Globalization and State Capitalism: Assessing Vietnam's Accession to the WTO*

Leonardo Baccini† Giammario Impullitti‡ Edmund J. Malesky§

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Abstract

What do state-owned enterprises (SOEs) do? How do they respond to market incentives? Can we expect substantial efficiency gains from trade liberalization in economies with a strong presence of SOEs? Using a new dataset of Vietnamese firms we document a set of empirical regularities distinguishing SOEs from private firms. We embed some of these features characterizing SOEs operations in a model of trade with firm heterogeneity and show that they can hinder the selection effects of openness and tame the aggregate productivity gains from trade. We empirically test these predictions analyzing the response of Vietnamese firms to the 2007 WTO accession. We find that WTO accession is associated with lower markups, higher probability of exit and substantial increases in productivity for private firms but not for SOEs. Domestic barriers to entry and preferential access to credit are key drivers of the different response of SOEs to trade liberalization. Our estimates suggest that the overall productivity gains would have been substantively larger in a counterfactual Vietnamese economy without SOEs.

JEL Classification: F12, F13, F14, P31, P33.

Keywords: State Capitalism, State-Owned Enterprises, Trade Liberalization, Heterogeneous Firms, Gains from Trade, WTO, Vietnam.

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†*McGill University*. Email: leonardo.baccini@mcgill.ca.

‡*University of Nottingham*. Email: Giammario.Impullitti@nottingham.ac.uk.

§*Duke University*. Email: ejm5@duke.edu

1 Introduction

In the major emerging economies, state owned enterprises (SOEs) still account for a substantial share of income and capital. Focusing on the Forbes Global 2000 list of the world's largest 2000 public companies and their 330,000 subsidiaries worldwide, a recent OECD study shows that SOE sales, market values and assets account for a large share of the economy in BRIC countries (Kowalski, Büge, Sztajerowska, Egeland, 2013).[1] The strong presence of SOEs and the staggering recent success of these economies has triggered a new debate over "State Capitalism" as a viable growth and development model (The Economist, 2012). Although they are at the center stage of this debate, little is known about this new form of enterprises. What do SOEs do? What are their distinguishing features? How do they respond, if at all, to market forces and reforms? Using a new rich data set of Vietnamese firms we first document a set of empirical regularities distinguishing SOEs operations from those of private firms. Second, we embed these characteristics in a simple model featuring both SOEs and private owned enterprises (POEs), and analyse the response of these different firms to increased product market competition induced by trade liberalization. Third, we use the predictions of the model as a guideline for an empirical assessment of the effects of Vietnam's 2007 accession to the WTO.

Vietnam represents an ideal country for our research purposes since more than one third of its economy is still state owned and the 2007 WTO accession represents one of the largest market reforms, possibly the largest, in Vietnam's history. We rely on data from the General Statistics Office (GSO), which covers the entire spectrum of Vietnamese firms over the period 2005-2012. Two features seem to stand out in characterizing the nature of SOEs operations compared to POEs: state-owned firms tend to enjoy a stronger market power, as suggested by their substantially larger markups and the higher degree of market concentration characterizing the sectors with dominant presence of SOEs. Second, external (borrowed) capital constitutes a substantially larger fraction of total capital for state-owned firms then for private firms, suggesting a privileged access to credit for the former.

Our model economy embeds these two key features distinguishing SOEs from private firms. First, larger barriers to entry allow SOEs to have stronger market power; second, they enjoy an easier

[1] Based on Country SOE Share (CSS), an index of weighted averages of SOE shares of sales, assets and market values among countries' top ten companies, the paper reports that about 95% of top 10 Chinese companies are SOEs, while in Russia, India, and Brazil, SOEs represent 80%, 60%, and 50% of top firms respectively.

access to credit. Moreover, both types of firms can be heterogeneous in their productivity and have access to foreign markets. All firms compete in oligopolistic markets, where their market power (i.e. markups) is affected by the number of competitors, and responds endogenously to changes in trade costs. Restricted entry implies that the number of firms is lower and market concentration is greater for SOEs than for POEs. Hence, SOEs enjoy greater market power and an ability to set higher markups and prices. All firms must borrow to finance part of their fixed operation costs, and we assume that credit markets are frictional. Although all firms interact with the same financial intermediaries, SOEs enjoy a preferential access to credit which makes them less financially constrained than private firms. Stronger marker power and lower credit constraints imply that surviving is easier for SOEs than for POEs.

Trade liberalization increases price competition, reducing markups. Lower markups force less productive firms out of the market, reallocating market shares toward more productive firms. While this selection effect operates for POEs, it is weaker and can potentially not take place for SOEs. When entry barriers are high, a reduction in trade costs has negligible effects on markups because restricted entry protects domestic firms from foreign competition. Similarly, easier access to credit makes SOEs more resilient to foreign competition, thereby further reducing the selection effects of trade liberalization. Selection and reallocation lead to increases in average productivity in POE-dominated sectors, while this efficiency effect is lower and can even be absent in SOE-dominated sectors. Hence, in our stylized economy, the presence of SOEs reduces the aggregate efficiency gains from trade liberalization.

