"Subsidy" or "Tax"?
Corporate Credit Misallocation Induced by the Nexus of State-Owned Enterprises and State-Owned Banks

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Different from the common claims in the literature, this paper showed that "two-way" credit misallocation is linked with state ownership status: Not all state-owned firms benefit from their ownership status by obtaining lower interest costs as a form of subsidy. Some are subjected to higher interest costs as a form of tax. We documented further evidence on the relationship between financial development and economic growth by accounting for heterogeneity in inter-state banking coverage. Using listed and unlisted firms' data, we found that when the presence of state-owned banks is strong, state ownership-associated distortions in interest costs would be more severe.

Keywords: Credit Misallocation, State-Owned Banks, State-Owned Enterprises, Productivity Gains

JEL: D23, G21, O16

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I. Introduction

In the past three decades, China has undergone an economic growth miracle as it reached an average growth rate of around 10 percent which, in turn, serves as the engine to lift millions of people out of poverty and approach prosperity. However, the slowing down of China's economic growth since 2012[1] widely triggered the concern on economic stagnation and re-ignited worries that China might fall to the Middle-Income Trap. The hopes to avoid slowdown and boost productivity mainly rest on innovation. In this paper, on the contrary, we will go back to the traditional growth factor—that is, capital—and examine whether improving resource allocation, by correcting credit misallocation associated with ownership status, and strengthening financial development by encouraging the entry of private banks, could help achieve innovation-equivalent growth.

The credit misallocation in China is signaled by the rapid buildup of corporate debt. Most of the build-up in corporate debt is observed among the less profitable state-owned enterprises (SOEs) rather than non-state-owned enterprises (non-SOEs). Using listed firms' data, IMF (2016) showed that from 2006 to 2015, the median liability-to-common equity ratio of non-SOEs fell to 55 percent while that of SOEs remained unchanged at 110 percent.

Government-backed SOEs can also enjoy a boost in credit ratings directly per The Economist (2016), which estimates that, in the onshore Chinese bond market, the rating upgrade attributed to the status of SOEs can help reduce the annual interest rate from 10 to 5 percent. The upgrading done by rating agencies provides implicit evidence on the favorable credit terms granted to SOEs.

To decipher the credit misallocation, we first re-examine the common perception of favorable credit terms given to SOEs in China. Different from previous studies in the literature, in addition to the favorable and cheaper credits

[1] A decrease from 9.5 percent in 2011 to 7.9 percent in 2012 (World Bank).

granted to SOEs, we further check whether there are unfavorable credit terms charged to SOEs. Moreover, we investigate the impact of financial development as measured by the coverage of state-owned banks (SOBs) on the degree of credit misallocation. We assess the potential efficiency gains that can be achieved by correcting the misallocation in credit using firm-level data and the monopolistic competition model proposed by Hsieh and Klenow (2009), where we incorporate the status- and financial development-dependent interest rate. Finally, we simulate the potential productivity gains in terms of GDP growth by correcting the status-associated credit misallocation and by improving private banking coverage.

We contribute to the existing literature in four aspects. First, to our best knowledge, this study is the first attempt to document "unfavorable" credit terms to SOEs in the form of higher interest rate charged to SOEs belonging to highly profitable, monopolistic sectors, since previous research concentrates only on the favorable credit terms received by SOEs. Second, we are among the first group who used firm-level data from ORBIS to analyze misallocation in Asian countries. Gopinath et al. (2017) used the data from Orbis for selected European countries, with focus on Spain, to show that capital tended to be allocated to large firms when Spain experienced a decline in real interest rate from the euro convergence. To bring the important agents of the government that execute the tax and subsidy scheme, the SOBs, in the analysis and thus to quantitatively document the contribution of financial development, we use the number of bank branches in each province from the SNL Financial dataset. Our measurement of financial development allows us to suggest a reform approach, which is encouraging the establishment of private banks to mitigate credit distortions. The role of private banks in this aspect so far has limited scope in the literature. Third, past evidence on the impact of financial development on economic growth are based on cross-country analysis (e.g., Rajan and Zingales 1998; Buera, Kaboski, and Shin 2011; Midrigan and Xu 2014). Our study is the first to quantitatively assess such

relationship using data within a country by introducing inter-state heterogeneity in financial development—that is, banking coverage by ownership status. The potential productivity loss for China due to the credit misallocation from ownership status and level of financial development with distributional analysis across provinces and sectors are thus calculated. Finally, we re-examine the modeling framework developed by Hsieh and Klenow (2009) and amended their understanding of the framework by showing that changes in the level and reduction in the variation of the cost of capital can both bring efficiency gains. This is different from their initial understanding wherein the only source of efficiency gain comes from reduction in the variation.

The paper is organized as follows. Section 2 summarizes the related literature on credit distortion, political ties enjoyed by SOEs, and financial development. Section 3 lays out the stylized facts on credit misallocation with buildup of debt by period, ownership status, sector, and SOB presence. Section 4 sets up the theoretical model, calibrates the model using firm-level data, and assesses the potential productivity gains by correcting the distortions. Section 5 shows the robustness checks done, including changing the observed period and firms and changing the threshold for the state-owned bank coverage variable in the regression model. Section 6 gives conditional policy recommendations for SOE reform and financial development based on the potential gain rankings of provinces and sectors. Section 7 concludes the paper.

II. Literature Review

Our analysis focuses on the non-linear relationship between capital misallocation and economic development, which is in line with the literature on misallocation, financial development, and economic growth. Early works go back to Rajan and Zingales (1998). Using cross-country data, Rajan and Zingales (1998)

argued that financial development can reduce the cost of external finance by showing that industrial sectors relying more on external finance experience faster growth in countries with more developed financial markets. More recent research includes Buera, Kaboski, and Shin (2011), which also used cross-country data and claimed that financial frictions associated with low financial development can cause low aggregate and sectoral productivity, through the channels of both capital constraints and firm entry and exits. Using plant-level data in South Korea, Midrigan and Xu (2014) made similar arguments on the relationship between financial development and productivity and attributed the channels to firm entry, adoption of new technology, and dispersion of firm returns by comparing the differences between the periods before and after a crisis. Our analysis enhances the current understanding of credit misallocation by providing evidence based on inter-state heterogeneity of financial development, particularly SOB coverage, and credit misallocation within a single country.

Credit distortion in China is largely attributed to biased lending due to the ownership status of SOEs. One commonly cited reason behind the biased lending is the implicit government guarantee on corporate debt of SOEs (Lu, Thangavelu, and Hu 2005), which raises their credit rating and lowers their cost of debt. Shailer and Wang (2015) found that government ownership plays a significant role in reducing a firm's cost of debt as they showed that government-controlled corporations pay lower interest rates than privately-controlled corporations by 12.3 percent. IMF (2016) estimated that the preferential access to finance and implicit government guarantees raised credit ratings of SOEs by up to two to three notches, which appeared to cut borrowing costs by ½-1 percentage point. SOEs and even private firms that have the state as the minority owner enjoy preferential access to bank loans (Firth et al. 2009; Lu et al. 2005). Also, high-risk SOEs pay lower interest rates (Shailer and Wang 2015) and get more bank loans (Lu, Thangavelu, and Hu 2005), which implies that the government extends soft

budget constraints in the form of favorable loan terms to assist distressed SOEs. With better access to bank credit and being subject to soft budget constraints, firms with large state ownership, even the distressed ones, tend to hold less cash and have lower marginal value for cash (Megginson, Ullah, and Wei 2014). On the other hand, non-SOEs resort to other channels, like trade credit, as alternative sources of financing amid limited access to bank lending (Ge and Qiu 2007).

The dominance of SOBs in China's banking sector could also have contributed to the bias for SOEs, perpetuating credit misallocation and generating further inefficiencies in the Chinese economy. In the theoretical literature, the political view emphasizes the negative effect of government ownership of banks on the efficiency and effectiveness of the banking sector. To give empirical evidence on this perspective, La Porta, Lopez-De-Silanes, and Shleifer (2002) used cross-country data and showed that government ownership of banks has a negative effect on productivity and growth, concluding that government ownership of banks politicizes the allocation of resources. Similarly, Xiao and Zhao (2012) found that banking sector development has a negative effect on firm innovation in countries where there is higher government ownership of banks. In China, financial distortions due to state interventionism in finance bring a negative effect on GDP and TFP growth, as well as on capital accumulation (Guariglia and Poncet 2008). Similarly, state ownership of firms does not affect the borrowing costs in Chinese provinces with better institutional development (Shailer and Wang 2015). Thus, promoting financial development in the banking sector by reducing the role of the government could improve efficiency.

III. Data and Stylized Facts

A. Data

The study uses three sources of data: Orbis, WIND, and SNL Financial. The Orbis database is a financial database which contains listed and unlisted company information on firms from several countries on a time-series basis. The WIND database gives financial information of Chinese listed firms on stocks, bonds, funds, derivatives, and indices, as well as macroeconomic data. SNL Financial reports news updates on and data of financial institutions, including geographical information of its branches, institutional ownership, and financial statements.

One advantage of the Orbis data for our analysis is that it includes data for unlisted firms, which are not well studied in the literature because of limitations in reliable data. For example, Lu, Thangavelu, and Hu (2005), Shailer and Wang (2015), and Megginson, Ullah, and Wei (2014) used datasets that concentrated on listed firms only. Firth et al. (2009) used an enterprise survey to cover not only listed firms, but their study is limited to private firms in the manufacturing and services sector. Ge and Qiu (2007) stated that the enterprise surveys conducted by the Chinese Academy of Social Sciences, which they used in their study, have been widely used in the Chinese economy literature, but their analysis focused on selected industrial sectors. Another advantage of Orbis is that it reports financial data in standardized format and categorizes firms into broad sectors. This is important in our study, as we need comparable US data for estimating the elasticity parameter. Hsieh and Klenow (2009) used US as a benchmark in estimating labor shares per industry because they presume that the US is relatively undistorted compared to China and India. Many studies, including Hsieh and Klenow (2009) and even the more recent ones like David and Venkateswaran (2017) and Whited and Zhao (2017), use the enterprises survey data for the

analysis of China and the publicly traded firm data from COMPUSTAT for the US firms. Using different data sources makes the benchmarking process across countries complicated. The Orbis data, on the other hand, give us an advantage of doing straightforward benchmarking.

