Factor Market Distortions in Vietnam for SOEs and Private Firms[1]

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This paper investigates whether state-owned enterprises (SOEs) and private firms face different distortions not only in the market for capital, but also for labor and land/buildings, applying a flexible theoretical framework with heterogeneous firms to a panel of enterprise census (2000-2009) and a cross-section investment climate survey (2005) for Vietnam manufacturing. I find that private firms face higher distortions in the markets for capital and land/buildings but lower distortions for labor than SOEs, ceteris paribus. The counterfactual GDP change after removing the ownership distortions while keeping other distortions unchanged is 0.7% (3.7%) for skilled (unskilled) labor but is surprisingly small and negative for capital and land/buildings. This is because marginal products increase with firm size and SOEs are larger than most private firms - counteracting the efficiency gains from neutralizing ownership distortions. GDP gains increase to 0.6%-11.3% for capital and 1.4% for land/buildings when isolating the confounding effect by firm size. Therefore policies exclusively aiming at neutralizing factor market distortions related to ownership but ignoring other confounding distortions will fail to improve aggregate efficiency.

1 Introduction

Resource misallocation leads to aggregate productivity losses and can contribute to large income gaps across countries. Baily et al. (1992) document that about half of overall productivity growth in US manufacturing in the 1980s can be attributed to factor reallocation from low productivity to high productivity establishments. Restuccia and Rogerson (2008) calibrate a growth model with heterogeneous establishments to US data

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and find the aggregate output and productivity losses are in the range of 30% to 50% with varying degrees and coverages of policy distortions. Hsieh and Klenow (2009) estimate GDP gains of 30%-60% in China and India if capital and labor were reallocated to equalize the marginal revenue products (hereafter, MRPs) to the extent observed in the US.

Resource misallocation is perceived to be severe in Vietnam. Using the theoretical framework from Hsieh and Klenow (2009), Ha and Kiyota (2015) find that the misallocation losses in Vietnam manufacturing during 2000-2009 are comparable to those in China and India. SOEs and private firms are noted to face unequal playing fields in the factor markets for capital, labor, and land/buildings. SOEs have preferential access to formal credit at lower prices and own the majority of industrial lands but face more rigid labor regulations than most private firms (Nguyen and Ramachandran 2006, Hakkala and Kokko 2007, Vo, et al. 2011, World Bank 2005, 2008). Capital market segregation in Vietnam also distorts labor allocation by creating a two-track market for skills and large wage gaps for workers in state and non-state sectors. Therefore growth is reduced by diminished allocative efficiency and reduced incentives to acquire education (Phan and Coxhead 2013).

Dollar and Wei (2007) investigate the capital market distortions across firm ownership, regions, and sectors and find that state-owned firms have significantly lower returns to capital, on average, than domestic private or foreign-owned firms, during 2002-2004 in China. They calculate that China could save 8% of its capital without sacrificing economic growth should capital be more efficiently allocated. But quantitative measures for the factor market distortions experienced by SOEs and private firms and calculations of the resulting efficiency gains in Vietnam are scarce, especially for labor and land/buildings.

Therefore in this paper I explore whether SOEs and private firms face different distortions not only in the market for capital, but also for labor and land/buildings in Vietnam. Distortions are identified by the difference in the conditional mean of MRPs, controlling for periods, sectors, regions, and sizes, similar to Dollar and Wei (2007). It helps to identify the relative contribution of specific factor market distortions to the

MRPs. Unlike most misallocation literature, I do not attempt to estimate the productivity effect from (partially) equalizing MRPs across firms (i.e. a reduction in the dispersion in the MRPs). Instead, I estimate how GDP would change in response to neutralizing the average distortions related to ownership only but keeping other distortions in place (e.g. size/sector/region). This provides more insights about how a specific and well recognized distortion leads to efficiency losses across firms *taking into account other existing distortions*. Also note that this paper makes relatively few structural assumptions apart from profit-maximizing behavior (but allowing for some market power), compared to some of the recent contributions in the literature.

Despite following Dollar and Wei (2007) closely, the analysis in this paper is based on a more flexible framework with heterogeneous firms. Dollar and Wei make two strong assumptions when calculating the efficiency gain from capital reallocation: a constant return to scale Cobb-Douglas production function and the existence of a representative firm. Heterogeneity is incorporated in this paper by removing the representative firm assumption and using the flexible translog (rather than Cobb-Douglas) production function.

I find that on average SOEs have significantly lower marginal revenue products of capital and land/buildings (MRPK/MRPD) but higher marginal revenue product of labor (MRPL) than private firms, especially for unskilled labor, holding sectors, regions, and sizes of the firms in place, using both panel enterprise census data (2000-2009) and cross-sectional Investment Climate Survey data (ICS 2005) for Vietnam manufacturing. This suggests that relative to SOEs, private firms face higher distortions in the markets for capital and for land/buildings but lower distortions in the labor market, ceteris paribus.

I then perform simulations to see how GDP would change in response to neutralizing the mean factor market distortions related to ownership while keeping other distortions unchanged. The simulation results show that capital and land/buildings should be transferred from SOEs to private firms but the opposite is true for skilled and unskilled labor in order to neutralize the ownership distortions. The resulting GDP changes are .7% and 3.7% respectively for the reallocation of skilled and unskilled labor. However, the GDP changes for the reallocation of capital and land/buildings are small and close to zero.

The results are generally robust to possible measurement errors in outputs and inputs except for skilled labor.

Interestingly, I find *negative* GDP changes from the reallocation of capital and land/buildings. This occurs mainly due to the confounding effect of firm size. A decomposition analysis of the difference of the average marginal products between SOEs and private firms show that the contribution by firm size is positive and large and of opposite sign to the contribution by ownership in the case of capital and land/buildings. This implies that the efficiency gain from reallocating capital and/or land/buildings from SOEs to private firms to remove ownership distortions will be counteracted by an efficiency loss as private firms are generally smaller than SOEs while marginal products increase with firm sizes. The resulting small and negative GDP changes imply that policies that aim at removing factor market distortions related to ownership but ignoring other confounding effects will do little to improve aggregate efficiency. If, counterfactually, private firms would have had the same employment sizes as SOEs from which capital and land/buildings are transferred, the GDP changes from reallocation would be higher at between .6% and 11.3% for capital, and 1.4% for land/buildings.

An alternative to a reallocation of sources between private firms and SOEs is privatization, which is not considered in this paper. Privatization in Vietnam has focused on small SOEs rather than large ones and was not very successful because ownership was mostly transferred to employees and management (insiders) rather than outside strategic investors (Sjöholm 2006). Also the state typically retains a controlling stake in the equitized SOEs. For privatization to work well, the institutional and regulatory environment must be improved as well. Previous studies have found conflicting results regarding whether private firms are more productive than SOEs in Vietnam. For instance, Newman et al. (2009) find that both SOEs and foreign firms have higher productivity levels than private firms, mostly driven by high investment and technology usage in SOEs, using Vietnam census data 2001-2007. However, Vu (2002) found that the technical efficiency for SOEs is lower than non-SOEs on average.

The structure of the paper is as follows. Section 2 briefly introduces Vietnam and the functioning of factor markets for capital, labor, and land/buildings; section 3 explains the

theoretical framework for analyzing factor market distortions; section 4 presents the census and ICS data that are used; section 5 illustrates our simulation strategy to remove the ownership distortion and presents the empirical results; section 6 concludes.

2 Vietnam and the Factor Markets

Vietnam is a transition country that embarked on a process of economic reforms (piecemeal) since 1986. The investment climate and economic development vary largely across regions in the country.[2] Manufacturing is increasingly important, contributing almost 20% to GDP between 2005 and 2011 (GSO 2013). The shares in GDP by state, private and foreign firms were 32.7%, 49.3%, and 18% respectively in 2011. It is widely noted that private sector firms face unfair competition from SOEs, which is manifested in problems with market access, financing, and access to land (Hakkala and Kokko 2007).

Capital market distortions are noted to be severe in Vietnam. The dominant 4 state-owned commercial banks (SOCBs) prefer lending to SOEs over private firms (Leung 2009). The young and small stock market serves mostly large SOEs and is inaccessible for the majority of private firms. In recent years, SOEs also turn to credit from Development Assistance Fund (DAF), provincial development funds, social insurance fund (SIF), and government guaranteed bond issues which are mostly directed to SOEs. These sources of credit are considered less "intrusive" than bank credit that require collateral and also some transparency regarding accounts and business plans (Hakkala and Kokko 2007). Private firms rely largely on self-financing for investment and also seek capital from the informal financial market.[3]

[2] The country is divided into 8 regions including Red River Delta, North West, North East, North and South Central Coast, South East, Central Highlands, and Mekong River Delta. South East and Mekong River Delta have better business environment and infrastructure, large markets but high competition and are far from the political center. North Vietnam is close to the political center with many SOEs, good infrastructure and a large market, but bureaucratic. Central Vietnam has a small market, poor infrastructure, and large regulatory uncertainty but has cheap labor and materials and low competition.

[3] It includes professional money lenders, friends and relatives, and rotating savings and credit associations (ROSCAs, called HUIs in Vietnam).

For the labor market, labor laws are supposedly more binding on SOEs, foreign firms, and a few large and formal private firms.[4] Effectively, SOEs are required to pay benefits (e.g. social and health insurance) to employees but many private firms are not. Since SOEs generally are unionized while most private firms are not, the degree of rent-sharing between workers and employers may be different for SOEs and private firms. Bales and Rama (2002) found that workers in SOEs are overpaid by 20% or even more compared to the private sector in Vietnam.