We use the predictions from the model to guide our empirical investigation of the most important trade liberalization episode in the history of Vietnam: its accession to the WTO in 2007. Given that Vietnam was in a weak bargaining position in seeking accession to the WTO, MFN tariff cuts provide arguably exogenous variation in international exposure, as tariff rates fell from an average of 20% in 2006 to 8% in 2009, and varied extensively across industries. Using a difference-in-differences approach, we directly estimate the impact of the reduction in Vietnam's Most Favored National (MFN) tariffs on the probability of exit of private firms in comparison to SOEs. We also explore the role of credit constraints in shaping the differential response of private and state owned firms to trade liberalization,

and assess the impact of MFN cuts on firms' market power, measured by their markups. In addition to analysis at the firm level, we study the impact of MFN cuts on average productivity at the industry level, exploiting the cross-industry variation of SOEs presence. The main econometric challenge is that private firms are likely to differ from SOEs in many characteristics which could also affect their probability of entering and exiting the market. We account for this source of heterogeneity by using entropy balancing to establish a reasonable comparison group between POEs and SOEs with respect to a battery of firm-level and industry-level confounding factors. A large set of robustness tests is also ran to account for possible confounding factors and specification issues.

Our reduced-form econometric analysis produces four main empirical findings. First, we only find strong evidence of trade-induced selection for POEs, but less so for SOEs: private firms are significantly more likely to exit the market compared to SOEs after Vietnam's accession to the WTO. Importantly, the selection effect scales with the size of MFN tariff cuts and productivity for POEs: larger tariff cuts are associated with a higher probability of exit, and less productive firms are more likely to exit after liberalization. These results do not hold for SOEs. Second, we find that SOEs with large debt to capital ratios, our proxy for access to credit, are less likely to exit the market after trade liberalization, while the opposite happens to private firms. Hence, debt helps SOEs to weather competitive pressures while it is a drag for private firms. This suggests that access to credit is a key factor sheltering SOEs from trade-induced increases in competition. Third, we find that POEs markups decrease after WTO accession, whereas we do not observe any pro-competitive effects of trade for SOEs. Fourth, productivity increases in industries with a negligible presence of SOEs as a result of multilateral trade liberalization, whereas this effect is disappears as the presence of SOEs becomes substantial.

The overall productivity gains have been lower than expected. We show that WTO access tariff cuts are associated with an average increase in productivity of 4 percent in the period 2005-2012. Larger gains were expected from a small fairly closed economy like Vietnam joining the WTO (IMF Survey, 2007).[2] Trefler (2004), finds that larger and less closed economies like Canada and the US

[2]Document available at `https://www.imf.org/en/News/Articles/2015/09/28/04/53/socar051a` [consulted on September 8, 2016].

obtained similar gains from their bilateral trade agreement.[3] We show that the presence of SOEs can partially account for the missing productivity gains. We do this by simulating a counterfactual scenario in which we measure the productivity gains that would have been brought about by WTO accession had SOE not been a strong presence in the economy. This exercise suggests that the loss of efficiency is proportional to the reduction of tariffs. For instance, we show that the overall productivity gains would have been 60 percent larger in a counterfactual economy where POEs replace SOEs and tariff cuts are substantive, i.e. larger than 7 percent. Hence, our results suggest that SOEs represent a large obstacle to trade-induced efficiency gains.

Our paper is related to several strands of the literature. First, the theoretical framework belongs to the new wave of trade models with firm heterogeneity that started with Melitz (2003). A stream of theoretical papers have explored the aggregate effects and transmission channels of trade liberalization in the presence of firm heterogeneity.[4] Although this literature analyses several dimensions of firm and plant heterogeneity, little attention is given to their ownership structure. Our paper fills the gap providing a simple model tackling the following questions: Does a strong presence of SOEs affect the consensus predictions of new trade models with heterogeneous firms? Can we still expect the productivity gains from trade-induced selection described in these models? If not, what are the key features of SOEs shaping new adjustment mechanisms and final outcomes? Our model borrows from the small literature on oligopoly trade (Neary, 2003)[5] and its more recent extensions to heterogeneous firms economies (e.g. Van Long, Raff and Stahler, 2011, Impullitti and Licandro, 2012 and 2015, and Bekkers and Francois 2013). Moreover, our approach to modeling credit constraints in heterogeneous firms trade economies is related to Manova (2013) and Bonfiglioli, Crino', Gancia (2016) among others.

Several empirical papers have documented the positive effects of trade on industry productivity through tougher selection and market share reallocation.[6] Pavcnik (2002), Trefler (2004), Bernard,

[3]Trefler (2004), shows that the reduction in Canadian tariffs following the US-Canada free trade agreement triggered a selection effect resulting in a 4.3 percent increase in Canadian manufacturing productivity. Lileeva and Trefler (2010) find that the reduction in US tariffs associated with the free trade agreement shifted market shares toward highly productive Canadian exporters, leading to an increase in productivity of 4.1 percent.

[4]See Melitz and Redding (2014) for an up to date review of the theoretical literature.

[5]Trade under oligopoly was introduced by Brander (1981) and Brander and Krugman (1983). See Neary (2010) for a survey of the literature.

[6]For recent extensive surveys and assessment of the empirical literature on trade with firm heterogeneity, see Bernard, Jensen, Redding, and Schott (2012) and Melitz and Trefler (2013).

Jensen, and Scott (2006), and Khandelwal and Topalova (2011) among others, analyze the effects of important trade liberalization episodes for Chile, the United States and Canada, the United States alone, and India. These works find that a substantial part of the trade-induced increase in productivity is generated by selection and intra-industry reallocations. Our paper contributes to this literature by assessing the productivity gains from trade through inter-firm reallocation in a capitalistic economy with a non-negligible share of firms owned by the state. This is a first step in understanding and measuring productivity gains from trade under state capitalism.