We use the US data to produce baseline values for sector-specific labor shares. Labor share is the share of total cost of employees to total value-added by sector. Orbis, however, has limited data on cost of employees and value-added at the firm level. To remedy this, we make use of the good coverage of data on the number of employees. We get the mean cost per employee of firms with available data in each sector, so that there is a common wage per sector. Then, we multiply this to the number of employees of the firm in the respective sector to get the total cost of employees in each firm. Value-added is estimated as the sum of cost of employees and operating revenue.[2] The elasticity of output with respect to capital per sector is simply one minus labor share.

In the simulation of efficiency gains for the sample of Chinese firms, we get the following variables from Orbis: fixed assets, average cost of employee, number of employees, and operating revenue. Fixed assets, which is net of depreciation, measures capital stock. Total cost of employees measures the labor input of a firm. Value-added is used as weights in aggregating firm and sectoral values and as means to estimate output. We follow the same method applied in the US firm data in calculating the cost of employees and value-added.

Aside from the simulation exercises, Orbis data is used to estimate firm interest rate in the absence of data on explicit interest rate imposed on firms by banks. We would have preferred to use interest paid, but only a small number of unlisted firms report interest paid. An alternative is to use financial expenses in the numerator (Shailer and Wang 2015), so we calculate firm interest rate as the ratio

[2] With Orbis data, it would be preferable to use earnings before interest, taxes, depreciation, and amortization (EBITDA) to estimate value-added. Because of limited data for EBITDA, we use operating revenue as a proxy.

of financial expenses to the sum of current liabilities and long-term debt. We also use the Orbis data to classify firms according to ownership status. If the government's and other SOEs' share to the firm's total shares is 25.01 percent or more, then the firm is classified as an SOE; otherwise, it is classified as a non-SOE. Other studies applied a stricter definition of SOEs, like in Lu, Thangavelu, and Hu (2005) where the fraction of state-owned shares to total shares is greater than 50 percent and in Shailer and Wang (2015) where the government is the ultimate controlling shareholder. However, applying a looser definition of SOEs has also been used in other studies like Fan and Kalemli-Ozcan (2016) who also used Orbis data.

WIND covers Chinese listed firms only, but it provides better coverage for time series data than Orbis. For instance, Shailer and Wang (2015) also used WIND, along with the China Stock Market and Accounting Research data, to analyze the role of government ownership on the cost of borrowing. We mainly use this database in constructing a panel data of listed firms from 2000 to 2016 to run the regression on the determinants of interest rates for bank loans. Financial data extracted from WIND include interest expense, short-term and long-term loans, total assets, earnings before interest and taxes (EBIT), total revenue, and inception year. Like Orbis, WIND does not provide data on the actual interest rate imposed on firms for their bank loans. However, unlike Orbis, WIND contains better coverage on interest expense, which is reported as one of the components of financial expense. Implicit interest rate is expressed as the ratio of interest expense to the sum of short- and long-term loans. Debt ratio, which is a measure of how much of total loans is financed by assets, is calculated by dividing the sum of short- and long-term loans by total assets. Profit ratio is expressed as the ratio of EBIT to total assets. Change in total revenue—the difference between log revenue at time t and log revenue at time $t-1$—is used as an indicator of a growing

firm, which is likely to have lower default risk. The age of a firm is calculated by subtracting the inception year from the year of observation.

Data on fixed assets, salary, staff headcount, and operating revenue are also obtained from WIND for the simulation exercise on SOE reforms from 2012 to 2016. The period of observation starts only in 2012 because this is when the better coverage of salary data started. There are no firms, which reported salary data before 2011, less than 200 firms reported salary data in 2011, and the number of firms jumped to more than 2,000 in 2012. To be consistent with the calculations based on Orbis data, we follow the same procedure in estimating the cost of employees; that is, get the mean cost per employee by sector and multiply it with staff headcount. Same method is done to estimate value-added.

The SNL Financial database gives information on the location of a bank's main office and branches, which can be utilized to determine the coverage of state-owned banks in Chinese provinces. We apply the same rule in classifying SOEs and non-SOEs to categorize banks by ownership status. Banks with at least 25.01 percent shares owned by the Chinese government and SOEs are classified as state-owned banks; otherwise, they are considered as private banks.[3] State-owned bank coverage refers to the share of state-owned banks to total banks in each province. We use state-owned bank coverage as a way to classify provinces with high and low SOB presence. Provinces whose state-owned bank coverage is equal to or more than 95 percent is described as having high SOB presence, while those with coverage of less than 95 percent is described as having low SOB presence.[4]

We match the three sources of data to have a consistent definition of sectors, classification of SOEs and non-SOEs, and state-owned bank coverage. The final

[3] Possible alternatives to measure SOB coverage are the commonly used financial indicators. For example, Guariglia and Poncet (2008) used provincial level data on the share of state-owned commercial banks in total credit, ratio of state-owned commercial banks' credit to GDP, and ratio of loans to deposits of state-owned commercial banks as the three indicators of state interventionism in the financial sector.

[4] The high threshold level reflects the dominance of state-owned banks in China's banking sector. The median provincial share of SOBs is around 96 percent.

sample using Orbis data consists of 203,662 firm-years from 2007 to 2016. There are 10,241 firms in 2013 for the main simulation exercise. The final sample using WIND data consists of 15,131 firm-years from 2000 to 2016. Refer to Online Appendix Table A.1 for the summary of variables used in the study and their definition.

B. Lower Capital Cost Charged to SOEs Re-examined

SOEs have long been claimed to be favored by banks, because they are perceived to be receiving more loans at a lower interest rate through their connections with the government. We re-examine this claim by using the data of listed firms from WIND. We plot average interest rates of SOEs and non-SOEs in each sector for the years 2004, 2008, 2012, and 2016 in Figure 1. Several points can be observed in Figure 1. First, the average interest rates for both SOEs and non-SOEs are the lowest in 2004, which increased in 2008 and 2012 but declined in 2016. Second, there are more dots above the 45-degree line in 2004, showing that the gap between the interest rate charged to SOEs and non-SOEs wherein the latter receive higher rates is more severe in 2004 than in later years. Finally, there are more sectors in which SOEs are charged at a higher interest rate than their non-SOE counterparts in more recent years (more dots below the line). Therefore, contrary to previous claims, SOEs do not universally enjoy a lower interest rate when we differentiate interest rate by sector, especially in more recent years.

[Insert Figure 1 Here.]

C. Association between State-Owned Bank Coverage and Distortions

Furthering the analysis, we examine whether financial development affects the degree of distortions. We use the coverage of SOBs as an indicator of the level of financial development of a province. In addition to the longer time series of listed

firm data from WIND, we include Orbis data in the calculations to incorporate unlisted firms in the analysis. To have comparable time coverage between the two datasets, we set the period of observation from 2007 to 2015.

[Insert Table 1 Here.]

As shown in Table 1, when all listed and unlisted firms are pooled, as indicated by the column for the Orbis data, the correlation between firm interest rate and the provincial share of SOBs is significantly positive at 0.07. That is, in provinces with higher SOB coverage, firms tend to be charged at higher interest rates. Differentiating SOEs and non-SOEs, we found that non-SOEs show a higher correlation coefficient (0.07) than SOEs (0.04) and the difference between the two groups is significant. This suggests that, on the average, SOEs are given more favorable interest rates in provinces with higher state-owned bank coverage. Differentiating listed and unlisted firms, we found that unlisted firms have a higher correlation coefficient (0.07) than the listed firms (0.03) and the difference is also significant. This implies that unlisted firms are more likely to be imposed with higher interest rates in provinces with higher SOB coverage. Differentiating ownership and listing status simultaneously, we saw that unlisted non-SOEs are the group that has the highest correlation coefficient. Hence, with increasing state-owned bank presence, it seems that it is the unlisted firms which face the largest distortions.

We also calculate the correlation coefficients for all firms and by ownership status using the WIND data. When all firms are included, the coefficient is 0.04, which is lower than the one using Orbis data. The smaller correlation coefficient when the WIND data is used indicates that unlisted firms experience larger distortions than listed firms, which is consistent with the results discussed above. Contrary to the results using Orbis data, the correlation coefficient between state ownership and provincial SOBs presence is 0.06, which is higher than its

counterpart using Orbis data (0.04 for listed SOEs). However, the difference between SOEs and non-SOEs is not significant.

D. Heterogeneous Interest Rates across Sectors and SOB Presence

We further investigate the relationship between financial development and interest rate to examine the variation across sectors. We calculate the correlation between firm interest rate and provincial SOB presence in each sector using Orbis and WIND data. As shown in Table 2, the correlation coefficients show large divergence between sectors in both data sources. Sectors such as chemicals, machinery, metals, publishing, textiles, and wood have significantly positive correlation coefficients, while sectors such as primary and transport have significantly negative coefficients using Orbis data. That is, the high SOB presence works in opposing directions for these two categories of sectors. Sectors with significantly negative correlation coefficients enjoy lower interest rate when the presence of SOBs is larger, which indicates that they are more likely the strategic sectors that the government supports by encouraging SOBs to provide them cheap credit. Sectors with significantly positive correlation coefficients are the firms that tend to be charged at higher interest rate when the presence of SOBs is strong.