As for the land market, most existing industrial lands are owned by SOEs while the "creation" of new industrial lands from agricultural land is difficult and controversial due to issues related to land compensation.[5] Moreover, the land market generally is inefficient. For example, there is a lack of information on the availability of land and low security and marketability of land use rights. SOEs have weak incentives and no legal means to sell or legally sub-lease the under-used or idle land to the private sector. The limited supply of land and inefficiency in the land market are particularly problematic for private firms with large and growing demand for land but without land use rights. The insecure and expensive informal renting of lands from SOEs also discourages private firms from making any long-term investments or business plans (Hakkala and Kokko 2007). Access to zoned areas is costly and has to go through a complex and lengthy procedure preventing many SMEs (mostly private firms) from using industrial zones.

Overall, there is ample anecdotal evidence showing that resource misallocation is severe in Vietnam, and SOEs and private firms are believed to experience different distortions in the markets for capital, labor, and land/buildings.

3 Theoretical Framework for Analyzing Factor Market Distortions

In this section I present the theoretical framework for analyzing market distortions across firms with different characteristics. For simplicity, the theoretical framework for analysis

[4] The labor law is in principle effective on firms with at least 10 employees. A large fraction of private firms hire less than 10 employees. Many private firms with more than 10 employees may not entirely follow the labor law.

[5] The potential value of agricultural lands converted for industrial use is much higher than the nominal value of agricultural lands.

starts from a production technology with two inputs capital and labor.[6] Assume that firm j is a price-taker facing possible distortions in both input (e.g. capital and labor) and output markets. Product market distortions affect revenues. Factor market distortions cause individual factor prices to deviate from competitive market prices. Examples of product and factor market distortions include corruption, poor infrastructure, preferential access to bank credit and industrial lands by SOEs, and restrictive labor market regulations.

Each firm maximizes its profit taking into account the above distortions:

$$\pi_j = \left(1 - d_y^j\right)pY_j - \left(1 + d_L^j\right)wL_j - \left(1 + d_K^j\right)rK_j$$

where p is the output price, and w and r are the market wage rate and interest rate; d_y^j, d_L^j, d_K^j denote the output, labor, and capital distortions for firm j. The marginal revenue products of capital and labor (MRPK/MRPL) can be derived from the first order conditions for K and L respectively:

$$\mathrm{MRPK}_j = \frac{\partial pY_j}{\partial K_j} = r\frac{1 + d_K^j}{1 - d_y^j};\ \mathrm{MRPL}_j = \frac{\partial pY_j}{\partial L_j} = w\frac{1 + d_L^j}{1 - d_y^j}$$

Because output is only observed with the output distortions, the observed MRPs are:

$$\mathrm{MRPK}_j^o = \mathrm{MRPK}_j\left(1 - d_y^j\right) = r\left(1 + d_K^j\right);\ \mathrm{MRPL}_j^o = \mathrm{MRPL}_j\left(1 - d_y^j\right) = w\left(1 + d_L^j\right)$$

where the superscript o indicates actually observed. Intuitively, the after-tax (distortions in the output market after production) MRPs are equalized across firms. The before-tax MRPs must be higher for firms that face more disincentives, and can be lower for firms that benefit from subsidies (Hsieh and Klenow 2009). Further taking the log transformation and after linearizing, the following holds:

$$\ln\left(\mathrm{MRPK}_j^o\right) = \ln r + \ln\left(1 + d_K^j\right) \approx \ln r + d_k^j \quad (1)$$

$$\ln\left(\mathrm{MRPL}_j^o\right) = \ln w + \ln\left(1 + d_L^j\right) \approx \ln w + d_l^j \quad (2)$$

[6] The model is readily extended to the case with more than 2 production inputs.

Equations (1) and (2) show that under perfect factor markets without any distortions, the MRPs should be the same across firms. Otherwise market distortions lead to dispersion in the MRPs.

So far I have assumed that firms are price-takers in both product and factor markets. But if firms produce differentiated products, the imperfect substitutability of different varieties allows firms to price above marginal costs. Hence after incorporating product differentiation into the model, the dispersion of the MRPs not only depends on product and factor market distortions, but also on the price elasticity of demand within sectors:[7]

$$\ln\left(\mathrm{MRPK}_j^o\right) = \ln r + \ln\left(1 + d_K^j\right) + \ln\frac{\sigma}{\sigma-1} \approx \ln r + d_k^j + \frac{1}{\sigma} \quad (3)$$

$$\ln\left(\mathrm{MRPL}_j^o\right) = \ln w + \ln\left(1 + d_L^j\right) + \ln\frac{\sigma}{\sigma-1} \approx \ln w + d_l^j + \frac{1}{\sigma} \quad (4)$$

This theoretical framework is similar to Dollar and Wei (2007), where they further assume a CRTS Cobb-Douglas (CD) production function and the existence of a representative firm for calculating the efficiency gain from removing the capital market distortions between state and private firms ($i.e.$ $\overline{d_k^s} - \overline{d_k^p} = 0$).[8] Assuming a CD production function has the advantage that the MRPs are proportional to the average revenue products (ARPs), which are directly observed. But the elasticity of substitution is constant and equal for all firms with CD production technology. The representative firm assumption implies that every firm should have the same capital labor ratio, which hardly holds in reality and conceals the heterogeneity across firms. Therefore I choose a flexible translog (rather than Cobb-Douglas) production function and also remove the representative firm assumption to incorporate heterogeneity in the model.[9]

The approach for analysis in the paper differs from the previous literature in two ways (Restuccia and Rogerson 2008, Hsieh and Klenow 2009, Midrigan and Xu 2014). First, I

[7]The derivations are shown in Appendix A3E. In this theoretical framework, factor market distortions and production differentiation are the only sources of dispersion. There's no room for other sources of dispersion such as measurement error, idiosyncratic production/demand shocks, and investment frictions (Song and Wu 2014). I will get back to this in the empirical section.

[8] $\overline{d_k^X} = \frac{\sum_{i=1}^{N_X} d_k^i}{N_X}$, where N_X is the number of firms in group X, with X=s for SOEs, X=p for private firms

[9] With a Cobb-Douglas production function, the model with 2 distortions (output and capital) is equivalent to the model with 3 distortions presented here (derivation available upon request). But this is no longer the case with a translog production function.

look at the variance of the conditional mean of the MRPs rather than the overall variance of the MRPs. Second, I also provide empirical evidence for market distortions in labor and land/buildings, which is equally interesting and policy-relevant as capital. By looking at the variance of the conditional mean, one can identify the relative contributions to the dispersion of the MRPs from different sources. The paper focuses on the market distortions related to ownership as it is perceived to be prevalent and severe in Vietnam and hence is highly policy relevant. Empirically, I investigate the variation of the conditional means for the MRPs by running regressions of the (log) MRPs on dummies for ownership, sizes, sectors, regions, and other variables if available. The coefficients of the ownership dummies for SOEs and foreign firms capture the *average* distortions in the markets for capital/labor/land/buildings *relative to private firms*, ceteris paribus. Therefore instead of removing all distortions by equalizing the MRPs across firms, I calculate the output gains after removing the dispersions of the MRPs related to ownership but keeping all other distortions in place. The details of the simulation strategy to compute the GDP changes after removing gap of the market distortions between SOEs and private firms related to ownership are illustrated in section 5.2.

4 Data Description

Two datasets are used for the analysis in the paper, the enterprise census (2000-2009) and the World Bank Investment Climate Survey (ICS, 2005) for Vietnam. The census is a panel dataset with wide coverage, allowing one to control for omitted variable bias due to unobserved (time-invariant) heterogeneity but with potentially large measurement errors. The ICS data provide more detailed information not only for capital, but also for labor and land/buildings, thus enabling one to examine the market distortions in labor and land/buildings as well. The quality of the ICS data may be better. The analysis focuses on the manufacturing sector where productivity is easier to measure than in the non-manufacturing sector (Bloom and van Reenen 2007).[10] Below I describe both datasets in detail.

[10] Before 2006, the Vietnam standard industrial classification 1993 (VSIC 1993) was used for data collection and VSIC 2006 was used since 2006. For consistency, we convert VSIC 2006 since 2006 to VSIC 1993; see Appendix A3B for the details.

4.1 The Vietnam Enterprise Census 2000-2009

The census data for 2000-2009 were collected annually between March and May of 2001-2010 by the General Statistics Office (GSO) of Vietnam.[11] It covers all state-owned and foreign invested enterprises, non-state enterprises with at least 10 employees, and 20% of randomly selected non-state enterprises with less than 10 employees, from all sectors in the economy.[12]

The census provides detailed information on ownership structure, location, sector, sales, net profits, capital stock, investment, employment, wages, depreciations, taxes, et cetera. Measurement error in the data is potentially large. For example, there is some inconsistency in the panel identifiers that are used to merge data across year.[13] Data on raw materials and year of establishment are not available every year. The sectors of tobacco (No.16), coke and refined petroleum (No.23), office, accounting and computing machinery (No.30), and recycling (No.37) are excluded due to a small number of observations and also uneven distribution of ownership types,[14] leaving 19 sectors for the analysis. After further data cleaning, around 76.2% the firm-year observations remain (180181 observations).[15] Nominal values are deflated by 2-digit industry deflators with 1994 as the base year.[16]

The enterprise census data have been used previously to study various economic issues in the manufacturing sectors, such as the spillover effect of FDI on domestic private firms (years 2000-2005) by Pham (2009), productivity (years 2001-2007) by Newman et al.

[11] The census has 3 questionnaires: the 1st is on basic indicators about production and various industrial activities conducted, the 2nd is on energy, and the 3rd is on the business environment. We use information from the first questionnaire for our analysis in this paper [Questionnaire No. 1A-DTDN].

[12] We assign a sampling weight of 5 for the non-state enterprises with less than 10 employees, and a weight of 1 for all other firms. Note that household enterprises (with less than 10 employees and small capital) are not included in the census but they do contribute to Vietnam GDP growth, job creation and poverty reduction significantly (GSO 2012).