Moreover, our paper provides evidence that non-tariff measures – financial constraints, for instance – generate the potential for *policy substitution*. As countries are restricted in the use of traditional tariffs by a trade agreement, they have incentives to distort domestic regulations as a secondary trade barrier (Bagwell and Staiger, 2001, Ederington 2001). As Horn, Maggi and Staiger (2010) note, removing behind-the-border barriers is more costly than removing border measure because the former are less transparent than the latter. We find strong empirical evidence that behind-the-border barriers substantively offset the gains from trade of multilateral liberalization. This may explain why the effect of the GATT/WTO on trade among member countries is sometime smaller than expected (Rose 2004). It also help explain why the design of preferential trade agreements is incresingly featuring the inclusion of trade-related provisions – regulating government procurament and competition policy, for instance – in an attempt to mitigate the potential for *policy substitution*.[7]

Finally, there is an emerging literature analyzing different features of state capitalism. Storesletten, Song, and Zilibotti (2010) present a theory of economic transition in China based on reallocation of manufacturing from less productive SOEs to highly productive "entrepreneurial" firms. Credit constraints and other cost wedges prevent the entry of more productive private firms and shelter sluggish SOEs from competition. Economic reforms reduce the cost wedges between the two types of firms and trigger a reallocation of resources toward the most efficient firms, thereby setting the economy on a path of privatization and fast growth. Hsieh and Klenow (2009) find that about two-thirds of aggregate TFP growth in China between 1998 and 2005 - a period that includes China's access to the WTO in 2001 - can be attributed to reallocation from low to high productivity plants. Hsieh and Song

[7]For a thorough literature review on non-tariff measures, see Ederington and Ruta (2016).

(2015) compare this view of China's growth, the triumph of "Markets over Mao", with the conflicting view that "State Capitalism" through large and successful SOEs has driven growth and development in China. They provide empirical evidence that the drastic reforms of Chinese SOEs started in the late 1990s led to the privatization or closure of small and inefficient firms, while large firms were corporatized and kept under State control. They find that the labor productivity of these large SOEs has converged to that of private firms, and they were responsible for about a fifth of aggregate TFP growth in the period 1998-2007. In line with this research, we analyze the productivity effects of reallocations from low to high productivity firms, but we differ by analyzing the specific role of trade liberalization as a source of productivity growth in an economy with a large presence of SOEs.[8]

The remainder of the paper proceeds as follows. In the next section, we offer an overview of the characteristics of Vietnamese firms and document the reduction in trade barriers produced by WTO accession. In the third section, we present our model and put forward our main hypotheses. In the fourth section, we explain our empirical strategy, presents the empirical results, and implement some robustness checks to further validate our findings. A final section concludes.

2 Market Reforms and Vietnamese Firms

In this section we document the reduction in trade barriers brought about by Vietnam's WTO accession, provide a brief discussion of the SOEs reforms which started before the accession, and report several stylized facts on Vietnamese firms mainly aimed at highlighting the different nature of SOEs and POEs operations.

Data. Before presenting the stylized facts, we describe the data and the main variables of interest. Our data come from the annual Enterprise Census of firms performed by Vietnam's General Statistical Office (GSO) for the period 2006-2012. They include the entire universe of Vietnamese firms which

[8] Another point of difference is our focus on Vietnam instead of China. There is little work on the productivity and welfare effects of Vietnam's WTO accession. Fosse and Raimondos-Moller (2012) and Gosh and Whalley (2008) use general equilibrium trade models with SOEs and calibrate them to Vietnam in order to study the effects of trade liberalization. These papers limit their analysis to economies with representative firms and perform calibration exercises. Our paper, instead, introduces heterogeneity of firm productivity and ownership and assesses Vietnam's WTO entry using firm-level data and by conducting reduced form econometric analysis.

have at least ten employees, and contain a rich set of firm-level characteristics.[9] We follow the classification of firm ownership employed in Vietnamese statistical handbooks and divide business operations into three large categories: State Owned Enterprises, including centrally-managed SOEs, locally-managed SOEs, and limited liability companies of which all shares are controlled by state agencies; the Non-State Sector, including registered private domestic operations and cooperatives; and foreign invested enterprises (FIEs) that have less than 50% state ownership. Large SOEs often have multiple subsidiaries, which compete in multiple industries, often outside of the core competency of the main SOE. To more directly model the competition between state and private sectors, we treat each subsidiary as an individual unit in our analysis. This allows for more diversity in the sectorial pattern of SOE participation than analyses which rely solely on the mother firm's headline sector. In addition, it aids comparisons between SOEs and private firms, because the subsidiaries are more similarly sized.

Following common practice, we do not include FIEs in our private firms category (POE), although we always control for FIEs in the econometric analysis. The trade categorization of the survey follows the fourth revision of the International Standard Industrial Classifications (ISICv4). The tariff data come from TRAINS (WITS) and are at the HS 6-digit level. We create a crosswalk from ISICv4 to HS 6-digit to merge the GSO data with tariff data. Next, we cross-check the WITS tariff data with Pelc's (2011) data and WTO tariff data. All the sources report the same tariff rates. We merge the tariff data at six-digit level with the four-digit firm-level data using average tariff values. The trade data come from COMTRADE and are at the HS 6-digit level. In merging the WTO tariff data and the GSO firm-level data, we lose around 20,000 firms for which the trade categories do not match. These firms are almost always in sectors, such as incense stick making or ice delivery, for which international analogues are hard to identify.