The signs of the correlation coefficients revealed by WIND are consistent with that of Orbis with differences on statistical significance, except for the transport sector. The relationship for the transport sector using Orbis is negative and the one using WIND is positive, which implies that the listed firms in the transport sector are charged at a higher interest rate in provinces with stronger SOB presence. This may also suggest that compared to unlisted firms, the listed firms in the transport sector are more likely to be "taxed" by the SOBs.

[Insert Table 2 Here.]

All the points documented in the above sections show the presence of heterogeneity in credit distortions across sectors, ownership, and degree of financial development. So far, however, all the heterogeneities presented are unconditional, as the determinants of credit are not controlled for. In the following section, we use a regression model to systematically examine the heterogeneity and its causes.

IV. Credit Misallocation

A. "Two-way" Misallocation and the Role of SOBs

In this study, we focus on the "two-way" misallocation. As we found from the previous section, when the presence of SOBs is strong, the treatment of SOEs go in two ways. For a special group of firms, they may be charged at a higher interest rate as a form of "tax" in exchange of market monopoly power granted by the government. That is, in addition to paying the conventional income tax, such firms also pay a higher interest rate as a complementary form of tax to the government's bank arm, the SOBs. We hypothesize that the SOBs become the agents of the government to either favor or tax firms through the interest rate. With the state as the owners sitting in the board, the SOBs take the role of helping the government charge a lower interest rate to the firms in sectors labeled as the " strategic industries", while charging a higher interest rate to the firms in sectors labeled as the "monopoly industry".

In the provinces with low SOB presence, the political ties of the SOEs with the government are more credit worthy in the perspective of private banks. Therefore, private banks are more likely to willingly grant loan to SOEs at a lower rate, compared to non-SOEs, holding all other things constant. However, even if the biased treatment in favor of SOEs in strategic sectors through lower interest rates

appears similar in provinces with high and low SOB presence, the incentives behind the bias are different. In provinces with low SOB presence, the imposition of lower interest rates is provided voluntarily by the privately-owned banks for the unobservable government guarantee backing the SOEs, while in provinces with high SOB presence, it is provided directly by the SOBs to support the strategic industries.

We translate the claims made above into testable hypothesis by applying the following regression equation:

$$r_{it} = X_{it}B_1 + \beta_{2Sec}D_{iSOE} * D_{iSOB} * D_{iSec} + \beta_3 D_{iSOE} + \varepsilon_{it}, \quad (1)$$

where r_{it} is interest rate of firm i at time t. The vector X_{it} contains the control variables that determine interest rate, including debt-to-assets ratio, profit-to-assets ratio, log of total assets, revenue growth, and firm's age. These variables are commonly used in the literature in analyzing interest rate or the cost of borrowing (literature referred for the variables can be found in Online Appendix Table A.2). ε_{it} is the i.i.d. error term, and

$D_{iSOE} = 1$, if firm i is an SOE, otherwise $D_{iSOE} = 0$;

$D_{iSOB} = 1$, if firm i is located in a province with high SOB presence, otherwise $D_{iSOB} = 0$;

$D_{iSec} = 1$, if firm i belongs in sector Sec, otherwise $D_{iSec} = 0$.

For each sector, the coefficient β_{2Sec} will be estimated for firms whose three dummy variables—D_{iSOE}, D_{iSOB}, and D_{iSec}—are all equal to one. It measures the impact of state-owned status and high SOB presence on the average interest costs of firms in that sector. Furthermore, the coefficient β_3 measures the impact of state-owned status on firms located in provinces with low SOB presence without differentiating sectors. The impact of being located in a province with high SOB

presence for an SOE is captured by $\beta_{2Sec} + \beta_3$. The non-SOEs serve as the base group and are included in the intercept term.

We expect $\beta_{2Sec} < 0$ if sector *Sec* belongs to a strategic sector which receives subsidies and $\beta_{2Sec} > 0$ if sector *Sec* belongs to a monopoly sector which faces higher interest rate as a form of tax. We expect $\beta_3 < 0$; that is, SOEs located in provinces with low SOB presence are voluntarily granted higher creditability by private banks.

In Table 3, we summarized the estimation results of regression equation (1). We estimated equation (1) by altering the inclusion and exclusion of control variables and year dummies, as well as using the usual, un-clustered, and clustered standard errors.

[Insert Table 3 Here.]

As shown in Table 3, the specifications that include the control variables and year dummies have higher R-squared compared to the specifications without control variables. For the specifications with control variables and year dummies included, all three versions with different standard errors yield the same results in terms of the significance of coefficients. Therefore, we will use the results listed from columns (4) to (6) to form our conclusion. We found that, first, the chemicals, metals, and primary sectors are the sectors with significantly positive estimated β_{2Sec}, which implies that these sectors enjoy market monopoly power granted by the government and the government shares the benefit of the monopoly by charging a higher interest rate through SOBs in provinces with high SOB presence. Second, the sectors of construction and machinery are the strategic industries, which enjoy lower interest rate as a form of support from the government through SOBs in provinces with high SOB presence. Third, as expected the estimated coefficient β_3 is significantly negative, an evidence that

SOEs located in provinces with low SOB presence borrow at lower interest rates due to the higher creditability granted by private banks.

Building on the solid empirical evidence on the two-direction distortions, we further assess the potential efficiency gain that can be achieved by correcting such distortion under a monopoly competition model.

B. Measuring Credit Misallocation

Our theoretical framework to assess the productivity gains largely follows the set-up of Hsieh and Klenow's (2009) model, where the economy consists of firms within a setting of monopolistic competition. Heterogeneity across firms is characterized by differences in productivity and firm-specific distortions, wherein these distortions cause wedges between the marginal products of capital and labor across firms within a sector. The wedge between the two marginal products signals misallocation between labor and capital and thus reduces aggregate Total Factor Productivity (TFP). We deviate from their model by including non-manufacturing firms in the sample and differentiating capital distortion by ownership status (i.e., SOEs vs non-SOEs) and provincial coverage of state-owned banks (i.e., high versus low presence).

Like Hsieh and Klenow (2009), we assume that there is a single final good Y that is produced by a representative firm under a perfectly competitive final output market. This representative firm combines all the output Y_s of S sectors using a Cobb-Douglas production technology:

$$Y = \prod_{s=1}^{S} Y_s^{\theta_s} \text{ where } \sum_{s=1}^{S} \theta_s = 1. \tag{2}$$

Cost minimization gives:

$$P_s Y_s = \theta_s PY \tag{3}$$

where P_s refers to the price of sector output Y_s, and P refers to the price of the final good. Setting the final good as the numeraire, P is equal to 1. The industry output uses a CES production function to combine M_s differentiated products and each firm produce a different product:

$$Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{4}$$

where σ is the elasticity of substitution between plant value-added. We assume that the production function of firm i in sector s takes a Cobb-Douglas function consisting of TFP (A), capital (K), and labor (L):

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s} \tag{5}$$

where α_s is the elasticity of output with respect to capital, which is assumed to be the same across firms within a sector.

In this framework, two types of distortions can be associated with the two inputs in the production function. One is output distortions τ_Y referring to the distortions that increase the marginal products of capital and labor by the same proportion, which can be caused by restrictions on size, transportation costs, and government subsidies on output. The other is capital distortions τ_K referring to the distortions that increase the marginal product of capital relative to the marginal product of labor. For example, τ_K would be high for firms that have poor access to credit.

Hence, profits per firm are given by:

$$\pi_{si} = (1 - \tau_{Ysi}) P_{si} Y_{si} - w L_{si} - (1 + \tau_{Ksi}) R K_{si}, \tag{6}$$

where w indicates the wage rate and R indicates the rental price of capital.

Profit maximization satisfies the condition that the firm's output price is a fixed markup over its marginal cost:

$$P_{si} = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\left[\frac{(1+\tau_{Ksi})^{\alpha_s}}{A_{si}(1-\tau_{Ysi})}\right] \tag{7}$$

The first-order conditions for profit maximization also yield capital distortion at the firm level as:

$$\tau_{Ksi} = \left(\frac{\alpha_s}{1-\alpha_s}\right)\left(\frac{wL_{si}}{RK_{si}}\right) - 1 \tag{8}$$

The credit-related distortion τ_{Ksi} enters the corresponding revenue productivity (TFPR) formula through the marginal products of capital (*MRPK*).[5] The resulted aggregated productivity TFP, which we used for the efficiency gain simulations in the following sections, is expressed as:

$$TFP = \prod_{s=1}^{S} TFP_s^{\theta_s} = \prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_s}{TFPR_{si}}\right)^{\sigma-1}\right]^{\frac{\theta_s}{\sigma-1}}, \tag{9}$$

where:

$$TFPR_{si} \triangleq P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\left[\frac{(1+\tau_{Ksi})^{\alpha_s}}{1-\tau_{Ysi}}\right],$$

and

$$\overline{TFPR}_s = \left(\frac{\sigma}{\sigma-1}\right)\left[\frac{R}{\alpha_s\sum_{i=1}^{M_s}\left(\frac{1-\tau_{Ysi}}{1+\tau_{Ksi}}\right)\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right]^{\alpha_s}\left[\frac{w}{(1-\alpha_s)\sum_{i=1}^{M_s}(1-\tau_{Ysi})\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right]^{1-\alpha_s}.$$

[5] Detailed deductions from equations (8) to (9) can be found in Online Appendix 1.

In our analysis, TFPR does not vary across firms within a sector in the absence of distortions. Without distortions, more inputs should be allocated to firms with higher physical productivity until their higher output results in lower price. Hsieh and Klenow (2009) attributed the efficiency gains induced by the reduction in capital distortions solely to the reduction in the variation in TFPR by equalizing the cost of capital across firms within an industry. However, in our analysis, we found that the mathematical attributes of the formula in equation (9) could also incorporate the improvement in productivity by moving the cost of capital closer to its market efficient level. That is, there are two types of efficiency gain that can be achieved by correcting distortions: one is the first-order impact from aligning the cost of capital to the market efficient level and the other is the second-order impact from reducing the variation in the cost of capital. We will discuss these two impacts in the efficiency gain simulations.