[13] To reduce the risk of mismatches across years, I remove duplicates in terms of the panel identifiers within each year, and drop observations if the growth rates of capital, labor, and output are exceptionally large or small, and if the differences between end of period t capital/labor and beginning of period t+1 capital/labor are extremely large or small.

[14] The majority of the firms in the 4 sectors listed above belong to the same ownership type (private firms).

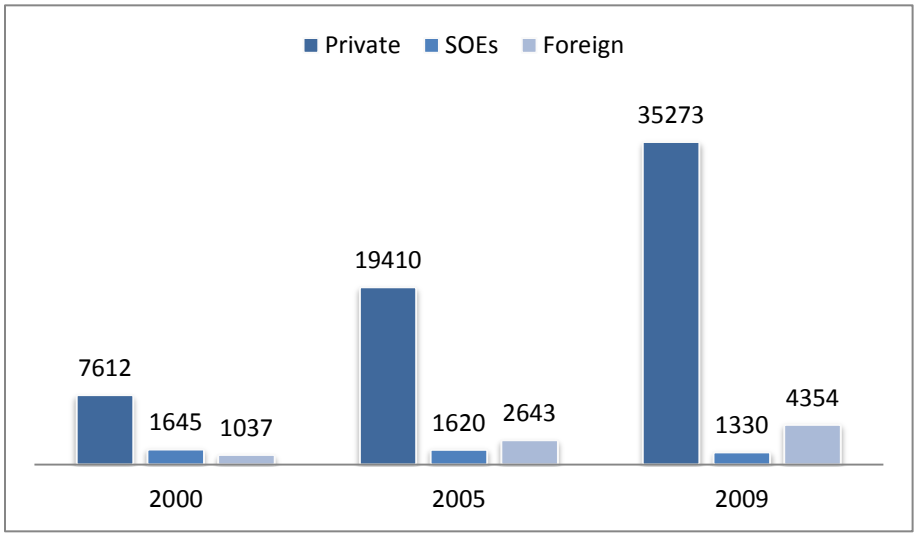
[15] Details of the data cleaning procedure are documented in Appendix A3D.

[16] See appendix A3A for variable definitions. We further trim off the top and bottom 1% of key variables per annum such as value added, capital, labor, debt, investment, et cetera. Therefore the sample sizes may vary for different tables hereafter.

(2009), the determinants of technical efficiency (years 2001-2005) by Carlin, Hoang, and Pham and Carlin (2008), the impact of economic growth on corruption (years 2006-2010) by Bai et al. (2013), industry switching by Newman, Rand, and Tarp (2013) using census 2001-2008, the relationship between pro-poor growth and the size distributions of manufacturing enterprises (years 2000-2004) by Shaffer and Le (2013), firm productivity, misallocation, and trade liberalization issues (Kiyota and Ha 2014, Ha and Kiyota 2015).

First I present some summary statistics related to ownership in the product and factor markets of Vietnam. Private firms dominate state and foreign firms in numbers (see figure 1). This dominance is reinforced over time. Private and foreign firms have grown more than 4 times in the decade. But the number of SOEs has decreased slightly since 2000.[17]

Figure 1: Number of firms by Year and Ownership



Source: census data 2000-2009 in Vietnam. Note: figures are weighted with sampling weights.

Table 1 displays the ownership distribution within (columns 2-4) and across regions (columns 6-9) for the years 2000 (panel A), 2009 (panel B), and all 10 years (panel C).[18] Firms are sorted into 4 groups based on their locations: Red River Delta (RRD), South

[17] The focus of SOEs reform before 2005 was on restructuring and equitizing SOEs. Since 2006, large state business groups and SCIC were created for the purpose of improving efficiency.

[18] Note that both figure 1 and table 1 are produced from the raw data but after removing the observations with duplicates in terms of value added/sales, (end of year) capital, labor, and debt within each year.

East (SE), Mekong River Delta (MRD), and all other regions.[19] The shares of private and foreign firms have increased but it has decreased for SOEs in all regions between 2000 and 2009. Most foreign firms are located in South East (67% in 2009). Private firms dominate in all regions in terms of firm numbers and are more evenly distributed across the 4 regions relative to SOEs and foreign firms.

Table 1
Ownership distribution within and across regions by year

	Distribution within regions				Distribution across regions			
	private	SOEs	foreign	Total	private	SOEs	Foreign	Total
Panel A: Year 2000								
Red River Delta	78.2	17.3	4.5	100	15.4	37.8	15.5	17.2
South East	80.6	6.4	13.0	100	25.4	22.4	71.7	27.5
Mekong River Delta	98.1	1.4	0.5	100	48.0	7.3	4.7	42.6
Other Regions	76.6	20.2	3.2	100	11.2	32.5	8.1	12.7
Total	87.1	7.9	5.0	100	100	100	100	100
Panel B: Year 2009								
Red River Delta	94.4	1.9	3.7	100	24.5	34.2	20.6	24.4
South East	93.0	0.8	6.2	100	46.7	28.3	67.1	47.4
Mekong River Delta	96.8	1.2	2.0	100	10.7	9.4	4.8	10.4
Other Regions	96.0	2.1	1.9	100	18.1	28.1	7.6	17.7
Total	94.3	1.3	4.4	100	100	100	100	100
Panel C: Years 2000-2009								
Red River Delta	90.8	4.8	4.4	100	25.2	35.3	18.0	25.1
South East	86.6	2.3	11.1	100	37.5	25.9	70.9	39.1
Mekong River Delta	97.0	1.7	1.3	100	19.5	9.0	3.7	18.2
Other Regions	91.6	5.8	2.6	100	17.8	29.8	7.4	17.6
Total	90.4	3.4	6.1	100	100	100	100	100

Note: all figures are with sampling weights; source: Vietnam census 2000-2009

[19] RRD, SE, and MRD represent the majority of manufacturing activities and FDI inflows in Vietnam.

Table 2
Firm Sizes, Wages and Capital Labor Ratio by Ownership

		Private	SOEs	Foreign
Labor	Mean	34	361	274
	p50	8	222	132
	contribution to total	49%	23%	28%
Capital	Mean	1371	17100	18634
	p50	236	6882	8339
	contribution to total	40%	22%	38%
Sales	Mean	2992	35667	29033
	p50	346	14549	10352
	contribution to total	45%	24%	31%
Wage per worker	Mean	5.8	9.6	12.0
	p50	4.9	7.9	9.4
Capital Labor Ratio	Mean	44.2	54.2	100.7
	p50	24.7	28.5	61.0

Note: unit for capital, sales, and wages is million VND; data are weighted by sampling weights. Source: same as table 1 (after data cleaning)

Although private firms dominate in numbers, they are much smaller in terms of employment, capital, and sales relative to SOEs and foreign firms.[20] Both the capital labor ratio and average wage per worker are the highest for foreign firms and smallest for private firms (see table 2). This is in line with the conjecture that the labor law in Vietnam affects SOEs and foreign firms most, although it could also reflect the higher worker skills and rent-sharing in larger firms. Nevertheless, the importance of private firms in the economy has been growing as they contribute the most to aggregate employment, capital, sales, and wages due to their dominance in numbers.

If private firms face more financial frictions than SOEs, one may expect that the fraction of capital financed from borrowing will be smaller for private firms than SOEs. Therefore I examine the debt asset ratios across ownership (see table 3).[21] The average debt asset ratio has increased from 20% to 43% for private firms and decreased from 60% to 55% for SOEs from 2001 to 2009. But the leverage ratios of SOEs (and foreign firms) remain much larger than those of private firms.

[20] Capital is defined as the end of period fixed assets and long-term investment.
[21] It's defined as the end of year net book values of debt payable over end of year total assets. I skip the statistics for other years to save space as they are similar.

Table 3
Debt Asset Ratio by Ownership and Year (with sampling weights)

year	private		SOEs		foreign	
	mean	median	mean	median	mean	median
2001	.20	.07	.60	.63	.41	.38
2005	.29	.24	.58	.61	.47	.47
2009	.43	.47	.55	.57	.48	.48
AVG	.28	.21	.59	.62	.46	.44

Note: the top/bottom 1% of debt asset ratio are trimmed off per annum; source: same as table 1

The financing structures of different ownership types can reflect capital market distortions to some extent. For example, private firms may rely more on self-financing and borrow from expensive and informal channels but have less borrowing from banks while SOEs may have access to cheap credit from formal sources. Therefore I investigate whether the financing structures are different between SOEs and private firms. Firms can finance investment from own capital, loans, state budget, and other sources.