Before providing an overview of Vietnamese firms, we describe the main variables that we use both in this descriptive section and in the empirical section. *Exit* is defined as the probability of exit for firm f in industry i between year t and $t+1$. Formally, $Exit = Pr(Exit_{fi,t} = 1)$. The panel structure

[9] The Enterprise Census includes a random sample of firms under ten employees outside of those in the panel. The data do not include firms that operate in the informal economy. The variables are reported in Vietnamese and translated into English by us.

of the Vietnamese firm-level data collected by the annual Enterprise Census allows us to track firms by tax code over time. In line with previous studies (Pavcinik, 2002; Topalova and Khandelwal, 2011), we use revenue-based total factor productivity *TFP*.[10] Moreover, we use the price-cost margin (PCM) as a proxy for a firm's market power or markup. Since we have a direct measure of firm profits in our data, it is straightforward to compute PCM as profits over revenues.[11] Furthermore, the logged number of employees is a proxy for size and the capital-labor ratio is a proxy for capital-intensive sectors. Finally, *Firm's Debt* is the difference between total capital *used* by firms and capital *owned* by firms divided by capital used.[12] We use this variable as a proxy for access to credit granted to firms. The higher the debt is, the larger the access to credit is.

WTO accession. We start documenting the characteristics of the tariff cuts brought about by WTO entry. We begin with the MFN tariff cuts implemented by Vietnam to enter the WTO. Tariff cuts are defined as the inverse first differences for each industry i, i.e. $MFN_{i,t-1} - MFN_{i,t}$, with larger values implying greater trade liberalization. The data are collected using the HS trade categorization at the six-digit level and come from WITS (2014). Since our tariff data are at the sectorial level, to analyze the characteristics and performance of private and public firms we break down our sample from the GSO census creating two macro sectors based on firm ownership. We call an ISIC 4-digit sector as SOE-dominated if the SOE labor share is larger than 40 percent, which the upper quartile, i.e. 75^{th} percentile. In the analysis that follows this is a dummy variable labeled *SOE-dominated Sector* [13]

The first thing to notice in Figure 1 is that with the exception of the year 2012 the MFN tariff

[10]TFP is calculated using simple firm-level Solow residuals. We calculate TFP for each firm-year by regressing the firm-level log of revenue on firm-level physical assets, employment, year and 4-digit industry fixed effects. The residuals of this regression, which might also be negative, are our time-varying measures of firm productivity. Results are robust to alternative measures of productivity such as labor productivity and a productivity index following Aw, Chen, and Roberts's (2001) standard methodology. Unfortunately, we are unable to build a structural measure of productivity, e.g. following Levinsohn and Petrin's methodology (2003), since we do not have data on raw materials to estimate the input demand function.

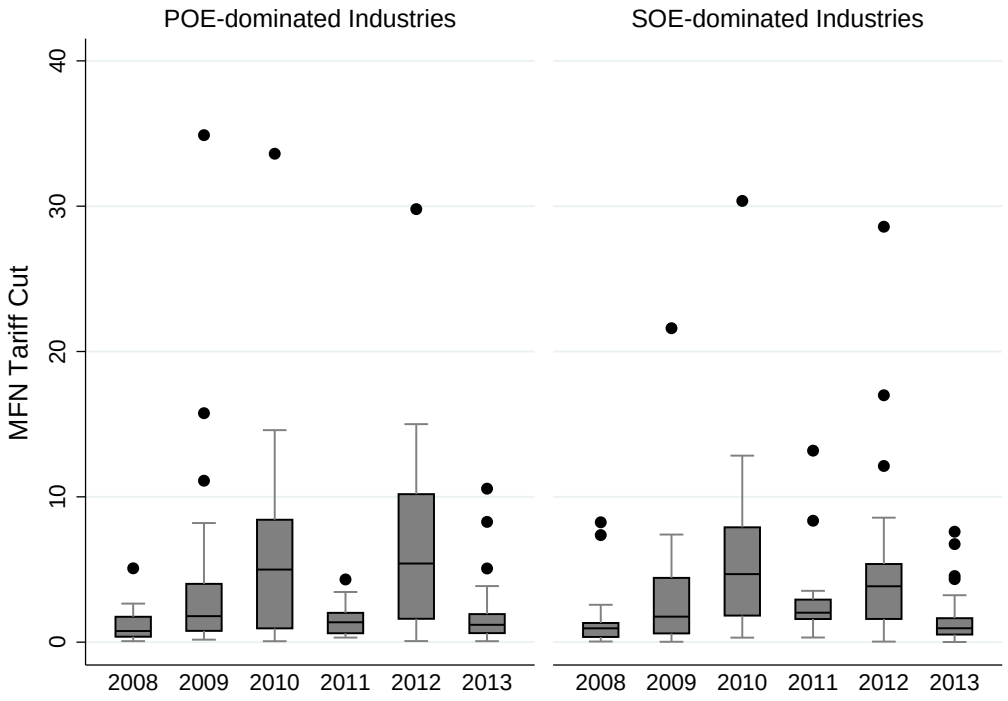
[11]We exclude from the sample firms that have negative markups. The presence of firms with negative markups unveil tax evasion, which is sizeable in the Vietnamese economy (Castel and To, 2012). Ideally, we would have liked to use more sophisticated measures of markups, such as those in De Loecker and Warzynski (2012). Unfortunately, our data do not include accurate pricing data on inputs and we are therefore unable to derive output elasticity.

[12]We use a ratio to avoid over-estimating capital-intensive sectors, in which SOEs tend to operate. Another option would be to use a ratio between liabilities and revenue. However, POEs tend to under-report sales to evade taxes (whereas SOEs do not). Thus, weighting liabilities over revenue would lead to overestimate POEs' debt. The variable liabilities is only available for the period 2006-2010.