Building on the above-proposed framework, we introduce the nexus of SOEs and SOBs as a source of misallocation. The possible sources that can generate firm-level capital distortions discussed in the previous literature include the following. Credit misallocation across firms could happen if a non-competitive banking system would favor certain firms by giving them lower interest rates based on non-economic considerations. The absence of credit history or insufficient guarantees would make credit inaccessible even to highly productive firms, which limits the expansion of their production (Dias, Robalo Marques, and Richmond 2016). In the case of China, the bias of banks to lend to SOEs at lower interest rates stems from implicit government guarantees to debt and obligation of state-owned banks to save poorly performing SOEs due to soft budget constraints.

In this study, we are particularly interested in the distortions that result from differences in the cost of capital—i.e., interest rate on debt—across ownership status and provincial SOB presence. Different from previous studies in the literature, instead of claiming that a universal favor is given to SOEs by lowering

their interest rate, we introduce the heterogeneity of bias towards SOEs by differentiating the degree of presence of SOBs and exerting more effort in revealing the underlying incentives.

As such, we decompose the capital distortion τ_{Ksi} into two components: one is status-associated distortion τ_{Ks}^{Status} and the other is an idiosyncratic distortion τ_{Ksi}^{id} as defined below:

$$\tau_{Ksi} = \tau_{Ks}^{Status} + \tau_{Ksi}^{id} \tag{10}$$

Consistent with the definition in equation (1), the distortion depends on both the ownership of firms and the presence of SOBs. The firms are classified into four groups: (A) SOEs located in provinces with low SOB presence, (B) non-SOEs located in provinces with low SOB presence, (C) SOEs located in provinces with high SOB presence, and (D) non-SOEs located in provinces with high SOB presence. That is,

$$\tau_{Ks}^{Status} = D_{s,gl}\tau_{Ks,gl} + D_{s,nl}\tau_{Ks,nl} + D_{s,gh}\tau_{Ks,gh} + D_{s,nh}\tau_{Ks,nh}, \tag{11}$$

where *g* refers to SOE, *n* refers to non-SOE, *l* refers to low SOB presence, *h* refers to high SOB presence, and:

$D_{s,gl} = 1$ if firm *i* in sector *s* is an SOE in a province with low SOB presence and 0 if otherwise (Group A);

$D_{s,nl} = 1$ if firm *i* in sector *s* is a non-SOE in a province with low SOB presence and 0 if otherwise (Group B);

$D_{s,gh}$=1 if firm *i* in sector *s* is an SOE in a province with high SOB presence and 0 if otherwise (Group C);

$D_{s,nh} = 1$ if firm *i* in sector *s* is a non-SOE in a province with high SOB presence and 0 if otherwise (Group D).

In Hsieh and Klenow (2009)'s analysis, they simulate an "ideal" scenario by using the sector average TFPR as the benchmark to simulate the distortion without differentiating the sources, which remove all the variations associated with τ_{Ksi} and τ_{Ysi}. We provide an alternative explanation on the sector average $\bar{\tau}_{Ksi}$, which should not be understood as a "distortion" itself. Rather it is assumed as the "market efficient equilibrium" interest rate in China. Two potential sources may generate the discrepancy between the market efficient equilibrium interest rate in China and in the US. One is the risk premium to compensate for the higher risk in China than in the US. The other is the higher cost of capital in China relative to that of the US because of lower capital intensity. Any deviation of an individual firm from the sector average $\bar{\tau}_{Ksi}$ should then be regarded as " inefficiency" in the ideal scenario.

Contrary to existing literature, we assume a less ideal and more realistic scenario: we can only correct the status-associated distortion τ_{Ks}^{Status} but not the idiosyncratic distortion as illustrated in equation (10). Furthermore, we use the average interest rates of non-SOEs located in provinces with low SOB presence as the "market efficient" interest rate to do the baseline simulation because we believe such interest rates are closer to the market efficiency concept compared to the simple sector average.

We aim to estimate efficiency gains derived from "correcting" the distortion in the cost of capital associated with ownership and financial development faced by firms to the "market efficient" interest rate. The next section discusses the calibration of parameters to estimate efficiency gains.

C. Credit Misallocation Associated with Ownership and Financial Development: Calibration of Parameters

Like Hsieh and Klenow (2009), we set the rental cost of capital R in the absence of distortions to 10 percent, which is equivalent to 5 percent real interest rate and 5 percent depreciation rate. Therefore, if $\tau_{Ksi} \neq 1$, the actual cost of capital faced by the firm is $(1 + \tau_{Ksi})R$. We also set the elasticity of substitution between plant value-added to $\sigma = 3$. The elasticity of output with respect to capital per industry α_s is estimated by subtracting the US labor share in the corresponding sector from 1. Capital refers to fixed assets net of depreciation and labor input to wage bill. TFP is aggregated using industry weight $\theta_s = P_s Y_s / PY$, which we estimate as the share of the value-added of sector *s* total value-added.

We get the weighted mean of τ_{Ksi} for each group within a sector to estimate $\tau_{Ks,gl}$, $\tau_{Ks,nl}$, $\tau_{Ks,gh}$, and $\tau_{Ks,nh}$. Capital distortions due to other factors are represented by τ_{Ksi}^{id}, which is only the residual of τ_{Ksi} after subtracting the group-specific distortions. Equation (12) is applied to estimate efficiency gains in each year from equalizing the status-associated cost of capital to the market efficient rate across groups:

$$(12) \quad TFP_{gains} = \left(\frac{TFP_{market}}{TFP_{full}}\right) - 1 = \left\{ \frac{\prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_{market,s}}{TFPR_{market,si}}\right)^{\sigma-1}\right]^{\frac{\theta_s}{\sigma-1}}}{\prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_{full,s}}{TFPR_{full,si}}\right)^{\sigma-1}\right]^{\frac{\theta_s}{\sigma-1}}} \right\} - 1$$

where TFP_{market} refers to the computed TFP when the misallocations in cost of capital associated with ownership and financial development are corrected and TFP_{full} refers to the computed TFP when all output and capital distortions are fully internalized by firms.

We consider three scenarios to estimate efficiency gains if the status-associated cost of capital were equalized across firms.[6] The first scenario looks at the impact of SOE reforms and accounts for the difference in cost of capital due to ownership status, holding SOB coverage constant. For SOEs in provinces with low SOB presence (Group A), $\tau_{Ks,gl}$ is set to equal $\tau_{Ks,nl}$, which is the mean capital distortion of non-SOEs in provinces with low SOB presence (Group B). For SOEs in provinces with high SOB presence (Group C), $\tau_{Ks,gh}$ is set to equal $\tau_{Ks,nh}$, which is the mean capital distortion of non-SOEs in provinces with high SOB presence (Group D).

The second scenario weighs on the impact of SOB reforms and equalizes the cost of capital across SOB coverage, holding firm ownership constant. For SOEs in provinces with high SOB presence (Group C), $\tau_{Ks,gh}$ is set to equal $\tau_{Ks,gl}$, which is the mean capital distortion of SOEs in provinces with low SOB presence (Group A). For non-SOEs in provinces with high SOB presence (Group D), $\tau_{Ks,nh}$ is set to equal $\tau_{Ks,nl}$, which is the mean capital distortion of non-SOEs in provinces with low SOB presence (Group B).

The third scenario considers the impact of both ownership and SOB coverage on the distortions in the cost of capital. We assume that non-SOEs located in provinces with low SOB presence—equivalently, provinces with a higher share of privately-owned banks—are charged at the "market equilibrium" interest rate. Therefore, $\tau_{Ks,gl}$ (Group A), $\tau_{Ks,gh}$ (Group B), and $\tau_{Ks,nh}$ (Group D) are all set to equal $\tau_{Ks,nl}$ (Group B).

[Insert Table 4 Here.]

[6] It is possible to obtain negative $1 + \tau_{Ksi}$ out of these three scenarios. To ensure that we will get non-negative values when estimating efficiency gains, we drop the observations with negative $1 + \tau_{Ksi}$. The share of dropped observations is only around 1.5 percent of total observations in the 2013 data.

Table 4 shows the efficiency gains that could be achieved from the three proposed scenarios. Holding SOB presence constant in Scenario 1, removing the biased treatment in favor of SOEs could increase TFP and output by 17.9 percent. This type of reform, however, requires an overhaul and re-structuring of SOEs, including their privatization, and would take a longer time to achieve. An alternative in the short run is to reform the banking system and encourage the entry of private banks to the financial intermediation market. The reform on the banking system is implied in Scenario 2, where the market equilibrium of status-associated cost of capital is assumed to be equal to that of firms in provinces with low SOB presence or equivalently with high coverage of privately-owned banks. The sole reform of SOBs could increase TFP and output by 29.2 percent, which is around 11 percentage points higher than the efficiency gains in the SOE reform. Therefore, loosening the restrictions on the establishment of private banks in China could result in larger efficiency gains within a shorter period compared to the long-term plan on SOE reform. Scenario 3 considers the simultaneous implementation of SOEs and SOBs reforms. The dual reform of SOEs and SOBs could result in the increase in TFP and output by as much as 45.9 percent. The estimates suggest that correcting for status-associated cost of capital due to ownership and SOB presence has the potential to increase income by almost 50 percent.

Next, we reduce the capital distortion, τ_{Ksi}, at the same rate for all firms, estimate how much efficiency gains would result in each simulation, and see which of these simulations would result in comparable estimates to our proposed reforms.

[Insert Table 5 Here.]