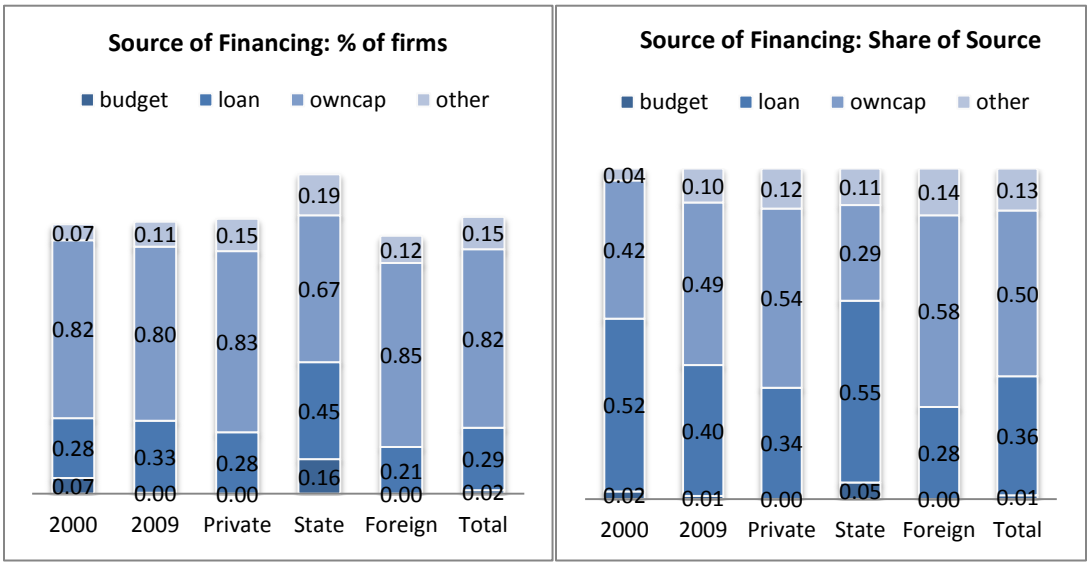
Figure 2 demonstrates the financing structures in 2000 and 2009 and also across ownership types. The left panel of figure 2 shows that more than 82% of private and foreign firms finance investment from own capital but this is only 67% for SOEs. 45% of the SOEs finance investment from loans compared to only 29% for private firms and 21% for foreign firms. Another 16% of SOEs also finance investment from the state budget, which is unavailable for most private and foreign firms.

The right panel of figure 2 shows the contribution to aggregate investment of each finance source. Own capital and loans are the two major sources of financing. But the share of loans in aggregate investment has decreased from 52% to 40% in the decade, meanwhile the share of own capital in aggregate investment has increased from 42% to 49%. In particular, 55% of the aggregate investment by SOEs is financed from loans compared to 34% for private firms and 28% for foreign firms. On the other hand, the share of own capital in aggregate investment is much lower for SOEs than private and foreign firms (29% versus 54% and 58%). Other source of financing takes up 11%-14% of aggregate investment in 2009 for all ownership types. Last but not least, the state

budget also accounts for 5% of the aggregate investment for SOEs but almost zero for private and foreign firms.

The evidence presented above for the financing structures across ownership types basically confirms that SOEs and private firms have different financing structures. This is consistent with the expectation that SOEs and private firms experience different degrees of financial frictions.

Figure 2: Source of Investment by Year and Ownership



Source: Vietnam Census 2000-2009. Note: figures are weighted with sampling weights.

4.2 The World Bank Investment Climate Survey (ICS) 2005

A second data source is also used in the paper, namely the World Bank Investment Climate Survey (2005) for Vietnam, for three reasons. First, it is interesting and important to investigate land market distortions which have been noted to be severe in Vietnam and the ICS has information on land/buildings. Second, the ICS data provides more information on human capital compared to the census, including the numbers of professionals, skilled and unskilled production workers, non-production workers, the education levels of employees, et cetera, which facilitates analyzing labor market distortions. Third, the quality of the ICS data may be better than the census. The analysis with ICS data provides a direct comparison with the results from the census data.

The ICS data was conducted in the summer of 2005. The survey covers all ownership types and all manufacturing sectors except coke and refined petroleum, radio and communication equipment, and medical, precision and optical instruments.[22] I remove the observations if any of the key variables (e.g. log of value added, capital, labor, and land/buildings) is with missing or non-positive values. I also trim off the top and bottom 1% of the data for the key variables. Capital and land/buildings are deflated by a capital deflator, while value added, wages, liabilities, and interest payment are deflated by the GDP deflator (same deflators as used for the census for year 2004).[23]

Because firms may face different degrees of financial frictions, it is helpful to first look at the borrowing, interest payments, and sources of financing across ownership types. Table 4 presents the results, which corroborates the findings from the census data. The table shows that on average SOEs borrow the most and make the largest interest payments while private firms borrow the least and have the smallest interest payments. I further examine whether the borrowing structure differs across ownership types (see figure 3).[24] On average, the largest source of financing for both working capital and new investment is retained earnings for both private and foreign firms against loans for SOEs. For example, financing from retained earnings is on average 63.7% (72.2%) for working capital and 54.4% (68.4%) for new investment for private (foreign) firms but only 29% for SOEs. The major source of financing for SOEs is loans from commercial banks, which takes up 46% of the working capital and 35% of the new investment. On average, less than 18% of the capital is financed from loans for private and foreign firms. State budgets are mostly directed to SOEs. Other sources of financing include the development assistance fund (DAF), leasing arrangement, trade credit, and borrowing from money lenders and friends and family. On average, other sources of financing contribute more than 12% to working capital and new investment for private firms and SOEs.

[22] The ICS did cover only 1 or 2 firms from tobacco and printing and were grouped into the "other manufacturing", which includes production of musical instruments, fine arts, handcrafts, et cetera. Furniture is grouped into the sector of wood and wood products. We document the grouping in detail in Appendix A3C.

[23] See appendix A3A for the definitions of key variables and appendix A3D for details of the data cleaning.

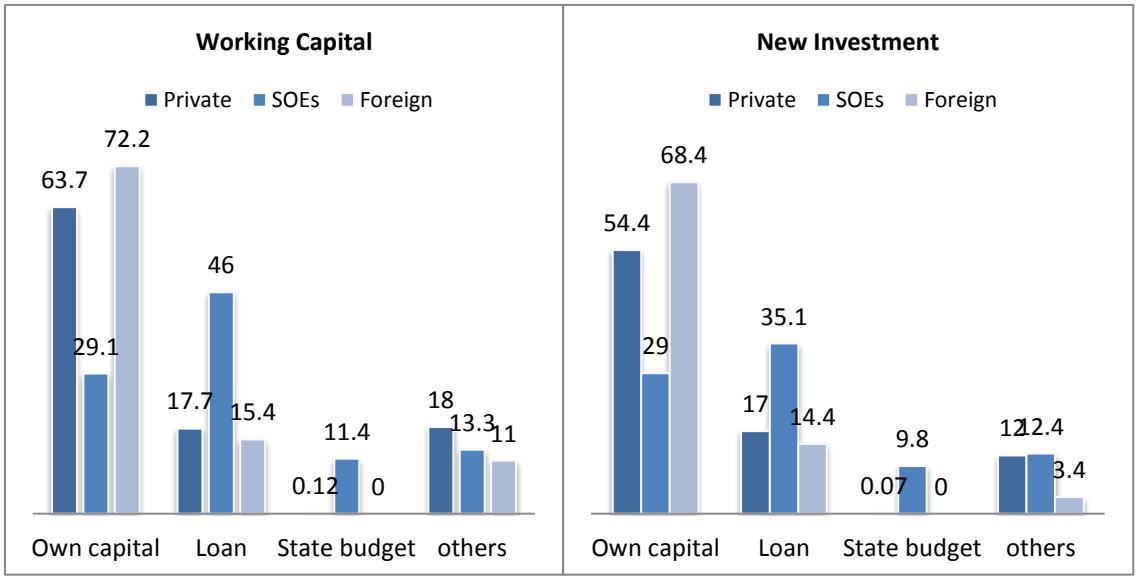
[24] Each bar in the graph is the average of the shares of financing from each source for each ownership type. Hence for example, the sum of the 4 bars (financing from own capital, loan, state budget, and others) in panel A or B for private firms may not be exactly 100 due to rounding errors. But for each individual firm, the 4 sources of financing should be exactly 100.

Table 4
Liabilities and Interest Payment across Ownership

		Private	SOEs	Foreign	Total
Liabilities	Mean	3748.9	30485	11424.4	7458.4
	Median	1104.2	14511.7	5580.0	1545.5
Interest Payment	Mean	155.5	1224	209.8	254.3
	Median	21.5	366.6	5.0	21.7

Notes: data are with sampling weights; Source: World Bank ICS 2005 for Vietnam

Figure 3: Financing Sources for Working Capital and New Investment



Source: World Bank ICS 2005 for Vietnam; Note: figures are weighted with sampling weights.

If SOEs and foreign firms experience more labor market regulations than private firms, one would expect that the labor costs will be higher for the former than the latter. However, wage differences may also reflect skill differentials. For that matter, I sort labor into skilled and unskilled labor, where skilled labor includes professionals and skilled production workers while unskilled labor includes unskilled production workers, non-production workers, and temporary workers. Panel A of table 5 shows that private firms are the smallest and SOEs are the largest in terms of the (mean and median) numbers of skilled and unskilled labor.[25] The average labor costs (wages and benefits) per worker (for both skilled and unskilled labor) are the smallest for private firms and the largest for

[25] The only exception is that the mean number of unskilled laborers for foreign firms is larger than SOEs.

foreign firms. This is consistent with our expectation, although the higher wages can also reflect different rent-sharing schemes across ownership types.

It is equally interesting and important to find out any distortions in the market for land/buildings. Panel B and panel C of table 5 show the distribution of land sizes occupied and the replacement values of land/buildings across ownership and firm size. The mean and median land sizes and replacement values of land/buildings occupied are the largest for SOEs and the smallest for private firms. Both land sizes and replacement values are increasing in firm sizes. The mean and median prices of land/buildings per m^2 are the highest (smallest) for foreign firms (SOEs).[26] SOEs have much more lands in hand than private firms. This is also consistent with the evidence for land market distortions documented in section 2.

Table 5
Labor and Land and Buildings Across Ownership (and Size)

	Private		SOEs		Foreign	
Panel A: Labor and Wages						
	mean	median	mean	median	mean	median
Skilled Labor	65.7	24.0	434.1	216.0	162.4	54.0
Unskilled Labor	47.5	16.0	157.7	68.0	171.8	35.0
Total Labor	113.2	40.0	591.7	365.0	334.2	120.0
Skilled labor cost per worker	16.4	14.6	18.9	17.0	27.3	23.5
Unskilled labor cost per worker	11.2	10.0	14.3	11.1	14.7	12.5
Labor cost per worker	6.4	5.8	7.7	6.8	9.1	8.6
Panel B: Land Size Occupied (m^2)						
Small	3490	1500	41830	9319	11492	5000
Medium	9633	3500	21487	12000	11752	5300
Large	21358	10000	62489	36000	23045	13800
Panel C: Replacement Values of Land and Buildings (Million VND)						
Small	4087	2282	13397	7625	18824	1501
Medium	8604	3603	24740	12008	15918	3603
Large	30648	12609	54808	37052	40037	19213

Note: data is weighted by sampling weights; source: World Bank ICS 2005.

[26] The mean (median) prices of land/buildings per m^2 are 8.2, 3.9, and 16 (.96, .85, and 1) respectively for private firms, SOEs and foreign firms.

5 Empirical and Simulation Results

In this section the estimates of the translog production function are presented for the panel census and the cross-section ICS data. Keniston (2011) found that structural models of production functions appear to be effective in recovering the parameters of production functions in the context of developing markets. Hence the estimates are used to derive the MRPs.[27] I further explore the dispersion of the MRPs across ownership, controlling for the estimation period (for panel data), sector, region, and size of the firms, where the coefficients for the ownership dummies capture the degree of distortions experienced by SOEs and foreign firms (relative to private firms). Finally, I calculate the GDP changes by simulation after removing the distortions related to ownership but keeping other distortions unchanged.

5.1 Estimation of the Factor Market Distortions with Census and ICS Data

The census data form an unbalanced panel allowing one to control for (time-invariant) unobserved heterogeneity and potential omitted variable bias. The ICS data are cross-sectional data but provide more information than the census, particularly on the replacement values of land/buildings and the numbers and costs of skilled and unskilled workers. The empirical specifications of the translog production function are as follows, with equation (5) for the census data, and equations (6) and (7) for the ICS data with homogenous and heterogeneous labor respectively:

Census data

$$\ln VA_{it} = a_0 + a_1 \ln L_{it} + a_2 \ln K_{it} + \frac{a_3}{2} \ln L_i^2 + \frac{a_4}{2} \ln K_i^2 + a_5 \ln L_{it} \ln K_{it} + \eta_i + d_t + \varepsilon_{it} \quad (5)$$

ICS data

$$\ln VA_i = b_0 + b_1 \ln L_i + b_2 \ln K_i + b_3 \ln D_i + \frac{b_4}{2} \ln K_i^2 + oct_i + v_i \quad (6)$$

[27] Table A3.5 and A3.6 in appendix A3D present the summary statistics for the key variables from the census and ICS data. Cobb-Douglas production function is rejected for both datasets with p-values close to zero at 99% significance level.

$$\ln VA_i = b_0 + b_1 \ln L_{1i} + b_2 \ln L_{2i} + b_3 \ln K_i + b_4 \ln D_i + \frac{b_5}{2} \ln {L_{1i}}^2 + \frac{b_6}{2} \ln {L_{2i}}^2 + \frac{b_7}{2} \ln {K_i}^2 + oct_i + v_i \quad (7)$$

where $\ln VA$, $\ln L$, $\ln L_1$, $\ln L_2$, $\ln K$, $\ln D$ denote value added, total labor, skilled labor, unskilled labor, capital, and replacement value of land and building respectively (all after logarithmic transformation);[28] $\ln K^2$, $\ln L^2$, $\ln {L_1}^2$, $\ln {L_2}^2$ are the square terms of capital and total, skilled and unskilled labor; $\ln L \ln K$ is the interaction between labor and capital; η_i is the time-invariant firm-specific fixed effect; d_t are time dummies; oct refers to any other variables used to approximate the revenue productivities.

The square of (log) land/buildings and the interaction terms between (log) labor and capital and between (log) labor and land/buildings are excluded in equations (6) and (7) due to small and (individually and jointly) insignificant coefficients. For the same reason, $\ln L^2$ is excluded in equation (6). The interaction terms between skilled and unskilled labor ($\ln L_1 \ln L_2$) and between capital and land/buildings ($\ln K \ln D$) are also excluded in eq. (7) even though the corresponding coefficients are significant. This is because the inclusion of them leads to a violation of the 2nd order conditions for profit maximization for more than 30% of the observations.

The coefficients for the production inputs may be biased and inconsistent if they are correlated with the unobserved productivity shocks (i.e. endogeneity). With panel data, the endogeneity issue can be solved to some extent by either an Instrumental Variable approach and generalized method of moments (Blundell and Bond 2000) or by a control function approach to approximate the unobserved productivity with either investment (Olley and Pakes 1996) or material inputs (Levinsohn and Petrin 2003).[29] With cross-sectional data, the best one can do to reduce the bias is to include as many observable variables related to productivity as possible. Since the focus of this paper is not to obtain precise estimates of the coefficients for the production inputs and calculate firm-level

[28] Value added is equal to the value of production minus raw materials and energy costs in the ICS, and the sum of net profit, wage, depreciation, and indirect taxes in the census. We choose the replacement value rather than the book values of land/buildings or the land size because this measure can capture both the current market price of land/buildings and the impact of land size and location on land values.

[29] The control function approach is not feasible here as investment data are subject to large measurement errors and data on material inputs are not available.

Table 6
Estimation of Translog Production Function with Census and ICS data

	(1)	(2)	(3)
	Census 2000-2009	ICS 2005	ICS 2005
lnK	.078***	-.132	-.016
	(.013)	(.110)	(.127)
lnD	--	.058***	.077**
	--	(.022)	(.023)
lnL	.605***	.715***	--
	(.021)	(.036)	--
LnL_1	--	--	.169*
	--	--	(.097)
LnL_2	--	--	.168**
	--	--	(.067)
lnL^2	.060***	--	--
	(.006)	--	--
lnK^2	.024***	.055***	.037**
	(.003)	(.015)	(.017)
lnL_1^2	--	--	.051**
	--	--	(.021)
lnL_2^2	--	--	.033*
	--	--	(.018)
lnLlnK	-.020***	--	--
	(.003)	--	--
Constant	2.245***	1.905**	2.077**
	(.054)	(.695)	(.709)
Year dummies	YES	NO	NO
Firm controls[#]	NO	YES	YES
Firm unit fixed effects	YES	NO	NO
N	172255	813	781

Note: standard errors in parentheses; * $p < .05$, ** $p < .01$, *** $p < .001$; clustered standard errors for column (1); #: firm controls in columns (2) and (3) include ownership, sector and region dummies, and the additional controls the fractions of female workers and production workers, average education level, capacity utilization, dummies of intense competition/bribe/loan, dummies of whether has branch or not, whether use email for sales or not, whether located in an industrial zone or not, and whether receive trade credit or not.[30] Source: Vietnam Census 2000-2009 and World Bank Vietnam ICS 2005.

[30] I include these additional controls to reduce potential omitted variable bias as these variables can capture productivity shocks to some extent and are likely to be correlated with the labor inputs choices as well.

productivity but rather predict the marginal products of production inputs, the endogeneity issue may be less of a concern.[31]

Table 6 presents the estimation results for the translog production function, with column (1) for the census data (eq. 5),[32] and columns (2) and (3) for the ICS data with homogenous (eq. 6) and heterogeneous (skilled and unskilled) labor (eq. 7) respectively.

Table 7 presents the distribution of the MRPs for capital, labor, and land/buildings derived from the estimated translog production functions.[33] The table tells that the averages and the variation of the MRPs across ownership, firm size, and region are larger in the ICS than in the census.[34] The average MRPL in the ICS is much more in line with the average monthly wage income of workers in 2011 reported by the general statistical office (GSO),[35] whereas the average MRPK in the census is closer to the cost of borrowing in Vietnam reported by the World Bank.[36]

[31] I have estimated the production function by GMM but the derived MRPs are not substantively changed.
[32] The estimation is clustered at the firm level. It could be argued that the data for 2000 are least unreliable because in 2000 the census was in its pilot stage and the survey design was immature compared to later years. But the estimation results for the production function with and without the 2000 data are very similar. Therefore I use the data from all years for the analysis.
[33] Note that the top and bottom 1% of MRPs are dropped before producing the statistics.
[34] The results are robust to: 1) restricting the sample for comparison to be in the same sectors, regions, and size groups, or 2) deriving the MRPs by OLS to reduce the downward bias of FE regression in the presence of measurement error for the census data.
[35] Monthly wage is obtained by dividing the estimated MRPL by 12 which is close to the average monthly wage of 3105 thousand VND for Vietnam reported by the GSO.
[36] Data can be found on http://data.worldbank.org/indicator/FR.INR.LEND. The cost of borrowing ranges from 9.1% to 15.8% between 2000 and 2009.

Table 7
Distribution of Marginal Revenue Products MRPs

		ICS				Census	
		MRPK	$MRPL_1$	$MRPL_2$	MRPD	MRPK	MRPL
Ownership	Private Firms	.88	26.66	41.51	.07	.11	6.34
	SOEs	.92	31.70	90.85	.13	.13	10.96
	Foreign Firms	.81	62.13	78.20	.17	.11	13.95
Size	Small Firms	.74	25.82	41.29	.07	.10	6.40
	Medium Firms	.96	34.94	56.05	.10	.14	9.42
	Large Firms	1.05	47.26	67.95	.13	.15	9.44
Region	Red River Delta	.82	22.80	42.07	.11	.10	5.78
	South Central Coast	1.03	24.61	43.78	.06	.11	5.01
	South East	.85	36.84	60.48	.08	.13	8.38
	Mekong River Delta	.98	44.88	34.88	.12	.10	7.43
	North Central Coast	.94	25.53	22.77	.09	.10	5.07
	North East and West	--	--	--	--	.09	4.96
	Central Highland	--	--	--	--	.11	5.97
	Number of Firms	742	742	742	742	167234	167234

Note: figures are with sampling weights; the unit for MRPs here is million VND; source: ICS 2005 and census 2000-2009

According to equations (3) and (4), the dispersion of the MRPs is caused by distortions in factor markets and imperfect competition in product market. Both factor market distortions and product differentiation probably vary across sectors and regions. Private firms may face different policy and institutional distortions from SOEs in the factor markets, e.g. SOEs have preferential access to capital and land compared to private firms. Some policy regulations (e.g. labor code) are purportedly effective only for relatively large and formal firms. Last but not least, size dummies can to some extent proxy for investment frictions (adjustment costs), measurement errors (e.g. misreporting), and idiosyncratic demand shocks (variable markups), which also cause dispersion in the MRPs but are not captured in equations (3) and (4).[37]

Therefore one can analyze the dispersion of the MRPs by regressing them on sector/size/region/ownership dummies. The coefficients of the ownership dummies then

[37] For instance, large firms may face larger investment frictions than small firms and may not respond to productivity shocks immediately, resulting in higher MRPs. Oostendorp and Zhou (2014) find that misreporting in sales is systematically related to firm sizes.

capture the mean distortions in the factor markets for SOEs and foreign firms relative to private firms, keeping sector, location, and firm size in place. A positive (negative) coefficient for the SOEs dummy implies that state firms face higher (lower) average distortions relative to private firms, ceteris paribus.

For the panel estimates of the MRPs (from the census), the impact of the (virtually) time-invariant ownership dummies can be estimated with various approaches (Mundlak 1978, Chamberlain 1982, Chamberlain 1984, Hausman and Taylor 1981, Plumper and Troeger 2007). I use the correlated random effects (CRE) model to control for any correlation of observed variables with unobserved firm specific heterogeneity (eq.8, Mundlak approach) by including ownership dummies, time invariant variables (e.g. region dummies), and the group means of time-varying regressors (year/sector/size dummies).[38] For the cross-sectional estimates of the MRPs (from ICS), it is difficult to control for omitted (unobserved) variables bias and unobserved heterogeneity (eq.9) due to data limitations. The empirical specifications for the census and ICS data can be expressed as follows:

Census data

$$\ln \mathrm{MRPX}_{it} = b_1 + \sum_{h=2}^{3} b_h \mathrm{own}_{h_{it}} + \sum_{h=2}^{3} b_{h+2} \mathrm{sizeL}_{h+1_{it}} + \sum_{h=1}^{7} b_{5+h} \mathrm{regd}_{h_i} + \sum_{h=2}^{19} b_{12+h} \mathrm{secd}_{h_{it}} + \sum_{h=2}^{10} b_{31+h} \mathrm{yr}_{h_{it}} + \mathrm{otrs}_{X_{it}} + u_{X_i} + \varepsilon_{X_{it}} \quad (8)$$

ICS data

$$\ln \mathrm{MRPX}_{i} = b_1 + \sum_{h=2}^{3} b_h \mathrm{own}_{h_i} + \sum_{h=2}^{3} b_{2+h} \mathrm{sizeL}_{h_i} + \sum_{h=1}^{5} b_{5+h} \mathrm{regd}_{h_i} + \sum_{h=1}^{11} b_{10+h} \mathrm{secd}_{h_i} + \varepsilon_{X_i} \quad (9)$$

where $X = K/L$ for the census data and $X = K/L/L_1/L_2/D$ for the ICS data; own_2 and own_3 are the ownership dummies for SOEs and foreign firms respectively; $\mathrm{secd}, \mathrm{regd}, \mathrm{sizeL}, \mathrm{yr}$ are sector, region, size, and year dummies; otrs include the group means of time varying variables e.g. year, sector and size dummies; and u is the individual random effect uncorrelated with other variables in the equation.

[38] The CRE assumes that after including the time-invariant variables and group means of time-varying variables, the individual specific effect is independent of the regressors in the model.

Table 8 presents the estimation results for equations (8) (columns (1)-(2)) and (9) (columns (3)-(9)). Controlling for sector, size, and region dummies, SOEs and foreign firms have significantly lower MRPK and MRPD but higher MRPL than private firms on average.[39] Medium and large firms have significantly higher MRPs than small firms. To summarize, I find evidence that private firms face higher average distortions than SOEs in the markets for capital and land/buildings. SOEs face higher labor market distortions on average than private firms, particularly for unskilled labor.

[39] The coefficient of SOEs dummy is -.032 and significant at 10% level in the census, which is much smaller than the coefficients of the SOE dummies in the ICS (-0.251 and -0.348).

Table 8
Dispersion of Log of Marginal Revenue Products of Capital, Labor, and Land and Buildings

	(1) Census log(MRPK)	(2) Census log(MRPL)	(3) ICS log(MRPK)	(4) ICS log(MRPL)	(5) ICS log(MRPD)	(6) ICS Log(MRPK)	(7) ICS Log($MRPL_1$)	(8) ICS Log($MRPL_2$)	(9) ICS Log(MRPD)
SOEs	-.032*	.357***	-.251**	.406***	-.198*	-.348***	.169*	.699***	-.264**
	(.018)	(.014)	(.082)	(.068)	(.120)	(.090)	(.088)	(.116)	(.123)
Foreign	-.496***	.435***	-.274**	.749***	.372**	-.302**	.921***	.552***	.370**
	(.016)	(.013)	(.119)	(.106)	(.174)	(.130)	(.127)	(.168)	(.178)
Medium	.315***[a]	-.188***[a]	.573***	--	.488***	.440***	.276***	.209	.537***
	(.013)	(.011)	(.076)	--	(.110)	(.084)	(.082)	(.108)	(.114)
Large	.599***[a]	-.305***[a]	.1.132***	--	1.280***	.917***	.530***	.494***	1.289***
	(.021)	(.018)	(.095)	--	(.138)	(.105)	(.103)	(.136)	(.144)
Constant	-3.186***	1.071***	-1.083***	2.759***	-3.787***	-.865***	2.645***	2.539***	-3.612***
	(.023)	(.018)	(.110)	(.086)	(.160)	(.121)	(.118)	(.156)	(.165)
Region dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummies	YES	YES	NO	NO	NO	NO	NO	NO	NO
Other controls[b]	YES	YES	NO	NO	NO	NO	NO	NO	NO
Observations	167234	167234	783	783	783	742	742	742	742
R-squared	--	--	.210	.288	.179	.143	.259	.219	.169

Note: Standard errors in parentheses; * $p < .05$, ** $p < .01$, *** $p < .001$; I trim off the top/bottom 1% of the MRPs before running the above regressions on both datasets; columns (1) and (2) present the estimation results of equation (8) using the correlated random effects model including within averages of time-varying variables as additional controls; [a]: the coefficients of the within averages of size dummies are -.06 and -.16 in column (1) and .40 and .57 in column (2); the size dummies are dropped in column (4) because the coefficients are small and insignificant; [b]: refers to within averages of year/sector/size dummies. Estimates using the Vietnam Census 2000-2009 and ICS 2005.

5.2 Simulation Strategy for Neutralizing Ownership Distortions

In this section I will elaborate on the simulation strategy for removing the ownership distortions between SOEs and private firms in the market for capital while keeping other sources of dispersion unchanged (e.g. region/sector/size). The same simulation strategy also applies to labor and land/buildings. Simulation is performed on firms within the same year. Therefore it is assumed that the production factors can move freely between SOEs and private firms from all sectors, regions, and firm size groups within the same year. For ease of simulation, I assume a proportional reallocation in the capital market, which means that all SOEs reduce their demand for capital by the same fraction, and all private firms increase their demand for capital by the same fraction.[40]

The simulation starts from the basic idea that one can treat the **means** of (log) MRPK for SOEs and private firms as implicit interest rates. Suppose the estimated average ownership distortion for capital is negative ($b_2 < 0$), it implies that the implicit interest rate faced by SOEs is $-b_2$ lower than private firms (keeping others the same).[41] To remove this interest rate gap, one can increase the implicit interest rate for SOEs by $\Delta r > 0$ and decrease the implicit interest rate for private firms by $-b_2 - \Delta r$. SOEs will cut their demands for capital and hence release unwanted capital (surplus) into the market when borrowing becomes more expensive for them. Similarly, private firms will increase their demand for capital and create a shortage of capital in the market as borrowing becomes cheaper for them. If the surplus is larger than the shortage for a given value of Δr, one can decrease Δr till the surplus is exactly equal to the shortage, and vice versa.[42]

The simulation procedure above can be illustrated further with a few equations. Before reallocation, the difference of the average log of MRPK between state and private firms is equal to:

$$\overline{\ln(\mathrm{MRPK_s})} - \overline{\ln\left(\mathrm{MRPK_p}\right)} = b_2 + \mathrm{otr_k}$$

[40] We choose proportional reallocation for its simplicity and analytical tractability. One can consider the more complex strategy where SOEs with the lowest MRPs transfer most and private firms with highest MRPs receive most of the production factor.

[41] b_2 is the coefficient of the SOE dummy in equations (8) and (9), the capital market distortion for SOEs relative to private firms keeping everything else the same.

[42] The details of the derivations for simulation are in the Appendix A3F.

where otr_k captures the difference of the mean log MRPK due to sector, size, and region. Suppose $b_2 < 0$ and the implicit interest rate of SOEs is increased by Δr and the implicit interest of private firms is decreased by $-b_2 - \Delta r$ (the MRPK after reallocation is denoted with a prime):

$$\overline{\ln(MRPK'_s)} - \overline{\ln(MRPK_s)} = \Delta r$$

$$\overline{\ln(MRPK'_p)} - \overline{\ln(MRPK_p)} = b_2 + \Delta r$$

Deducting the above 2 equations on both sides, I have

$$\left(\overline{\ln(MRPK'_s)} - \overline{\ln(MRPK'_p)}\right) - \left(\overline{\ln(MRPK_s)} - \overline{\ln(MRPK_p)}\right) = -b_2 \quad (10)$$

Equation (10) shows that the simulation reduces the gap of implicit interest rates between SOEs and private firms by $-b_2$. Besides, the surplus of capital released by SOEs should be exactly equal to the shortage of capital expressed by private firms in the simulation:

$$kt_{out} \sum_{i=1}^{N_{out}} K_i - kt_{in} \sum_{h=1}^{N_{in}} K_h = 0 \quad (11)$$

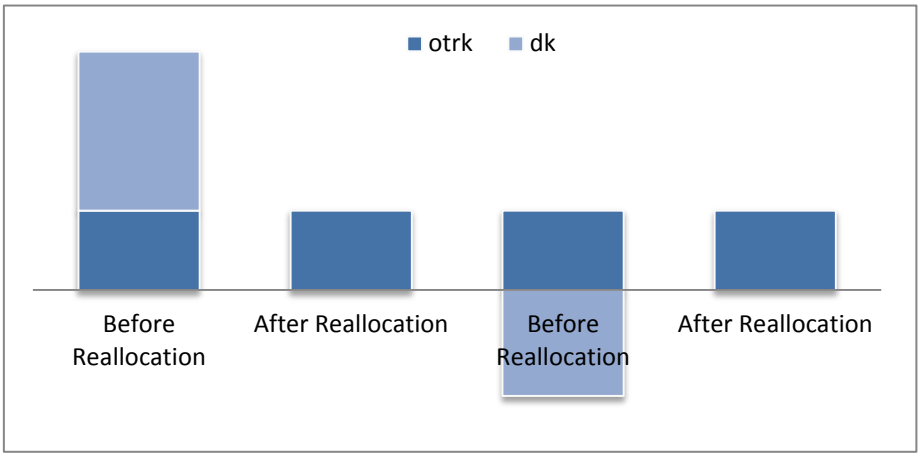
where kt_{out} and kt_{in} are the fractions of capital transferred and received; and N_{out} and N_{in} are the numbers of transferring and receiving firms. The simulation searches for an optimal value of Δr that satisfies both equations (10) and (11). This value implicitly pins down the optimal reallocation to remove the ownership distortions with proportional reallocation.

Figure 4 further illustrates the above simulation strategy graphically. Bars 1 and 3 show the differences of mean log of MRPK between SOEs and private firms before reallocation due to ownership being positive (bar 1) or negative (bar 3). Bar 2 and 4 give the difference of mean log of MRPK between SOEs and private firms after reallocation to remove the average capital market distortions due to ownership.[43]

Finally, summing up the outputs across firms before and after reallocation, one can calculate the GDP changes. The simulation process for labor and land/buildings is the same as for capital.

[43] Simulation shows that the difference of mean log MRPK between SOEs and private firms from sector, size, and region (otr_k) doesn't change with the reallocation, although the mean log MRPK contributed by sector, size, and region for both SOEs and private firms change with the reallocation.

Figure 4: Difference of Avg. MRPK between SOEs and Private Firms Before and After Reallocation



In this paper I calculate the GDP changes from hypothetical reallocation with linear aggregation of outputs across firms from each sector, whereas Hsieh and Klenow (2009) directly calculate the aggregate TFP losses by assuming some functional forms for aggregation within and across sectors. For instance, they assume a Cobb-Douglas production function at firm level, CES aggregation within sectors, and Cobb-Douglas aggregation across sectors. In my case the Cobb-Douglas production function is rejected in favor of the translog production function at the firm level for each of the datasets that I use.

5.3 Simulation Results for Removing Ownership Distortions

In this section I present the simulation results after removing the distortions related to ownership in the markets for capital, labor, and land/buildings (see Table 8 for the coefficient of SOEs dummy) using the simulation strategy illustrated in the previous section. The simulation gives the direction and extent of factor reallocation between SOEs and private firms and the resulting changes in aggregate outputs from removing the ownership distortions while keeping other distortions unchanged.

Before presenting the simulation results, I first decompose the raw difference in the mean log MRPs for capital, labor and land/buildings between SOEs and private firms across ownership, size, sector, and region (see Table 9). The differences in the mean log MRPs due to differences in sector and region are relatively small with varying signs. The contribution to the differences in the log mean MRPs by firm size for capital, labor, and land/buildings is positive and large (see

the column denoted by 'size'), and is of opposite sign of the contribution by ownership (except for labor). The pattern is consistent across both datasets, despite with varying degrees. This suggests that size may be a confounding factor when calculating the efficiency gains from neutralizing ownership distortions in the factor markets, given that MRPs increase with firm size and SOEs are larger than most private firms.

Table 9
Decomposition of Differences of Mean log(MRPs) Between SOEs and Private Firms

	Total	ownership	Size	Sector	Region	Year	Random Effect
ICS: Capital	-.08	-.35	.30	-.04	.01	--	--
ICS: Land and buildings	.15	-.26	.43	-.01	-.00	--	--
ICS: Skilled Labor	.28	.17	.17	-.04	-.01	--	--
ICS: Unskilled Labor	.91	.70	.16	.06	-.01	--	--
Census: Capital	.21	-.03	.24	.03	-.06	.02	.01
Census: Labor	.51	.36	.16	.04	-.07	-.09	.11

Source: census 2000-2009 and ICS 2005.

A. Simulation to Remove Ownership Distortions in Capital

How does manufacturing GDP change if one would remove the ownership distortions in one or more factor markets while keeping other distortions unchanged? Table 10 presents the simulation results of removing the capital market distortions between SOEs and private firms using the census (panel A, row 1) and ICS data (panel B for homogenous labor and C for heterogeneous labor, row 1).[44] The distortion parameters for capital are negative and significant in both datasets (more so for ICS data), implying that SOEs face fewer distortions in the capital market relative to private firms. To neutralize the ownership distortions in the capital market, around 3% (21%-25%) of capital should be transferred from SOEs to private firms in the census (ICS) data but surprisingly the resulting GDP changes are small and even negative for both datasets (ΔGDP1).

[44] Here we focus on reallocation between SOEs and private firms because many foreign firms do not really finance in the Vietnamese capital market.

Table 10
Simulation for Removing Capital Distortion, With Robustness Checks

	Distortion parameter	Share transferred for SOEs	Share received for Private Firms	ΔGDP1	ΔGDP2
		Panel A: Census 2000-2009			
Data	-.032	-.029	.016	-.001	.006
Y_p*1.1	-.126	-.109	.061	-.002	.019
Y_p*1.2	-.210	-.179	.100	-.003	.028
Y_p*1.3	-.285	-.238	.133	-.003	.035
		Panel B:ICS 2004 (Homogenous Labor)			
Data	-.251	-.212	.321	-.002	.090
Y_p*1.1	-.333	-.280	.428	.000	.114
Y_p*1.2	-.413	-.346	.530	.004	.137
Y_p*1.3	-.489	-.405	.624	.007	.158
		Panel C: ICS 2004 (Skilled and Unskilled Labor)			
Data	-.348	-.248	.382	.002	.113
Y_p*1.1	-.404	-.288	.443	.006	.132
Y_p*1.2	-.482	-.343	.530	.009	.155
Y_p*1.3	-.545	-.386	.598	.014	.171

Note: Y_p*1.1/1.2/1.3 refers to scaling up the output of private firms by 10/20/30 percent to control for potential mismeasurement (e.g. misreporting) in output; ΔGDP2 refers to the average of the GDP changes from capital reallocation if private firms would have the same employment as SOEs from which the capital is transferred. Source: Vietnam census 2000-2009 and ICS 2005.

The observed outputs used to calculate MRPs are values with output distortions and it is likely that private firms face more output distortions or charge lower markups than SOEs or misreport more than SOEs. For example, Zhou and Oostendorp (2014) detects different degrees of misreporting behaviors in sales by firms of different sizes to the tax office and in the survey in Mongolia, whereas ownership has been shown to be positively correlated with firm size in both census and ICS data for Vietnam.[45] Besides, private firms may be solicited for bribes while SOEs are not; private firms may face unfair competition from SOEs in the product market. What matters for efficiency are the real MRPs rather than observed MRPs. There is a risk of underestimating the GDP changes from reallocation with the observed MRPs. Hence I scale up the outputs of private firms in both datasets by 10%, 20%, and 30% respectively, assuming that private firms face more output distortions than SOEs. Table 10 shows that the estimated capital market distortions become larger with the scale-ups in outputs for private firms (rows 2-4 in each

[45] Zhou and Oostendorp (2014) is the second chapter of my PhD dissertation.

panel). The shares of capital transferred from SOEs to private firms have also increased. The resulting GDP changes increase slightly but remain small, however.

How to explain the small (and even negative) GDP changes from neutralizing ownership distortions in the capital market? Table 9 has shown that the raw ownership difference in the mean log MRPK ($\overline{\ln \mathrm{MRPK}_s} - \overline{\ln \mathrm{MRPK}_p}$) that can be explained by the difference from region and sector is small. But the contribution to the difference by size is positive and large, and of opposite sign of the contribution by ownership dummies in both datasets. SOEs are much larger than most private firms in both datasets, hence counteracting the efficiency gain from a reallocation of capital from SOEs to private firms to neutralize ownership distortions. If private firms would have had the same employment sizes as SOEs from which capital is transferred,[46] the resulting GDP changes from capital reallocation would be much larger (9%-11.3% for ICS and 0.6% for census - see last column of table 10).[47] The GDP changes from reallocation are even larger when scaling up the outputs of private firms to account for the possibility that private firms suffer from larger output distortions or misreport more than SOEs.

B. Simulation to Remove Ownership Distortions in Labor

It's more difficult to deal with the market distortions for labor as labor is measured in numbers rather than values (capital is measured in values), which does not capture the large heterogeneity in labor quality and the number of hours worked within and across firms. The simulation results from removing labor market distortions may therefore be misleading if one does not control for labor heterogeneity.

[46] We document the details of the simulation procedure in Appendix A3F.

[47] Due to the randomness of the matching between SOEs and private firms, we repeat the simulation 500 times and calculate the 500 resulting GDP changes. I find that the calculated GDP changes are closely clustered around their average (with standard deviation less than 10% of the mean).

Table 11
Simulation Results from Removing Labor Distortion

	Distortion Parameter	Share reallocated for SOEs	Share reallocated for Private Firms	ΔGDP1
		PANEL A: Homogenous Labor		
Census	.357	.475	-.967	.145
ICS	.406	.742	-.580	.049
		PANEL B: Skilled Labor (ICS)		
data	.169	.183	-.174	.007
Y_p *1.1	.093	.102	-.097	.003
Y_p *1.2	.014	.015	-.015	.000
Y_p *1.3	-.047	-.051	.049	-.001
		PANEL C: Unskilled Labor (ICS)		
data	.699	.798	-.447	.037
Y_p *1.1	.618	.709	-.397	.028
Y_p *1.2	.543	.625	-.351	.023
Y_p *1.3	.493	.567	-.318	.018

Note: Y_p*1.1, Y_p*1.2, and Y_p*1.3 refer to scaling up the outputs of private firms by 10%, 20%, and 30% respectively; Source: ICS 2005 and Census 2000-2009

The census data only have information on total employment sizes and labor costs. The ICS data have additional information on labor including the numbers and the costs of permanent, temporary, professional, production, and non-production workers. I further perform simulations to neutralize ownership distortions in the markets for skilled and unskilled labor with the ICS data (Panel B and C of table 11). For comparison, the simulation results with homogenous labor for both datasets are also included (panel A of table 11). SOEs face more labor market distortions relative to private firms in both datasets, especially for unskilled labor. Labor should be transferred from private firms to SOEs. The resulting GDP changes are .7% and 3.7% for unskilled and skilled labor respectively.

Similar to capital, as a robustness check, the outputs of private firms (ICS) are scaled up to control for the possibility that private firms may face higher output distortions or misreport more than SOEs. SOEs no longer face higher distortions in the market of skilled labor after a scale-up of outputs by 20% and above. But it remains true that SOEs face higher distortions in the market for unskilled labor even after the output scale-ups, although the degree of distortions is reduced. The GDP changes are zero for skilled labor and reduce to less than 2% for unskilled labor after a scale-up of outputs by 30%. The large ownership distortions in the labor market mainly come from the distortions in the market for unskilled labor.

C. Simulation to Remove Ownership Distortions in Land and Buildings

It is widely believed that the development of the land market in Vietnam lags behind, failing to meet the growth in demand for land from private firms. Therefore this subsection is devoted to study the ownership distortions in land/buildings between SOEs and private firms. I use the ICS data for the analysis (with 2 types of labor) as the census data have no information on land/buildings. Table 12 below presents the simulation results (including robustness checks).

Table 12
Simulation Results to Remove Ownership Distortion in Land and Buildings

	Distortion Parameter	Share transferred for SOEs	Share received for Private Firms	ΔGDP1	ΔGDP2
Data	-.264	-.139	.146	-.001	.014
Y_p*1.1	-.314	-.165	.173	-.001	.017
Y_p*1.2	-.373	-.195	.205	-.001	.019
Y_p*1.3	-.446	-.232	.245	-.001	.022
DB_s*1.1	-.362	-.182	.210	-.001	.018
DB_s*1.2	-.431	-.208	.262	-.001	.021
DB_s*1.3	-.485	-.227	.308	-.001	.024

Note: Y_p*1.1/1.2/1.3 refer to scaling up the outputs of private firms by 10%/20%/30% respectively; DB_s *1.1/1.2/1.3 refer to scaling up the replacement values of land and buildings of SOEs by 10%/20%/30% respectively; ΔGDP2 is the average of the 500 calculated GDP changes if private firms would have the same employment sizes as SOEs from which the land and buildings are transferred. Source: ICS 2005

Private firms face significantly higher distortions in the market for land/buildings than SOEs. Land/buildings should therefore be reallocated from SOEs to private firms. But the simulated GDP changes from reallocation are small and negative, similar to the reallocation of capital. The results are robust to scaling up the outputs for private firms.

The average price of land/buildings per m^2 is much lower for SOEs than private and foreign firms in the ICS data. The market prices of land/buildings can be higher for private firms than SOEs as most industrial lands are owned by SOEs and private firms have to sublease from SOEs at higher prices while industrial zones are expensive and unaffordable for many private firms (the majority of which are SMEs). Many SOEs have idle industrial lands on hand and it is likely that the market values of the idle lands are underestimated. Therefore the replacement values of land/buildings are scaled up by 10%, 20%, and 30% respectively in the ICS data for SOEs to take into account the possibility that SOEs undervalue the land/buildings they possessed. The

degree of distortions increase with the scale-up but the simulated GDP changes from reallocation again remain small.

The small and negative GDP changes from the reallocation of land/buildings are mainly caused by the ownership differences of the mean log MRPD ($\overline{\ln \text{MRPD}_s} - \overline{\ln \text{MRPD}_p}$) due to size. In particular, the difference contributed by firm size is positive and much larger than the negative contribution by ownership in land/buildings (see table 9 for the decomposition). Hence any gain from reallocation to remove the difference of the average distortions related to ownership is largely offset by the positive correlation between the MRPD and firm size. I proceed to calibrate the GDP changes assuming that private firms would have had the same employment sizes as SOEs from which land/buildings are transferred (see last column of Table 12). The GDP changes become larger and positive (1.4%). Since the share of land/buildings in output is less than 8% (not land intensive), and only 14% of the land/buildings is transferred from SOEs to neutralize the ownership distortions, this 1.4% GDP change is reasonable.[48]

To summarize, the GDP changes are small and even negative from neutralizing the gap of the average distortions related to ownership in the markets for capital and land/buildings. This is because MRPs increase with firm sizes while SOEs are larger than most private firms, counteracting the efficiency gain from neutralizing ownership distortions in the case of capital and land/buildings. It implies that many private firms are operating at inefficiently small scales. Simply reallocating production factors between SOEs and private firms but ignoring other distortions may do little to improve aggregate efficiency in Vietnam.

So far, I have focused on the difference of the *average* market distortions between SOEs and private firms. Production inputs may be allocated less efficiently within SOEs than within private firms, which can further contribute to the aggregate efficiency loss. This is because SOEs have more resources for use than private firms in Vietnam. Therefore I examine the dispersion of the marginal products for capital, labor, and land and buildings within each ownership type. The evidence is mixed for the allocation efficiency of capital. Specifically, the variance of the marginal products for capital is much larger within SOEs than within private firms from the ICS data but it is similar from the census data. The variances of the marginal products for unskilled

[48] Again the 500 calculated GDP changes are closely clustered around their average, with the standard deviation less than 10% of their average.

labor (ICS) and total labor (census) are larger for SOEs than private firms (the variance of the marginal product for skilled labor is similar for the two ownership types in the ICS data). Hence the production factors are generally allocated more efficiently within private firms than within SOEs.

6 Conclusion

In this paper I investigate whether SOEs and private firms experience different distortions in the markets for capital, labor, and land/buildings, by looking at the dispersion of the MRPs across ownership/size/sector/region using a panel of enterprise census data (2000-2009) and a cross-section of World Bank Investment Climate Survey (2005) for manufacturing firms in Vietnam. I find that private firms face significantly higher average distortions in the markets for capital and land/buildings but significantly lower mean labor market distortions than SOEs, controlling for sectors, regions, and firm sizes. The findings are consistent across both datasets for capital and labor.

With the estimated gaps of the average factor market distortions between SOEs and private firms, I perform simulations to calculate the aggregate output changes from removing the gaps of the average factor market distortions related to ownership while keeping other distortions unchanged. The simulations show that capital and land/buildings should be reallocated from SOEs to private firms in order to remove the ownership distortions while the opposite is true for (skilled and unskilled) labor. The resulting GDP changes are .7% for skilled labor and 3.7% for unskilled labor. Surprisingly, the GDP changes from the reallocation of capital and land/buildings are small and even negative. Further analysis shows that this is due to the confounding effect of firm size, whose contribution to the raw differences in the average log MRPs between SOEs and private firms is positive and is of opposite sign to the contribution by ownership. If private firms would have had the same employment sizes as SOEs from which the production factors are transferred, the GDP changes would increase to 0.6% for the census data and 9%-11.3% for the ICS data with the capital reallocation, and 1.4% from the reallocation of land/buildings for the ICS data.

However, the analysis is not without limitations. In this paper, I only focus on misallocation among existing firms while the TFP losses from possible entry distortions can be large. The analysis is done within a partial equilibrium rather than a general equilibrium framework. Also,

the simulation of the GDP changes from reallocation is a static analysis and GDP changes could be larger in a dynamic framework. Nevertheless, the two main findings are interesting. First, the analysis confirms the evidence that factor markets are distorted in Vietnam and provides an empirical estimate of their significance. And second, while one would expect that a removal of the much-debated ownership distortions would increase aggregate efficiency, but this does not appear to be the case because of the presence of other distortions. Policy-makers therefore face second-best rather than first best policy choices when reforming factor markets in Vietnam.

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