[13]Results are not sensitive to this threshold and are similar if we use fractions of SOEs over total number of firms in a industry, SOE revenue share, fraction of SOE capital in each industry.

cuts faced by POE-dominated sectors were roughly comparable to the MFN tariff cuts faced by SOE-dominated sectors. This result mitigates concerns that multilateral trade liberalization is endogenous to the type of ownership. The second thing to notice is that there is a great deal of variation across industry types in terms of tariff reduction. Digging inside our two macro sectors, we look at the variation of tariff cuts across 2-digit industries.[14] There is evidence that POE-dominated sectors faced larger tariff cuts than SOE-dominated sectors in the following industries: food processing, textiles, wood and precision instruments (Appendix Figure A2). The furniture industry appears to be the only one in which the SOE-dominated sector faced larger MFN cuts than the POE-dominated sector. The final thing to notice is that MFN tariff cuts are relatively small.

Figure 1: MFN tariff cuts after WTO accession over time.



Note: the box plots show the distribution of tariff cuts in different years. The bars represent the lower and upper quartiles of each distribution, whereas the dots are outliers.

The SOE reform. In 1986, the Vietnamese government launched *Doi Moi* (renovation), an ambitious program of economic reforms which resulted in dismantling most instruments of control over the

[14]Since the macro POE and SOE sectors are defined at the 4-digit level, in the same 2-digit industries there might be both POE-dominated and SOE-dominated sectors at the ISIC four-digit level.

economy. Among the most critical pillars of *Doi Moi* was a separation of SOE business operations from state planning in Decision 217/HDBT (1987). The 12,000 SOEs which existed at the time were given general guidelines as part of the government's ten-year socioeconomic plan, but their decisions were independent of ministerial planning. They were expected to negotiate the price of inputs with suppliers and set their own prices based on market costs. SOE profits were calculated based on the true costs of material inputs (although this figure did not include land and cheap capital), and, with the exception of a compulsory tax payment to the central or local government, SOEs were allowed to retain their profits and reinvest as they saw fit. A number of SOEs struggled under these conditions and these low-performing operations were soon liquidated by the government authorities or equitized with their shares sold to the private sector.[15] In 1995, the hiving off of SOE business operations was further institutionalized under Decisions 90 and 91. Decision 90 merged SOEs into 17 large holding companies, which became the monopoly conglomerates that we see today. Decision 91 created another group of 70 central conglomerates. The new conglomerates were encouraged to structure themselves in such a way as to provide incentives for SOEs to operate along commercial lines. In 2006, with SOEs now equitizing by selling shares and even listing shares on the stock market, the government formed the State Council Investment Corporation (SCIC) to manage the state assets held by the newly equitized firms under a single entity. The SCIC has decision-making autonomy and is not subject to state planning considerations. Hence, as a result of the economic reform path started in the 1980s, on the eve of the WTO accession Vietnamese SOEs had substantial autonomy from the government in planning their business strategies.[16]

An anatomy of Vietnamese firms. In our census data, before WTO accession we have 2,086 fully-owned SOEs and 1,731 joint stock companies where Vietnamese state agencies were the dominant remaining shareholders. Together, on the eve of WTO accession, these SOEs accounted for 20% of gross industrial output, 37.2% of new investment, and about 11% of total employment (24% of labor employed by the formal business sector). By contrast, there were 151,576 POEs in Vietnam: 146,615 domestic companies and 4,961 active FIE operations. Together, they accounted for 80% of industrial

[15] See Painter (2002) for a detailed discussion of the Doi Moi reforms.
[16] Vasavakul (1997) and Vo (2007) provide an in-depth examination of the reforms implemented after Doi Moi.

output (35% domestic, 45% foreign), 63% of new investment (38.5% domestic, 24% foreign), and about 33% of total employment (76% of the formal business sector).

Table 1 provides a snapshot of the distribution of SOEs across broad categories of economic activity in Vietnam. The share of firms accounted for by SOEs is roughly 5% of operations across all broad sectors except for agriculture, where SOEs account for 35%. SOEs are not involved in family farming activities; their agricultural operations include large-scale plantations for producing rubber, and major food processing operations, such as rice mills. The rest of the first panel provides a sense of the scale of SOE capital investment relative to other firms. While SOEs represent only 7.5% of mining firms, they account for over 80% of the stock of capital in this sector. Similarly, large SOEs account for 80% of capital in the agriculture and electricity sectors. The major exception is manufacturing, where SOEs account for about 40% of capital, which, far from being the majority of capital, still represents a substantial share. Given the emphasis of our empirical analysis on manufacturing industries, Table 1 also shows the distribution of SOE activity (i.e. % of firms and % of capital) in manufacturing at the ISIC 2-digit level. The data suggest that SOEs have a non-negligible presence in a wide range of sectors in the economy, with a striking dominance in the manufacture of gas and tobacco products. SOEs are only absent in the computer industry.

Next, we document some key features of SOEs and POEs both before and after WTO access. In Table 2 we can see that although SOEs do exit, the probability of this event is substantially lower for them than for private firms. Although WTO access increase the exit hazard for both firms, their difference persists. A second remarkable difference is that SOEs have a strikingly stronger market power, as their average markup is four to six times larger than that of POEs in our sample periods. Moreover, while we observe a substantial markup reductions for POEs post-WTO, markups seem to slightly increase for SOEs.

Another remarkable feature is the size and productivity difference. SOEs are larger and less productive than POEs. Figure 2 provides a more suggestive picture of the productivity difference and their change over time. In the period 2006-2007 there is a wide productivity dispersion for both types of firms, and a substantial overlap between the two productivity distributions. However, POEs are on average more productive than SOEs even prior to the WTO accession. In the post-WTO years, the

Table 1: Sectoral distribution of SOEs activity (summary statistics in 2007).

Statistics	% of Firms	% of Capital
Agriculture	36.1	81.1
Mining	7.5	82.9
Electricity	4.4	79.2
Manufacturing	5.4	40.2
Manufacturing Sector (ISIC 2-digit)		
Manufacture of food products and beverages	2.8	16.4
Manufacture of tobacco products	67.7	86.3
Manufacture of textiles	5.6	17.2
Manufacture of wearing apparel	1.4	11.3
Tanning and dressing of leather	3.8	2.8
Manufacture of wood and of products of wood and cork, except furniture	1.1	13.7
Manufacture of paper and paper products	1.6	20.6
Publishing, printing and reproduction of recorded media	0.3	1.0
Manufacture of coke, refined petroleum products and nuclear fuel	9.1	13.2
Manufacture of chemicals and chemical products	3.2	19.8
Manufacture of rubber and plastics products	3.3	42.2
Manufacture of other non-metallic mineral products	3.7	32.8
Manufacture of basic metals	5.6	22.4
Manufacture of fabricated metal products, except machinery and equipment	2.3	25.0
Manufacture of machinery and equipment	4.3	23.6
Manufacture of office, accounting and computing machinery	0	0
Manufacture of electrical machinery and apparatus	4.5	14.0
Manufacture of radio, television and communication equipment and apparatus	3.0	10.7
Manufacture of medical, precision and optical instruments, watches and clocks	3.0	4.6
Manufacture of motor vehicles, trailers and semi-trailers	11.8	21.0
Manufacture of other transport equipment	2.0	2.6
Manufacture of furniture	1.7	17.9
Manufacture of gas	0.07	89.7

Note: The manufacturing sector is at the ISIC 2-digit.

distribution for POEs progressively shifts to the right and, as a result, the productivity gap between POEs and SOEs widens. Moreover, we also find that the average firm size is fairly stable for POEs but declines dramatically for SOEs. Finally, Table 2 shows that SOEs have a substantially higher debt ratio, suggesting a easier access to the credit market.

What is special about SOEs? The descriptive statistics presented above suggest that on the eve of WTO access Vietnamese SOEs, despite being corporatised and drastically reformed, were still more protected from competition both along the entry and exit margin. Here we dig deeper into these barriers to competition characterizing SOEs operations, using our data when possible but also referring to other work in order to provide a more comprehensive view.

First, we look at market concentration measures, which can be interpreted as the consequences

Table 2: SOE vs POE: Firm characteristics in Vietnam before and after WTO accession.

Statistics	2006-2007		2008-2010		2011-2012	
	SOEs	POEs	SOEs	POEs	SOEs	POEs
Exit* (% of firms)	1.5	6.1	7.1	15.9	3.3	9.1
Mean Productivity	-0.10	0.02	-0.16	0.09	-0.28	0.01
Std. Productivity	1.1	1.2	1.3	1.7	1.6	2.1
Mean Markups (logs)	1.4	1.1	1.6	0.9	1.5	1.0
Mean Employment (logs)	5.8	3.1	5.6	2.9	3.8	2.8
Mean Firm's Debt	0.48	0.25	0.45	0.32		

Note: the difference between SOE and POE is statistically significant ($p<.05$) for each covariate.

of barriers to entry. In Figure 3, we show that sectors dominated by SOEs have remarkably higher Herfindahl indices and lower import penetration than POE-dominated sectors.[17]

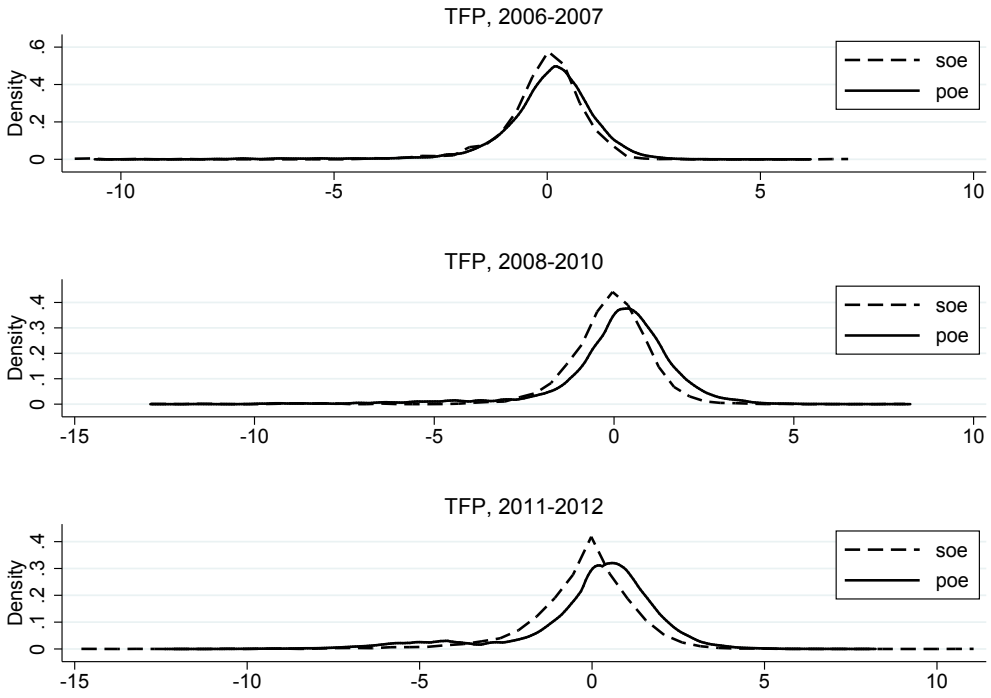
The literature documenting barriers shielding Vietnamese SOEs from competition focuses on several factors. Some of them constitute explicit or implicit barriers to entry, other are de facto subsidies helping incumbent firms avoiding exit when competitive pressure rises. Among the barriers to entry we have: First, certain sectors face formal restrictions for purported national security reasons. These sectors, known as "Group A" projects, require special approval from the Prime Minister's Office to receive an investment entry license. While provinces can locally register any investment up to a specified amount, Group A projects still require central approval and the Prime Minister's signature (Malesky et al. 2014).[18] Second, as in China (Song et al. 2011), many SOEs operate in capital-intensive sectors for which private firms currently do not have the scale or access to capital necessary to compete. Utilities, shipbuilding, steel and cement production are all industries that are formally open but actually feature little private activity (Phan and Coxhead 2013).

Other SOEs privileges help them dealing with competition both on the entry and exit margin. First, it has been shown that access to credit is greater when firms have close connections to the party and government (Malesky and Taussig, 2008). Even in 2013, after the dramatic growth of the private

[17]The Herfindahl index is calculated using revenue. Import penetration is defined as ratio of total import over revenue by sector (four-digit industry level) and for each year.

[18]One frustration for POEs is that SOEs have been able to use these protected enclaves to cross-subsidize their expansion into mixed sectors. For instance, Vinashin, the state shipbuilding firm, has 445 subsidiary businesses and twenty joint ventures, which range from real estate to hotels to karaoke bars. These sideline businesses crowd out entrepreneurial businesses (Nguyen and Freeman 2009).

Figure 2: Distribution of POE TFP and SOE TFP pre- and post-WTO accession.

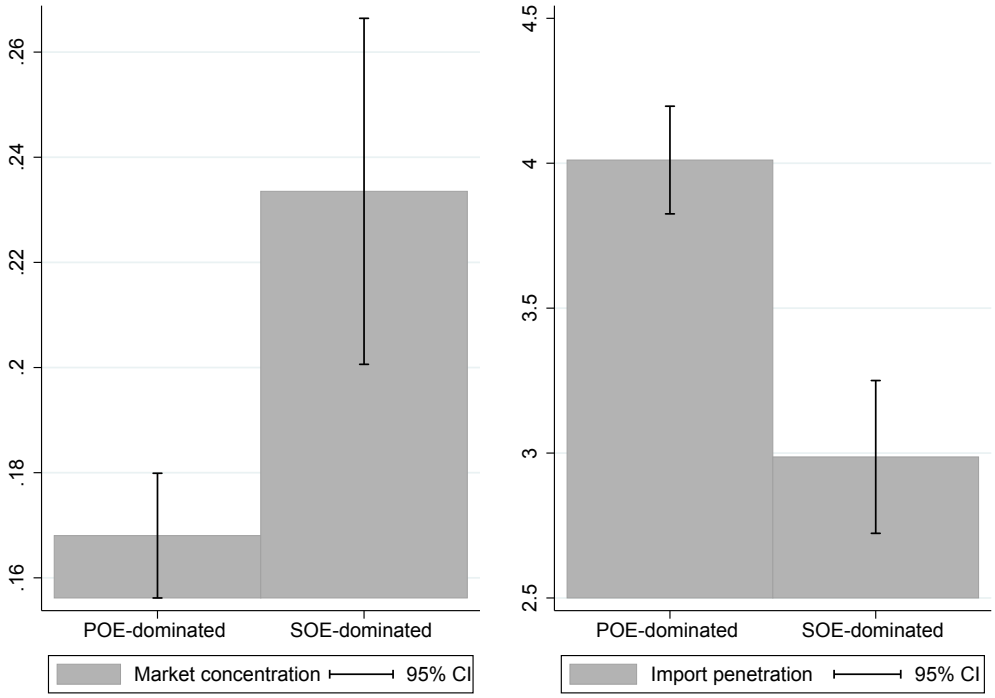


Note: the difference between TFP of SOE and TFP of POE is statistically significant ($p<.05$) in 2011-2012.

sector, roughly 60% of lending by the state-owned banking sector went to SOEs. In line with these arguments, our data in Table 2 above shows that SOEs have significantly higher debt ratios, which suggests a potentially easier access to credit. Second, market access is easier for SOEs than for private firms (Nguyen and Freeman 2009). This is particularly true for government procurement (Pincus et al., 2012). Third, previous studies have found that for land use right certificates, private firms face processing times that are two hundred times greater than those faced by SOEs (Tenev et al., 2003, and Pincus et al., 2012). We can get an overall sense of the barriers to competition protecting SOEs activity by looking at the annual Provincial Competitiveness Index (PCI) survey, a survey of 8,500 firms which is conducted annually in Vietnam by the Vietnamese Chamber of Commerce and Industry in order to assess the business environments of Vietnamese provinces[19]. Responses to a battery of questions in the PCI survey suggest a bias toward state-owned firms in Vietnamese policy-making. In particular, we find the biggest bias toward SOEs in public procurement and access to credit (see

[19]The PCI is performed annually in Vietnam by the Vietnamese Chamber of Commerce with the goal of documenting the investment environment nationally and within individual provinces. For further information, see at `www.pcivietnam.org`.

Figure 3: POE-dominated vs. SOE-dominated industries: average Herfindal index (firm revenue) and average (log of) import penetration ($\frac{import}{revenue}$).



Figures A3 and A4 in the Appendix).

Taking stock, we have shown that barriers to competition seem to be key in differentiating SOEs and POEs operations. Our firm-level data suggest that Vietnamese SOEs enjoy higher market power, possibly deriving from several sources of entry barriers, and barriers to exit likely related to easier access to credit. These two elements of entry and exit restriction will characterize our theoretical and empirical analysis of SOEs operations and their response to the WTO access that follows.

3 An illustrative model economy

Next, we set up a simple model the main purpose of which is to provide a guide for the empirical analysis and to offer some economic intuitions for its results. In order to highlight the implications of heterogeneity in firm productivity and in ownership as transparently as possible, we focus on a static (one-period) model.

3.1 Economic environment

The economy is populated by a continuum of identical consumers of measure one. The preferences of the representative consumer are $U = \ln X + \beta \ln O$, where O is a homogeneous good and X is a differentiated good. The homogeneous good is the numeraire. Consumers are endowed with a unit flow of labor, which can be transformed one-to-one into the homogeneous good. This implies that equilibrium wages are equal to one. Without loss of generality, the total size of the population, and therefore of the labor force, is set at one.

The differentiated good sector X is an aggregate of the sets of goods produced by POEs and SOEs: $X = G^{\gamma} Y^{1-\gamma}$. Differentiated goods have the following CES structure:

$$G = \left(\int_0^{M_g} g_j^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}}, \qquad Y = \left(\int_0^{M_y} y_j^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}} \tag{1}$$

where g_j represents a product line j produced by public firms, and y_j is a product line j produced by private firms. Each product line in G and Y respectively is produced by n_g and n_y identical oligopolistic firms, using labor to cover a fixed production cost $\lambda > 0$ and a variable cost. This market structure follows the "small in the large and large in the small" approach to model oligopoly trade in general equilibrium (e.g. Neary, 2003). We assume that each oligopolistic firm is small in the whole economy, and large and powerful within its product line. We also assume that firms are heterogeneous in productivity across product lines. A firm with productivity $\tilde{z}$ has the following production technology $\tilde{z}_j^{-1} q_j + \lambda = l_j$, where l represents labor input and $q = y, g$ is the quantity produced of a POE and a SOE variety respectively.

Motivated by the previous insights on the nature of modern Vietnamese SOEs, we assume that due to higher entry barriers SOEs enjoy a larger market power than POEs. Larger barriers to entry in SOE product lines imply that the number of firms competing in each public product line g_j is lower than that in private sector product lines y_j.

Assumption 1 (restricted entry). The number of firms per product line is lower in SOE than in POE sectors: $n_g < n_y$.

This is a reduced-form way to introduce barriers to entry in SOE sectors. A more general formulation would postulate different entry costs, which would lead to a different equilibrium number of firms in the two sectors. Modeling entry in oligopoly models is notoriously hard due to the well-known 'integer problem': analyzing markets with a variable but finite number of firms is difficult because we cannot use infinitesimal calculus, a fundamental tool in economic analysis (Neary, 2010). Consequently, it is standard in the literature on oligopoly and trade to work with a fixed number of firms.[20] In line with the literature, we keep the number of oligopolistic firms within a product line n_g and n_y constant, but, as we will discuss later, we allow for horizontal entry, that is entry of new product lines. Finally, notice that in our overview of Vietnamese firms we have seen that SOEs operate in a large number of sectors competing head to head with private firms. To keep the model tractable we first do not allow SOEs and POEs to compete in the same industries, but later we extend the framework to account for mixed industries and show the the key results hold.

The global economy is populated by two symmetric countries with the same technologies, preferences, and endowments. We assume full symmetry across countries, implying that domestic private firms compete with foreign private firms, and similarly for SOEs.[21] Trade costs are of the iceberg type: $\tau > 1$ units of goods must be shipped abroad for each unit finally consumed. Costs τ can represent transportation costs or trade barriers created by policy. For simplicity, we assume that all sectors, public and private, and all goods within each sector are subject to the same iceberg trade costs. Finally, we focus on an economy in which all operative firms sell both to the domestic and foreign markets.[22] Two-way trade in similar products takes place in this economy for the same reasons as in Brander (1981) and Brander and Krugman (1983).

In order to introduce credit constraints, we follow Manova (2013) and assume that while variable costs can be funded internally, firms must born a fraction $d \in (0, 1)$ of their fixed operating costs λ

[20] Several papers have introduced entry in trade and oligopoly models ignoring the integer problem (e.g. Brander and Krugman, 1983, Markusen and Venables, 1988, and Head, Mayer, and Ries, 2002). Introducing entry but keeping a continuum of firms has been criticized for leading to market structures not sufficiently different to monopolistic competition. Some preliminary attempts to deal with the integer problem in models of trade and oligopoly are discussed in Neary (2010).

[21] This is another simplifying assumption which allows a clean derivation of the key mechanisms. As discussed later, removing this assumption would complicate the analysis without qualitatively affecting the main results.

[22] As we can see in Impullitti and Licandro (2014 and 2015), introducing the extensive margin of export reduces the tractability of oligopoly models with firm heterogeneity. Since the extensive margin would not add much to the key mechanism we want to explore here, and in the interest of tractability, we abstract from it.

upfront. In order to cover this upfront cost, firms borrow from financial institutions pledging a fraction $t \in (0,1)$ as collateral.[23] Higher d and lower t indicate stronger *financial vulnerability* of the firm or sector. We assume that there is neither cross-sector nor cross-firm heterogeneity along this dimension. