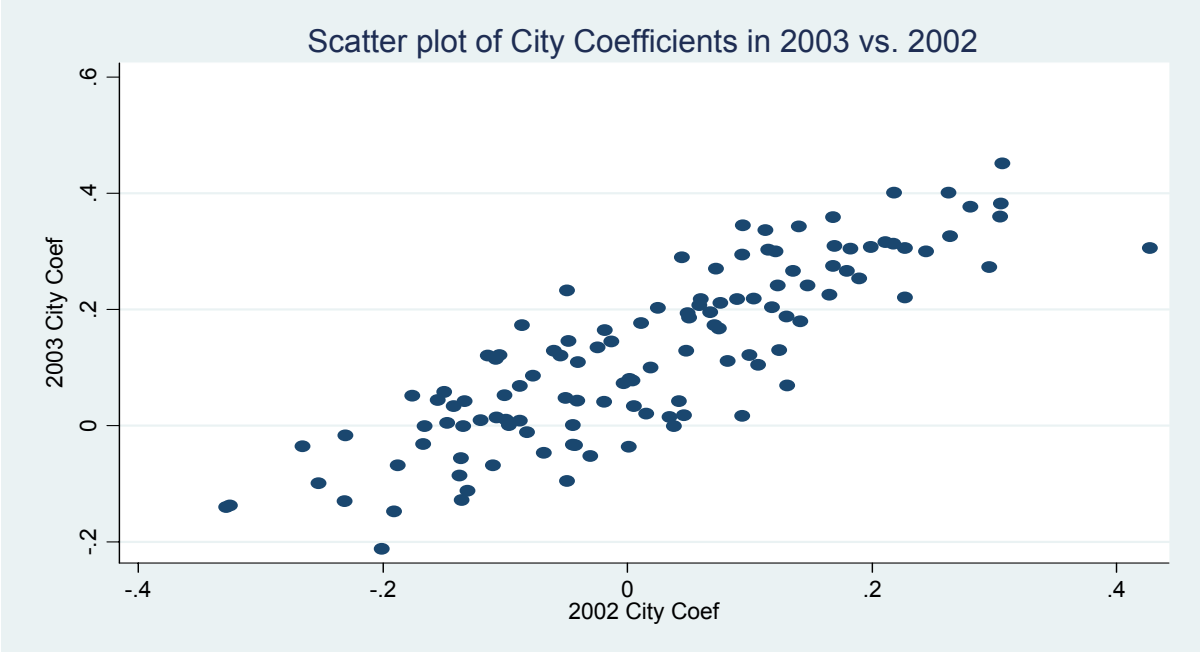


Figure 3. Sector Fixed Effects, 2004 vs. 2003

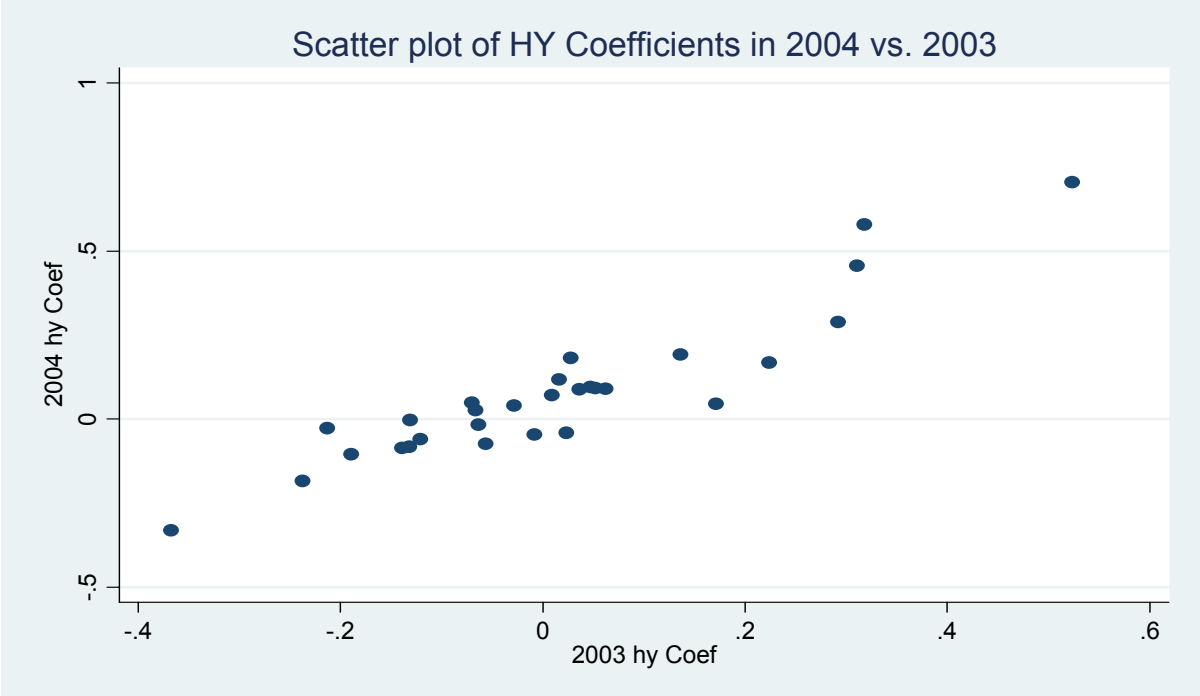
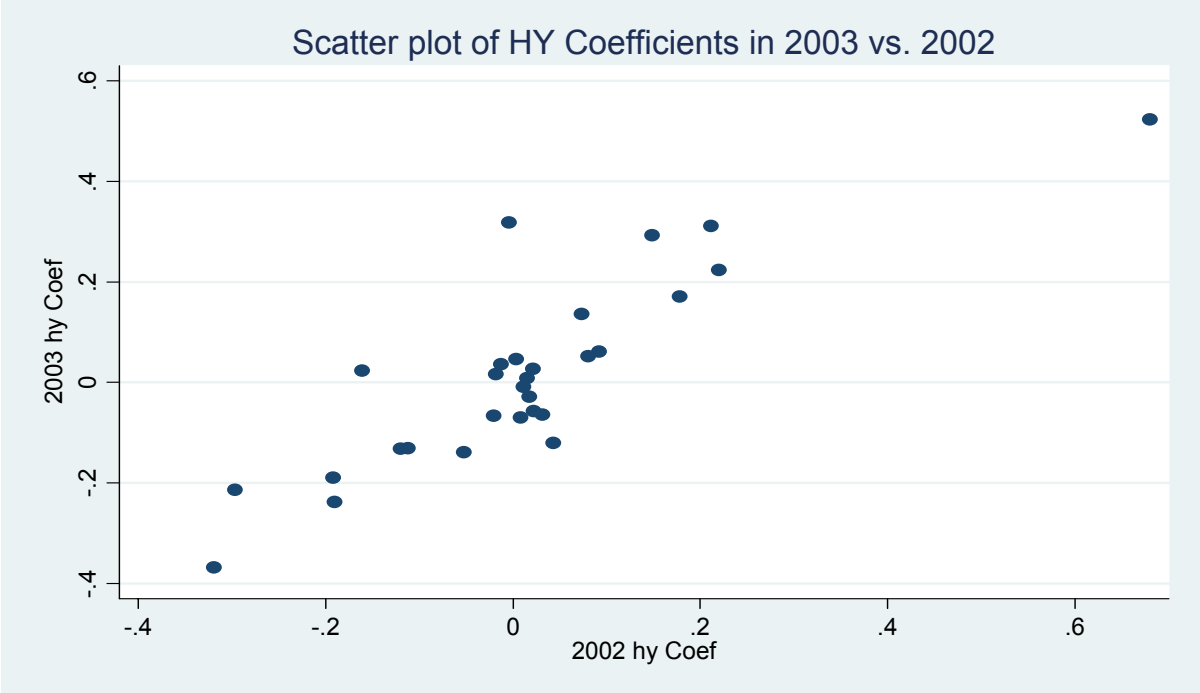


Figure 4. Sector Fixed Effects, 2003 vs. 2002



Appendix 1: City Fixed Effects from Regression of ln(VA/K)

(based on the last regression in table 3; in descending order of the size of the estimates in the last column)

Rank by Coefficient of 10 percent drop	city	Chinese name	ln(VA/K)		
			All Sample	Drop 5 percent on both ends	Drop 10 percent on both ends
1	leshan	乐山	-0.23	-0.23	-0.23
2	huanggang	黄冈	-0.27	-0.21	-0.23
3	xiaogan	孝感	-0.20	-0.28	-0.23
4	xining	西宁	-0.43	-0.33	-0.21
5	shenyang	沈阳	-0.27	-0.26	-0.18
6	tianjin	天津	-0.12	-0.20	-0.17
7	jiangmen	江门	-0.25	-0.26	-0.17
8	shantou	汕头	-0.32	-0.35	-0.16
9	yuncheng	运城	-0.09	-0.16	-0.15
10	jingmen	荆门	-0.33	-0.18	-0.15
11	guangzhou	广州	-0.15	-0.15	-0.15
12	cangzhou	沧州	-0.47	-0.33	-0.14
13	mianyang	绵阳	-0.02	-0.06	-0.14
14	shijiazhuang	石家庄	-0.02	-0.08	-0.12
15	xinxiang	新乡	-0.11	-0.13	-0.12
16	tianshui	天水	-0.27	-0.17	-0.11
17	sanming	三明	0.00	-0.08	-0.11
18	xian	西安	-0.15	-0.14	-0.11
19	jiujiang	九江	-0.08	-0.18	-0.11
20	benxi	本溪	-0.31	-0.26	-0.10
21	langfang	廊坊	-0.07	-0.13	-0.09
22	daqing	大庆	-0.01	-0.13	-0.09
23	yibin	宜宾	-0.15	-0.15	-0.09
24	wulumuqi	乌鲁木齐	-0.07	-0.16	-0.09
25	lanzhou	兰州	-0.22	-0.20	-0.09
26	datong	大同	-0.18	-0.15	-0.08
27	shangrao	上饶	-0.17	-0.20	-0.07
28	ganzhou	赣州	0.00	-0.04	-0.07
29	qinhuangdao	秦皇岛	-0.11	-0.03	-0.07
30	changchun	长春	-0.19	-0.15	-0.06
31	baoding	保定	-0.09	-0.08	-0.06
32	fushun	抚顺	0.00	-0.05	-0.06
33	weifang	潍坊	0.12	0.06	-0.06
34	yinchuan	银川	-0.13	-0.10	-0.05
35	haikou	海口	0.03	0.00	-0.05
36	jingzhou	荆州	-0.16	-0.12	-0.04
37	kunming	昆明	0.07	-0.01	-0.04
38	taiyuan	太原	-0.24	-0.18	-0.04

Appendix 1: City Fixed Effects from Regression of ln(VA/K) (cont.)

(based on the last regression in table 3; in descending order of the size of the estimates in the last column)

Rank by Coefficient of 10 percent drop	city	Ccity	ln(VA/K)		
			All Sample	Drop 5 percent on both ends	Drop 10 percent on both ends
39	hengyang	衡阳	0.05	-0.05	-0.04
40	qujing	曲靖	-0.09	-0.05	-0.04
41	dongguan	东莞	-0.01	-0.08	-0.03
42	zunyi	遵义	0.04	0.02	-0.03
43	yuxi	玉溪	-0.20	-0.17	-0.03
44	maoming	茂名	-0.15	-0.10	-0.02
45	wuhu	芜湖	0.11	0.10	-0.02
46	tangshan	唐山	0.07	0.06	-0.02
47	zhoukou	周口	0.14	0.04	-0.02
48	chuzhou	滁州	0.15	0.03	0.00
49	yancheng	盐城	-0.03	-0.05	0.00
50	xianyang	咸阳	-0.15	-0.11	0.00
51	chengdu	成都	-0.04	-0.08	0.00
52	xiangfan	襄樊	0.04	0.07	0.01
53	baotou	包头	0.08	0.05	0.02
54	liuzhou	柳州	-0.04	0.02	0.02
55	haerbing	哈尔滨	-0.26	-0.13	0.02
56	foshan	佛山	0.03	0.04	0.02
57	handan	邯郸	-0.09	-0.06	0.03
58	changde	常德	0.01	0.04	0.03
59	zhangzhou	漳州	-0.12	-0.06	0.03
60	fuzhou	福州	0.09	0.08	0.04
61	anqing	安庆	0.18	0.07	0.04
62	jilin	吉林	0.12	0.03	0.05
63	suzhou	苏州	0.22	0.09	0.05
64	changsha	长沙	0.15	0.10	0.05
65	dalian	大连	-0.03	0.03	0.06
66	yichang	宜昌	-0.02	-0.03	0.06
67	xiamen	厦门	0.31	0.17	0.07
68	huhehaote	呼和浩特	0.24	0.09	0.07
69	nanning	南宁	0.14	0.16	0.08
70	luoyang	洛阳	0.06	0.03	0.08
71	yueyang	岳阳	0.27	0.09	0.08
72	chongqing	重庆	0.08	0.08	0.08
73	nantong	南通	0.35	0.17	0.09
74	hefei	合肥	0.22	0.15	0.10
75	jining	济宁	0.31	0.22	0.10
76	qingdao	青岛	0.26	0.10	0.10
77	quanzhou	泉州	0.18	0.14	0.11
78	guilin	桂林	0.30	0.22	0.11
79	hangzhou	杭州	0.30	0.23	0.12

Appendix 1: City Fixed Effects from Regression of ln(VA/K) (cont.)

(based on the last regression in table 3; in descending order of the size of the estimates in the last column)

Rank by Coefficient of 10 percent drop	city	Ccity	ln(VA/K)		
			All Sample	Drop 5 percent on both ends	Drop 10 percent on both ends
80	lianyungang	连云港	0.23	0.15	0.13
81	jinzhou	锦州	0.27	0.10	0.13
82	huizhou	惠州	0.31	0.14	0.13
83	nanchang	南昌	0.40	0.19	0.14
84	shaoxing	绍兴	0.26	0.22	0.14
85	ningbo	宁波	0.30	0.19	0.15
86	jinhua	金华	0.29	0.25	0.15
87	baoji	宝鸡	-0.01	0.10	0.15
88	nanyang	南阳	0.26	0.25	0.15
89	deyang	德阳	0.23	0.23	0.15
90	zhengzhou	郑州	0.27	0.22	0.16
91	zhangjiakou	张家口	0.18	0.13	0.16
92	wuzhong	吴忠	0.06	0.10	0.16
93	wuhan	武汉	0.20	0.22	0.17
94	zhuzhou	株洲	0.27	0.24	0.17
95	zibo	淄博	0.20	0.16	0.17
96	xuchang	许昌	0.41	0.30	0.18
97	yantai	烟台	0.37	0.26	0.19
98	qiqihaer	齐齐哈尔	0.20	0.13	0.19
99	wuxi	无锡	0.29	0.24	0.20
100	guiyang	贵阳	0.06	0.12	0.20
101	xuzhou	徐州	0.31	0.28	0.20
102	yichun	宜春	0.31	0.25	0.20
103	binzhou	彬州	0.19	0.22	0.21
104	huzhou	湖州	0.40	0.29	0.21
105	jiaxing	嘉兴	0.15	0.26	0.21
106	beijing	北京	0.41	0.35	0.22
107	yangzhou	扬州	0.28	0.30	0.22
108	taizhou	台州	0.39	0.35	0.22
109	wenzhou	温州	0.37	0.28	0.23
110	taian	泰安	0.43	0.31	0.23
111	shanghai	上海	0.39	0.32	0.23
112	linyi	临沂	0.44	0.31	0.25
113	shenzhen	深圳	0.52	0.32	0.26
114	shangqiu	商丘	0.22	0.20	0.26
115	zhuhai	珠海	0.15	0.16	0.26
116	changzhou	常州	0.51	0.37	0.30
117	nanjing	南京	0.35	0.31	0.32
118	jinan	济南	0.29	0.33	0.33
119	weihai	威海	0.65	0.53	0.34

Appendix 2: City Fixed Effects from Regression of ln(VA/K)
(separate regressions for separate years)

Rank	city	Ccity	coef2002	coef2003	coef2004	coef_avg
1	huanggang	黄冈	-0.33*	-0.14	-0.22	-0.23
2	leshan	乐山	-0.32*	-0.14	-0.22	-0.23
3	xiaogan	孝感	-0.20	-0.21	-0.27*	-0.23
4	xining	西宁	-0.27*	-0.04	-0.33*	-0.21
5	shenyang	沈阳	-0.19	-0.15	-0.20	-0.18
6	tianjin	天津	-0.23*	-0.13	-0.16	-0.17
7	jiangmen	江门	-0.14	-0.13	-0.23	-0.17
8	shantou	汕头	-0.19	-0.07	-0.23	-0.16
9	yuncheng	运城	-0.10	0.00	-0.39*	-0.16
10	jingmen	荆门	-0.14	-0.09	-0.23	-0.15
11	guangzhou	广州	-0.23*	-0.02	-0.19	-0.15
12	cangzhou	沧州	-0.05	-0.10	-0.27*	-0.14
13	mianyang	绵阳	-0.13	-0.11	-0.17	-0.14
14	shijiazhuang	石家庄	-0.14	-0.06	-0.17	-0.12
15	xinxiang	新乡	-0.25*	-0.10	0.01	-0.12
16	tianshui	天水	-0.10	0.01	-0.26*	-0.12
17	sanming	三明	-0.17	0.00	-0.17	-0.11
18	jiujiang	九江	-0.17	-0.03	-0.13	-0.11
19	xian	西安	-0.13	0.00	-0.19	-0.11
20	benxi	本溪	-0.11	-0.07	-0.13	-0.10
21	langfang	廊坊	0.00	-0.04	-0.27*	-0.10
22	wulumuqi	乌鲁木齐	-0.04	-0.03	-0.21	-0.09
23	daqing	大庆	-0.07	-0.05	-0.17	-0.09
24	yibin	宜宾	-0.15	0.00	-0.14	-0.09
25	lanzhou	兰州	-0.18	0.05	-0.14	-0.09
26	datong	大同	-0.16	0.04	-0.13	-0.08
27	shangrao	上饶	-0.14	0.03	-0.11	-0.07
28	ganzhou	赣州	-0.04	0.00	-0.17	-0.07
29	qinhuangdao	秦皇岛	-0.11	0.01	-0.12	-0.07
30	changchun	长春	-0.02	0.04	-0.21	-0.06
31	baoding	保定	-0.03	-0.05	-0.10	-0.06
32	fushun	抚顺	-0.04	-0.03	-0.11	-0.06
33	weifang	潍坊	-0.10	0.05	-0.13	-0.06
34	haikou	海口	0.02	0.02	-0.19	-0.05
35	yinchuan	银川	-0.15	0.06	-0.06	-0.05
36	jingzhou	荆州	-0.13	0.04	-0.04	-0.05
37	kunming	昆明	-0.12	0.01	-0.02	-0.04
38	hengyang	衡阳	-0.08	-0.01	-0.04	-0.04
39	taiyuan	太原	0.04	0.00	-0.16	-0.04
40	qujing	曲靖	-0.05	0.05	-0.11	-0.04
41	dongguan	东莞	-0.09	0.01	-0.03	-0.04

Appendix 2: City Fixed Effects from Regression of ln(VA/K) (cont.)

(separate regressions for separate years)

Rank	city	Ccity	coef2002	coef2003	coef2004	coef_avg
42	zunyi	遵义	-0.09	0.07	-0.07	-0.03
43	yuxi	玉溪	0.00	0.07	-0.15	-0.03
44	maoming	茂名	-0.11	0.11	-0.08	-0.03
45	wuhu	芜湖	-0.11	0.12	-0.07	-0.02
46	zhoukou	周口	-0.05	0.15	-0.15	-0.02
47	tangshan	唐山	0.01	0.03	-0.09	-0.02
48	yancheng	盐城	0.04	0.04	-0.10	-0.01
49	chuzhou	滁州	-0.08	0.09	-0.03	-0.01
50	chengdu	成都	0.05	0.02	-0.07	0.00
51	xianyang	咸阳	-0.06	0.13	-0.08	0.00
52	xiangfan	襄樊	-0.05	0.12	-0.06	0.00
53	liuzhou	柳州	-0.10	0.12	0.03	0.01
54	baotou	包头	0.03	0.01	-0.01	0.01
55	haerbing	哈尔滨	-0.04	0.11	-0.01	0.02
56	foshan	佛山	0.00	0.08	-0.01	0.02
57	handan	邯郸	-0.04	0.04	0.08	0.03
58	changde	常德	0.00	0.08	0.01	0.03
59	zhangzhou	漳州	-0.02	0.13	-0.01	0.03
60	fuzhou	福州	0.02	0.10	-0.01	0.04
61	anqing	安庆	-0.01	0.15	-0.02	0.04
62	jilin	吉林	-0.02	0.16	-0.01	0.05
63	suzhou	苏州	-0.09	0.17	0.07	0.05
64	changsha	长沙	0.05	0.19	-0.08	0.05
65	dalian	大连	0.05	0.13	0.00	0.06
66	xiamen	厦门	0.09	0.02	0.08	0.06
67	yichang	宜昌	0.13	0.07	-0.01	0.06
68	huhehaote	呼和浩特	0.08	0.11	0.01	0.07
69	nanning	南宁	0.11	0.10	0.01	0.07
70	luoyang	洛阳	0.10	0.12	0.02	0.08
71	yueyang	岳阳	0.07	0.17	0.00	0.08
72	chongqing	重庆	0.01	0.18	0.06	0.08
73	nantong	南通	0.08	0.17	0.02	0.09
74	hefei	合肥	0.02	0.20	0.06	0.10
75	jining	济宁	0.14	0.18	-0.02	0.10
76	qingdao	青岛	-0.05	0.23	0.13	0.10
77	quanzhou	泉州	0.12	0.13	0.06	0.11
78	guilin	桂林	0.06	0.22	0.04	0.11
79	hangzhou	杭州	0.07	0.20	0.09	0.12
80	lianyungang	连云港	0.08	0.21	0.10	0.13
81	jinzhou	锦州	0.12	0.20	0.07	0.13
82	huizhou	惠州	0.13	0.19	0.08	0.13
83	shaoxing	绍兴	0.12	0.24*	0.06	0.14
84	nanchang	南昌	0.05	0.19	0.18	0.14
85	ningbo	宁波	0.18	0.27*	-0.02	0.14

Appendix 2: City Fixed Effects from Regression of ln(VA/K) (cont.)
(separate regressions for separate years)

Rank	city	Ccity	coef2002	coef2003	coef2004	coef_avg
86	jinhua	金华	0.06	0.21	0.17	0.14
87	nanyang	南阳	0.23	0.22	0.00	0.15
88	baoji	宝鸡	0.04	0.29*	0.11	0.15
89	deyang	德阳	0.10	0.22	0.14	0.15
90	zhengzhou	郑州	0.12	0.30*	0.05	0.16
91	zhangjiakou	张家口	0.07	0.27*	0.14	0.16
92	wuzhong	吴忠	0.09	0.29*	0.09	0.16
93	wuhan	武汉	0.17	0.27*	0.06	0.17
94	zhuzhou	株洲	0.15	0.24*	0.13	0.17
95	zibo	淄博	0.09	0.22	0.22	0.17
96	xuchang	许昌	0.14	0.27*	0.15	0.18
97	yantai	烟台	0.16	0.23	0.17	0.19
98	wuxi	无锡	0.17	0.31*	0.11	0.20
99	qiqihaer	齐齐哈尔	0.22	0.31*	0.06	0.20
100	guiyang	贵阳	0.18	0.30*	0.10	0.20
101	xuzhou	徐州	0.14	0.34*	0.12	0.20
102	yichun	宜春	0.11	0.34*	0.16	0.20
103	binzhou	彬州	0.12	0.30*	0.20	0.21
104	huzhou	湖州	0.09	0.34*	0.19	0.21
105	jiaxing	嘉兴	0.30*	0.27*	0.06	0.21
106	taizhou	台州	0.22	0.40*	0.02	0.21
107	beijing	北京	0.17	0.36*	0.12	0.22
108	yangzhou	扬州	0.23	0.31*	0.12	0.22
109	taian	泰安	0.30*	0.36*	0.00	0.22
110	wenzhou	温州	0.21	0.32*	0.15	0.23
111	shanghai	上海	0.20	0.31*	0.18	0.23
112	shenzhen	深圳	0.28*	0.38*	0.09	0.25
113	linyi	临沂	0.19	0.25*	0.31*	0.25
114	shangqiu	商丘	0.26*	0.33*	0.18	0.26
115	zhuhai	珠海	0.24*	0.30*	0.25*	0.26
116	changzhou	常州	0.31*	0.38*	0.20	0.30
117	nanjing	南京	0.26*	0.40*	0.28*	0.32
118	jinan	济南	0.43*	0.31*	0.23	0.32
119	weihai	威海	0.31*	0.45*	0.26*	0.34
120	anshan	鞍山	.	.	.	.

Notes: * denotes significant at the 10 percent level; Benchmark city = Anshan