In Table 5, we show the efficiency gains from reducing capital distortions, holding all other things constant. From our perspective, this scenario corresponds

to lowering the cost of capital at the same percentage for all firms. Mitigating τ_{Ksi} from 10 to 50 percent would give very small efficiency gains. Cutting the capital distortions by a large margin would result in getting efficiency gains equivalent to our proposed reforms. Reducing τ_{Ksi} by 80 and 90 percent is roughly equivalent to the SOE and SOB reforms, respectively. The efficiency gains from the dual reform of SOEs and SOBs would still give higher efficiency gains relative to decreasing the amount of capital distortions for all firms.

In their paper, Hsieh and Klenow (2009) attribute productivity loss to the dispersion in TFPR. Consequently, removing the distortions by eliminating the variance in TFPR would result in improvement in TFP and output. However, re-examining their framework, we argue that not only the dispersion in the TFPR matters but also the level of TFPR in correcting distortions to improve efficiency. Recognizing the dispersion in TFP as the single source of productivity loss, as suggested by Hsieh and Klenow (2009), might be misleading. Several follow-up research took this assumption as the cornerstone in pursuing more in-depth analysis, such as Midrigan and Xu (2014) who made a clear argument in their abstract that "…finance frictions generate dispersion in the returns to capital across existing producers and thus productivity losses from misallocation…", and David and Venkateswaran (2017) who disentangled various sources of capital misallocation by using "dispersion in static marginal products" as the indicator of misallocation. Gopinath et al. (2017) stated that a significant increase in the dispersion of the return to capital across firms is associated with a significant increase in productivity losses from capital misallocation in Spain from 1999 to 2012. Our findings, however, offer an alternative interpretation of Hsieh and Klenow's (2009) framework and propose to alter the direction of future extension of the corresponding methodology to avoid misleading assessments.

We also examined if setting τ_{Ksi} to the highest τ_{Ksi}—that is, the τ_{Ksi} of the firm with the largest capital distortion—would result in achieving efficiency gains.

Theoretically, increasing the distortions should not result in improvement in TFP, but Hsieh and Klenow's (2009) framework allows for realizing efficiency gains whenever the variance in TFPR is narrowed. As expected, setting τ_{Ksi} to the highest τ_{Ksi} increased TFP and output at the same rate as completely dropping τ_{Ksi} from the simulation; that is, equalizing capital distortions for all firms is equivalent to removing capital distortions in the model. We get this result because the reduction in the variance in TFPR is similar in both cases. Removing distortions completely is an ideal solution which may not be achieved in real-life policies, but increasing distortions up to a point where it is equal for everyone is not possible because of limited resources. Therefore, on top of equalizing the status-associated cost of capital faced by firms to reduce the variance, setting its level to the market equilibrium rate is also important in improving productivity within more practical conditions.

V. Robustness Check

A. Change the Threshold Set for SOB Presence Dummy

In our regression model, we changed the threshold on the share of SOBs in a province to give alternative definitions for the dummy for SOB presence (high vs. low). To be consistent with the previous regression results, we expect that high SOB presence in some sectors would also significantly increase interest rate, while in some sectors this would significantly reduce interest rates.

[Insert Table 6 Here.]

Table 6 shows the regression results for different thresholds for defining high SOB presence as the share of SOB to total banks to 90, 91, 92, 93, 94, and 96 percent. β_3 is still significantly negative in almost all specifications, an indication

that SOEs in provinces with low SOB presence receive lower interest rates than non-SOEs. Like in the previous regression results, SOEs in sectors like chemicals and primary are charged at higher interest rate in provinces with high SOB presence. Also, SOEs in the machinery sector are the strategic sectors that are charged at lower interest rates in provinces with low SOB presence.

B. Replace the Baseline Year 2013 with 2008 and 2016

Another robustness check is to see if changing the observation year would exhibit comparable efficiency gains from the estimates using 2013 as the sample period. As shown in Table 7, the gains from SOE reforms in 2008 and 2016, as well as the SOB reforms in 2008, are close to our estimates in 2013. The results also show that the gains in the three scenarios are decreasing from 2008 to 2013 to 2016, which suggests that although the build-up of corporate debt have triggered alarms on financial stability, the credit misallocation associated with firm ownership has improved rather than worsened. A caveat of the study is that the data of SOB presence is based on 2016 data, so the SOB presence in 2008 might be underestimated.

[Insert Table 7 here.]

C. Using Other Data Sources to Calculate Efficiency Gains

We also test if using another data source would also result in efficiency gains if SOE reforms were implemented. We focus on SOE reform alone because we do not have time series data on SOB coverage. We compare the calculations in efficiency gains from 2012 to 2016 using Orbis and WIND data. To make the results from the two data sources comparable, we limit our analysis to the sample of listed firms. From Table 8, the simulation of SOE reforms using listed data also generated efficiency gains, albeit smaller from our estimates which used both

listed and unlisted firms with Orbis data. These results indicate that the implied credit distortions associated with ownership are more severe among unlisted firms. Therefore, the inclusion of unlisted firms is important in analyzing distortions and estimating the potential to improve productivity and output.

In contrast to the declining efficiency gains from 2013 to 2016 that were simulated using both listed and unlisted firms from Orbis in Tables 6 and 7, there appears no clear declining trend by using either Orbis or WIND data for the sample of listed firms. Furthermore, the difference in efficiency gains between using Orbis and WIND is small only in 2015, while in the other years, the efficiency gains from WIND are much smaller than those of Orbis. The discrepancy might be caused by the inconsistency in the labor cost estimates between these two data sources. To calculate the efficiency gains, we relied on the US wage data from Orbis to calculate the sector-specific labor shares. In the absence of US firm data in WIND, we still used the Orbis-generated labor shares to calibrate the simulation of efficiency gains. This possibly explains the smaller estimates generated by using WIND. We can also consider the estimates using WIND as the "lower-bound" of the efficiency gains from reforms.

[Insert Table 8 Here.]

We had planned to simulate the efficiency gain from setting the degree of distortion between the SOEs and non-SOEs in China equal to that in the US. However, we found that the US SOEs have very limited data in Orbis[7].

VI. Policy Implications

In this section, we simulate efficiency gains by assuming that each province implements their respective SOE and SOB reforms and we rank the provinces

[7] Between 2008 and 2016, only two SOEs in Orbis have fixed assets data, which is one of the major variables needed for calibration.

according to the magnitude of the efficiency gains. We also rank sectors in terms of potential gains if they reform their SOEs. Based on the simulated rankings, we propose different reform strategies conditional on different provincial and sectoral features.

A. Ranks of Provinces in Terms of Efficiency Gains of SOEs and SOBs Reforms

Using our framework, there are two types of efficiency gain that can be achieved. For provinces with relatively less developed financial sectors as indicated by high SOB presence, efficiency gains can be achieved by developing the financial sector in terms of mitigating the distortions caused by the "tax" and " subsidies" imposed by SOBs and by reforming the SOEs in terms of removing the implied credit upgrading associated with the SOE status. For provinces with relatively better developed financial sectors as indicated by low SOB presence, the efficiency can be achieved by reforming SOEs.

Table 9 summarizes the efficiency gains from SOE reforms for provinces with low SOB presence. Henan province shows the highest potential SOE reform gain, while the provinces of Shandong and Jiangsu have the lowest. In columns (2) and (3) of Table 9, we listed the corresponding share of SOEs in terms of value-added and in terms of number of firms. Beijing has the lowest potential gain from SOE reform. This result is surprising, since Beijing has the highest share of SOEs in terms of value added at around 85 percent and the second highest in terms of number of firms at around 31 percent. We examined the data and found that the estimate for Beijing is largely affected by the inclusion of a giant SOE, Sinopec. By removing this SOE from the sample, the efficiency gain reached 24.95 percent**.**

[Insert Table 9 Here.]

[Insert Table 10 here.]

Table 10 presents the potential efficiency gains from sole banking reform, sole SOE reform, and a combination of banking and SOE reform for provinces with high SOB presence. Provinces are ranked according to the efficiency gains from implementing both reforms (column 4). Comparing the efficiency gains from banking reform (column 2) and the SOE reform (column 3), we found that for most of the provinces, the potential gains brought by the banking reform is much higher than that of SOE reform, which demonstrate the importance of financial sector development. For the provinces of Guizhou and Jiangxi, the gains are higher than 100 percent, which means that simply improving the coverage of private banks could double the current GDP. For the province of Hunan, the efficiency gains by implementing the banking reform is -0.33 percent, which indicates that although the SOB presence is strong in the province, the interest rate distortions caused by SOBs are trivial. The interest rates charged to firms in Hunan are possibly similar to the interest rates imposed on firms located in provinces with better financial development. This negative result also provides strong evidence in supporting the mathematical property of equation (12), which allows the incorporation of both first-order (level of interest rates) and second-order (variance across interest rates) impact on the efficiency gain. As previously mentioned, Hsieh and Klenow (2009) in contrast only recognized the second-order impact and ruled out the first-order impact.

B. Ranking of Sectors according to Efficiency Gains from SOE Reforms

In this section, we simulate the potential efficiency gains from the reforms for different sectors. In Table 11, we listed the sectors in descending order of efficiency gains achievable by implementing SOE and SOB reforms simultaneously (column 4). Columns (2) and (3) give the efficiency gains from

implementing SOE reform and SOB reform, respectively. As shown in Table 11, almost all the efficiency gains for the sector of wholesale and retail trade comes from the SOB reform; that is, this sector will benefit the most from financial development and have its GDP doubled. The primary sector comes second in terms of benefiting from sole financial development. The construction and primary sectors will benefit the most from sole SOE reform, with GDP increases of 61.9 and 41.8 percent, respectively. The sector of metals and metal products can benefit from SOE reform but can gain very little from SOB reform (only 1.1 percent of GDP). If the two reforms took place simultaneously, aside from the wholesale sector, the sectors of construction and transportation can benefit the most. For the wholesale and construction sectors, the efficiency gains of the simultaneous reforms are larger than the sum of the sole SOE and sole SOB reforms. Achieving efficiency gains that are larger than the sum of the two solo reforms suggests that by improving and expanding the coverage of private banks, the "efficient" interest rate that the SOEs will be charged is closer to the optimal market efficient interest rate than the interest rate where only SOE reform was executed. On the contrary, for the primary sector, the gain from the simultaneous reforms is lower than the sole SOE reform. It indicates that the distortion in primary sector is mainly due to SOE factor rather than SOBs.

[Insert Table 11 Here.]

C. Policy Toolkits

Compared to the SOE reforms, stimulating financial development by encouraging the entry of private banks is much easier to carry out. With the changes of ownership, SOE reforms usually have to suffer from layoff of employees, shutdown of unprofitable plants, and so on, which usually induce concerns on social stability. That is, in addition to the economic costs, SOE

reforms might incur large social costs. Financial development, on the other hand, will shift employment from the unprofitable firms to the more profitable ones indirectly through market price signals, which will generate smaller social costs and less opposition from people who would be directly affected. The reform strategy also depends on the institutional structure. For example, financial development would be easier to carry out by either the central financial governing authority or the provincial government, while the SOE reform would be easier to execute for the central governing authorities rather than the provincial government.

Based on the simulation results discussed above, the policy makers might want to consider differentiating the policy strategies depending on the current situation of provinces and sectors. Based on the magnitude of the potential improvement in output due to the reforms, the provinces with high SOB presence can largely benefit from boosting financial development. Therefore, Guizhou, Jiangxi, Anhui, and Shaanxi should prioritize reforming the banking system. On the other hand, for provinces with relatively better financial development, SOE reform should be considered. The top priorities where SOE reform should be implemented include the provinces with the highest potential benefit from such reforms, like Henan and Fujian. From the perspective of sector management, the construction and primary sectors should encourage SOE reform first because of its larger potential benefit. Moreover, in terms of the governance body of sectors, it is much easier to carry out the SOE reform within each sector rather than accelerating financial development, since this is beyond the scope of sector management.

VII. Conclusion

In this paper, we examined the credit misallocation associated with the state-owned attributes of firms and banks. Different from previous studies in the

literature, we introduced the role of SOBs and found that in addition to the commonly claimed lower interest rate provided to SOEs, firms in certain sectors are charged at a higher interest rates in a form of "tax" to share their monopoly profits with the government through the SOBs. We extended the monopolistic competition model proposed by Hsieh and Klenow (2009) to incorporate the distortions in the cost of capital by explicitly differentiating state-owned attributes of firms and the presence of SOBs in the provinces where firms are located. Building on the augmented model, we simulated efficiency gains that can be achieved by implementing reforms in SOEs and in financial development by encouraging the entry of private banks in China.

We showed that the potential gains by taking the respective reforms to correct the distortions are quite significant. The combined reforms in SOEs and SOBs can bring efficiency gains at around 46 percent of GDP, while about 18 percent gains for sole SOE reform and around 29 percent for sole banking reform. Contrary to previous studies in the literature, we assume a more realistic scenario by correcting only the sector or group distortions implied in the interest rate but left the idiosyncratic component untouched, so our results are conservative estimates. We also found that while the alarm on the buildup of corporate debt has gotten more severe in recent years, there has been a reduction in distortions induced by SOEs in the past decade instead of worsening.

For the modeling framework, we have to keep in mind that our model is a static one, which is not capable of accommodating dynamic reactions. A dynamic and more generalized modeling framework might be more desirable because it allows the "feedback" of productivity changes induced by reforms or increased financial development to the system as it reaches a new steady-state equilibrium and efficiency gains can then be evaluated. However, we have to bear in mind that the generalized equilibrium modeling frameworks have their own limitations. For example, Moll (2014) particularly argued that the speed of transitions affects the

assessment of productivity loss associated with financial frictions, so analyzing steady states alone in the proposed general equilibrium model can be misleading. Sraer and Thesmar (2017) proposed a method to estimate aggregate output by using the statistics of key moments in the data in inferring parameters in a general equilibrium model, but they also emphasized that their approach can only be applied when the distribution of capital wedges is independent of general equilibrium; otherwise, it is going to be invalid. Therefore, our static modeling framework still provides useful insights, especially when the interaction between financial development and ownership structure is highly non-linear. Our static analysis can help give a clear snap shot of the complex "two-way" misallocation situation in China.

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TABLE 1—CORRELATION BETWEEN FIRM INTEREST RATE AND PROVINCIAL SOB PRESENCE (2007-2015)

	Orbis	WIND
All	0.07*	0.04*
Ownership		
SOE	0.04*	0.06*
Non-SOE	0.07*	0.03*
Absolute difference	*0.03**	*0.03*
Listing status		
Listed	0.03*	…
Unlisted	0.07*	…
Absolute difference	*0.04**	...
Ownership and listing status		
Listed SOE	0.04*	…
Listed non-SOE	0.03*	…
Unlisted SOE	0.04*	…
Unlisted non-SOE	0.07*	…

Note: Included are the observations with assets, debt, and profit data. We exclude observations whose interest rates are greater than 50 percent.

Source: Authors' calculations using Orbis and WIND data.

*Significant at 10 percent level.

TABLE 2— SECTOR CORRELATION BETWEEN FIRM INTEREST RATE AND PROVINCIAL SOBS PRESENCE (2007-2015)

	Orbis	WIND
Chemicals, rubber, plastics, and non-metallic products	0.06*	0.03
Construction	0.03	0.22*
Food, beverages, and tobacco	0.02*	0.01
Gas, water, and electricity	-0.01	0.005
Machinery, equipment, furniture, and recycling	0.08*	0.005
Metals and metal products	0.06*	0.09*
Other services	0.03*	0.07*
Primary sector	-0.05*	-0.04
Publishing and printing	0.08*	-
Textiles, wearing apparel, and leather	0.09*	0.08
Transport	-0.04*	0.14*
Wholesale and retail trade	0.02*	0.01
Wood, cork, and paper	0.12*	0.02

Note: Included are the observations with assets, debt, and profit data. We exclude observations whose interest rates are greater than 50 percent.

Source: Authors' calculations using Orbis and WIND data.

*Significant at 10 percent level.

TABLE 3— ROLES OF OWNERSHIP AND FINANCIAL DEVELOPMENT IN DETERMINING INTEREST RATES ACROSS SECTORS

	(1)	(2)	(3)	(4)	(5)	(6)
SOE dummy (β_3)	-0.26*	-0.26*	-0.26*	-0.18*	-0.18*	-0.18*
Sector dummies interacted with SOE and SOB dummies (β_{2Sec})						
Chemicals	0.46*	0.46*	0.46	0.54*	0.54*	0.54*
Construction	-0.35	-0.35	-0.35	-0.67	-0.67*	-0.67*
Food	-0.08	-0.08	-0.08	0.33	0.33	0.33
Utilities	-0.60*	-0.60*	-0.60*	0.30	0.30	0.30
Machinery	-0.04	-0.04	-0.04	-0.46*	-0.46*	-0.46*
Metals	0.77*	0.77*	0.77*	0.58*	0.58*	0.58*
Other services	0.97	0.97	0.97	0.61	0.61	0.61
Primary	1.39*	1.39*	1.39*	1.09*	1.09*	1.09*
Textiles	0.02	0.02	0.02	-0.24	-0.24	-0.24
Transport	0.93	0.93	0.93	0.67	0.67	0.67
Trade	0.73	0.73	0.73	0.35	0.35	0.35
Wood	-0.15	-0.15	-0.15	0.61	0.61	0.61
Control variables	..	..	..	Included	Included	Included
Year dummies	..	..	..	Included	Included	Included
Constant	6.77*	6.77*	6.77*	8.38*	8.38*	8.38*
Adj. R-squared	0.001	0.001	0.001	0.10	0.10	0.10
No. of Obs.	15,131	15,131	15,131	15,131	15,131	15,131

Note: Significance for columns (1) and (4) are based on usual standard errors; columns (2) and (5) are based on unclustered robust standard errors; columns (3) and (6) are based on robust standard errors clustered with respect to sector and year. WIND data from 2000 to 2016 is used.

*Significant at 10 percent level.

TABLE 4—EFFICIENCY GAINS FORM SOES AND SOBS REFORMS (UNIT: PERCENT OF GDP)

Scenario	Efficiency gain
Scenario 1: Efficiency gain by sole reform of SOEs	17.9
Scenario 2: Efficiency gain by sole reform of SOBs	29.2
Scenario 3: Efficiency gain by dual reform of SOEs and SOBs	45.6

TABLE 5—EFFICIENCY GAINS BY REDUCING CAPITAL DISTORTIONS IN DIFFERENT DEGREE (UNIT: PERCENT OF GDP)

	Scenario	Efficiency gains
(1)	Reduce τ_{Ksi} by 10 percent	2.9
(2)	Reduce τ_{Ksi} by 20 percent	4.3
(3)	Reduce τ_{Ksi} by 50 percent	8.5
(4)	Reduce τ_{Ksi} by 80 percent	17.5
(5)	Reduce τ_{Ksi} by 90 percent	27.0

TABLE 6—REGRESSION RESULTS WITH DIFFERENT THRESHOLDS FOR SOB PRESENCE

	90 percent		91 percent		92 percent	
	(1)	(2)	(3)	(4)	(5)	(6)
SOE dummy	-0.58*	-0.53*	-0.41*	-0.36*	-0.26*	-0.21*
Sector dummies (interacted with SOE and SOB dummies)						
Chemicals	0.59*	0.76*	0.44	0.62*	0.31	0.47*
Construction	-0.45	-0.50*	-0.63*	-0.66*	-0.44	-0.40
Food	-0.29	-0.05	-1.00*	-0.71	-0.97*	-0.53
Utilities	-0.28	0.52*	-0.45	0.36	-0.61*	0.22
Machinery	0.78*	0.41*	0.56*	0.19	0.07	-0.24*
Metals	0.70*	0.63*	0.57*	0.47*	0.59*	0.58*
Other services	0.16	0.06	-0.02	-0.11	0.23	0.27
Primary	1.46*	1.18*	1.33*	1.06*	1.32*	1.11*
Textiles	1.69*	1.43*	1.66*	1.39*	0.26	0.02
Transport	0.17	0.36	-0.15	-0.06	0.36	0.49
Trade	0.50	0.50	0.33	0.33	-0.02	0.02
Wood	1.02*	1.27*	0.77	1.04*	0.62	0.91*
Control variables	..	Inc.	..	Inc.	..	Inc.
Year dummies	..	Inc.	..	Inc.	..	Inc.
Constant	6.77*	7.99*	6.77*	8.15*	6.77*	8.42*
R-squared	0.004	0.11	0.004	0.11	0.002	0.11
Adj. R-squared	0.003	0.10	0.003	0.10	0.001	0.10
No. of Obs.	15,131	15,131	15,131	15,131	15,131	15,131

(Cont.)

	93 percent		94 percent		96 percent	
	(7)	(8)	(9)	(10)	(11)	(12)
SOE dummy	-0.24*	-0.16	-0.18*	-0.13	-0.20*	-0.15*
Sector dummies (interacted with SOE and SOB dummies)						
Chemicals	0.34	0.46*	0.27	0.42*	0.62	0 .73*
Construction	-0.37	-0.67*	-0.43	-0.71*	-0.55	-0.82*
Food	-0.99*	-0.57	-1.05*	-0.61	0.50	1.31*
Utilities	-0.61*	0.19	-0.66*	0.15	-0.95*	0.29
Machinery	0.01	-0.37*	-0.30*	-0.61*	-0.22	-0.54*
Metals	0.45	0.37	0.43	0.44	0.01	0.16
Other services	0.32	-0.23	0.26	-0.27	-1.79*	-1.75*
Primary	1.19*	0.94*	1.19*	0.99*	1.21*	0.92*
Textiles	0.24	-0.02	-0.10	-0.31	0.14	0.04
Transport	0.83	0.86	1.31	1.09	-0.25	-0.40
Trade	0.38	0.38	0.31	0.34	1.95*	1.43
Wood	0.76	1.03	-0.23	0.57	-0.21	0.58
Control variables	..	Inc.	..	Inc.	..	Inc.
Year dummies	..	Inc.	..	Inc.	..	Inc.
Constant	6.77*	8.41*	6.77*	8.45*	6.77*	8.34*
R-squared	0.002	0.11	0.002	0.11	0.002	0.11
Adj. R-squared	0.001	0.10	0.001	0.10	0.001	0.10
No. of Obs.	15,131	15,131	15,131	15,131	15,131	15,131

Note: Based on robust standard errors clustered with respect to sector and year.

*Significant at 10 percent level.

TABLE 7—EFFICIENCY GAINS FROM REFORMS USING 2008 AND 2016 AS OBSERVATION YEARS

Scenario	2008	2016
Scenario 1: Efficiency gain by sole reform of SOEs	20.7	16.7
Scenario 2: Efficiency gain by sole reform of SOBs	30.7	19.9
Scenario 3: Efficiency gain by dual reform of SOEs and SOBs	68.6	29.0

TABLE 8—EFFICIENCY GAINS FROM SOE REFORMS: ORBIS VS WIND

Year	Orbis	WIND
2012	10.3	4.3
2013	11.3	2.2
2014	13.0	7.7
2015	10.2	9.7
2016	13.5	7.9

TABLE 9—RANKING OF PROVINCIAL EFFICIENCY GAINS BY SOLE SOES REFORM WITH LOW SOB PRESENCE

Province	Efficiency Gain (Percent GDP)	Share of SOEs (Value-added)	Share of SOEs (Number)
(1)	(2)	(3)	(4)
Henan	56.36	57.60	19.78
Fujian	43.22	39.33	5.65
Shanghai	43.06	52.00	10.83
Yunnan	41.78	27.41	15.52
Hubei	28.26	70.20	15.93
Inner Mongolia	23.81	56.86	34.88
Chongqing	21.51	48.95	16.22
Tianjin	18.28	52.14	16.11
Zhejiang	7.68	14.58	3.46
Guangdong	6.70	31.88	4.36
Shandong	6.51	32.63	8.95
Jiangsu	5.97	16.34	3.25
Beijing	3.29	84.82	30.93

Note: The efficiency gain of Beijing is 24.65 percent if excluding Sinopec.

TABLE 10—RANKS OF PROVINCIAL EFFICIENCY GAINS BY SOES/SOBS REFORM WITH HIGH SOB PRESENCE

Province	Banking reform (Percent of GDP)	SOE reform (Percent of GDP)	Banking and SOE reform (Percent of GDP)	Share of SOEs (Value-added)	Share of SOEs (Number)
(1)	(2)	(3)	(4)	(5)	(6)
Guizhou	154.27	70.84	159.80	22.63	28.00
Jiangxi	118.11	96.23	131.02	14.91	8.07
Anhui	86.31	57.28	98.37	45.39	7.48
Shaanxi	82.18	54.48	88.92	55.41	22.49
Heilongjiang	81.71	29.66	75.50	67.10	18.67
Hebei	67.69	47.06	70.71	55.53	16.24
Sichuan	62.19	46.57	66.08	51.01	18.63
Guangxi	50.80	28.48	60.23	33.02	15.25
Jilin	50.93	35.03	57.93	19.94	8.16
Liaoning	46.73	26.58	52.03	52.07	11.41
Shanxi	47.77	84.53	50.21	49.81	26.56
Gansu	32.40	-10.49	42.24	29.79	12.00
Ningxia	6.09	8.42	9.00	44.49	42.11
Hunan	-0.33	2.41	2.27	43.35	22.86

TABLE 11—RANKS OF SECTORAL EFFICIENCY GAINS BY SOLE SOES REFORM[8]

Sector	SOE reform	SOB reform	SOE and SOB reforms
(1)	(2)	(3)	(4)
Wholesale and retail trade	-0.4	100.4	113.4
Construction	61.9	7.9	77.2
Transport	29.7	14.0	72.4
Machinery, equipment, furniture, and recycling	26.5	26.6	39.1
Primary sector[9]	51.0	1.4	46.3
Gas, water, and electricity	-3.1	26.4	33.7
Metals and metal products	22.0	1.1	22.5
Chemicals, rubber, plastics, and non-metallic products	6.9	4.6	10.8
Other services	0.8	3.9	3.3

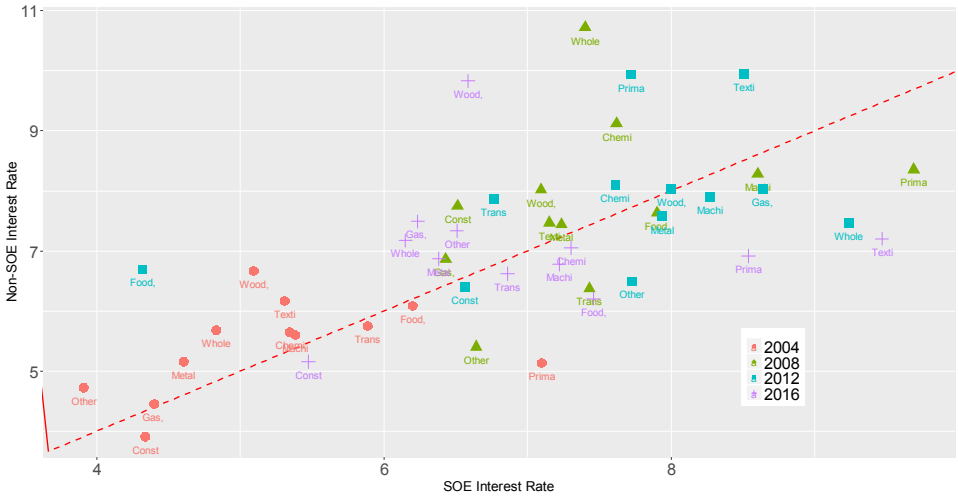


FIGURE 1—COMPARISON OF SECTOR AVERAGE INTEREST RATES OF SOES AND NON-SOES (2004-2016)

[8] Refer to Online Appendix Table A.3 for the baseline τ_{Ks}^{status} used in each sector and reform scenario.
[9] We found that the primary sector is subjected to the impact of an outlier. After removing the largest firm - China Shenhua Energy Company Limited (an SOE in a province with low SOB coverage), the efficiency gains for SOB reform declined from 51.7 to 1.4 percent. It implies that the 51.7 percent efficiency gain is mainly due to SOE factor rather than the SOB.

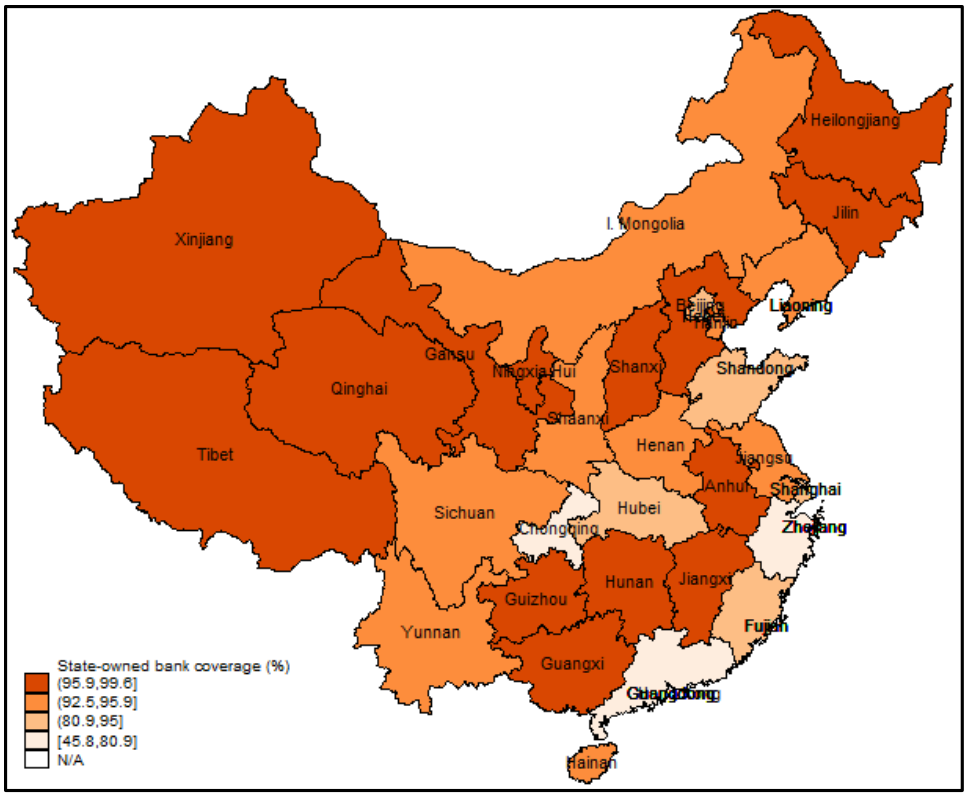
FOR ONLINE PUBLICATION

APPENDIX TABLE A.1—VARIABLES USED IN THE STUDY AND THEIR DEFINITION

Variable	Definition
I. Orbis	
Interest rate	Financial expenses divided by the sum of current liabilities and long-term debt
SOE	Firm whose 25.01% or more of total shares is owned by the government and other SOEs
Total cost of employees	Average cost of employees per capita in the sector where the firm belongs times the total number of employees in a firm
Value-added	Total cost of employees plus operating revenue
Labor share	Total cost of employees in a sector divided by the total value-added in a sector
Elasticity of output wrt capital	One minus labor share
Capital stock	Fixed assets net of depreciation
Labor input	Total cost of employees
Sectoral wage	Average cost of employees in the sector
Output	Value-added raised to $^3/_2$ (Hsieh and Klenow, 2009)
II. WIND	
Interest rate	Interest expense divided by the sum of short-term and long-term loans
Debt ratio	Sum of short-term and long-term loans divided by total assets
Profit ratio	EBIT divided by total assets
Growth in revenue	Natural logarithm of total revenue at time t minus the natural logarithm of total revenue at time t minus one
Age of firm	Year of observation minus inception year
Staff headcount	Staff headcount as of year-end
Total cost of employees	Average annual salary per capita in a sector times staff headcount in a firm
Value-added	Total cost of employees plus operating revenue
Labor share	Total cost of employees in a sector divided by the total value-added in a sector
Elasticity of output wrt capital	One minus labor share
Capital stock	Fixed assets
Labor input	Total cost of employees
Sectoral wage	Average cost of employees in the sector
Output	Value-added raised to $^3/_2$ (Hsieh and Klenow, 2009)
III. SNL	
SOB	Bank whose 25.01% or more of total shares is owned by the government and SOEs
SOB coverage	Share of SOBs to total number of banks in a province

APPENDIX TABLE A.2—LITERATURE REFERRED FOR VARIABLES SELECTION

Study	Dependent variable	Main independent variable of interest	Control variables
Sapienza (2004)	Interest rate less prime rate	Dummy for state-owned bank	Log of total assets of the bank Bank's percentage of nonperforming loans to total loans Market concentration at the province level Log of sales Firm's risk score Firm dummies Year dummies
Goss and Roberts (2011)	Cost of bank loans	Measure of corporate social responsibility	Maturity of the loan Dummy on security of the loan Loan concentration Loan type dummies Loan purpose dummies Dummy for syndicated loans Industry dummies Altman z-score Firm's growth opportunities Debt-to-equity ratio Log of total assets Bond rating Investment grade EBIT/total assets Net working capital/total assets Retained earnings/total assets Institutional shareholders Institutional concentration Exclusionary screens for controversial industries
Strahan (1999)	Price paid for the loan	Terms of loan contract	Log of assets EBITDA/total assets Interest coverage ratio Sales-to-total assets ratio Quick ratio Dummy for good bond rating Leverage Market value of assets/book value of assets
Shailer and Wang (2015)	Interest rate	Firm ownership and financial distress indicator	Ownership concentration CEO duality dummy Percentage of independent directors on the corporation's board Administrative expenses/operating revenue EBIT/average total assets Firm’s age Log of book value of total assets Gross PPE/total assets Cash flow from operations/total assets Growth of sales Log of the ratio of market value to book value of equity Current liabilities/total assets Book value of long-term debt/book value of total assets Inverse of operating revenue/average total assets Log of provincial GRP per capita



APPENDIX FIGURE A.1—STATE-OWNED BANK COVERAGE ACROSS PROVINCES

Appendix 1. Remaining equations in the theoretical model

Combining Equations (4) and (6) in the main text yields output distortion:

$$1 - \tau_{Ysi} = \left(\frac{\sigma}{\sigma-1}\right)\left[\frac{wL_{si}}{(1-\alpha_s)P_{si}Y_{si}}\right] \tag{1}$$

The marginal products of labor (*MRPL*) and capital (*MRPK*) are given as:

$$MRPL_{si} = w\frac{1}{1-\tau_{Ysi}} \tag{2}$$

$$MRPK_{si} = R\frac{1+\tau_{Ksi}}{1-\tau_{Ysi}} \tag{3}$$

Getting MRPL and MRPK with weights at the industry level are given as follows:

$$\overline{MRPL_s} = \frac{w}{\left[\sum_{i=1}^{M_s}(1-\tau_{Ysi})\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)\right]} \tag{4}$$

$$\overline{MRPK_s} = \frac{R}{\left[\sum_{i=1}^{M_s}\left(\frac{1-\tau_{Ysi}}{1+\tau_{Ksi}}\right)\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)\right]} \tag{5}$$

Distinguishing physical productivity (TFPQ) from revenue productivity (TFPR) is important in the model. TFPQ is defined as:

$$TFPQ_{si} \triangleq A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} \tag{6}$$

Since physical output Y_{si} is not observable, $P_{si}Y_{si}$ is raised to the assumed elasticity of demand $\frac{\sigma}{\sigma-1}$ to estimate Y_{si}.

$$TFPQ_{si} = \kappa_s\left[\frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}}\right], \text{ where } \kappa_s = 1 \tag{7}$$

On the other hand, TFPR is defined as:

(8) $$TFPR_{si} \triangleq P_{si}Y_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\left[\frac{(1+\tau_{Ksi})^{\alpha_s}}{1-\tau_{Ysi}}\right] = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{MRPK_{si}}{\alpha_s}\right)^{\alpha_s}\left(\frac{MRPL_{si}}{1-\alpha_s}\right)^{1-\alpha_s}$$

TFPR does not vary across firms within an industry in the absence of distortions. Without distortions, more inputs should be allocated to firms with higher TFPQ until their higher output results in lower price. The lower price would then equalize the TFPR of bigger and smaller firms.

Industry TFPR can be computed by aggregating firm TFPR using value-added as weights:

(9) $$\overline{TFPR}_s = \left(\frac{\sigma}{\sigma-1}\right)\left[\frac{R}{\alpha_s\sum_{s=1}^{M_s}\left(\frac{1-\tau_{Ysi}}{1+\tau_{Ksi}}\right)\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right]^{\alpha_s}\left[\frac{w}{(1-\alpha_s)\sum_{s=1}^{M_s}(1-\tau_{Ysi})\left(\frac{P_{si}Y_{si}}{P_sY_s}\right)}\right]^{1-\alpha_s} = \left(\frac{\sigma}{\sigma-1}\right)\left(\frac{\overline{MRPK}_s}{\alpha_s}\right)^{\alpha_s}\left(\frac{\overline{MRPL}_s}{1-\alpha_s}\right)^{1-\alpha_s}$$

We can then express industry TFP as:

(10) $$TFP_s = \left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_s}{TFPR_{si}}\right)^{\sigma-1}\right]^{\frac{1}{\sigma-1}}$$

Aggregating TFP and output using the Cobb-Douglas technology yields:

(11) $$TFP = \prod_{s=1}^{S}TFP_s^{\theta_s} = \prod_{s=1}^{S}\left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_s}{TFPR_{si}}\right)^{\sigma-1}\right]^{\frac{\theta_s}{\sigma-1}}$$

(12) $$Y = \prod_{s=1}^{S}\left(TFP_sK_s^{\alpha_s}L_s^{1-\alpha_s}\right)^{\theta_s}$$

APPENDIX TABLE A.3—BASELINE τ_{Ksi} BY SECTOR AND REFORM SCENARIO

Sector	SOE reform		SOB reform		SOE and SOB reforms
	Low SOB presence	High SOB presence	SOE	Non-SOE	
Chemicals, rubber, plastics, and non-metallic products	10.6	9.0	5.1	10.6	10.6
Construction	80.2	41.8	15.9	80.2	80.2
Gas, water, and electricity	0.3	2.0	-0.2	0.3	0.3
Machinery, equipment, furniture, and recycling	166.2	97.0	39.2	166.2	166.2
Metals and metal products	9.0	8.6	3.0	9.0	9.0
Other services	26.6	14.7	7.9	26.6	26.6
Primary sector	16.7	24.1	26.8	16.7	16.7
Transport	69.4	15.0	3.2	69.4	69.4
Wholesale and retail trade	136.2	158.1	14.2	136.2	136.2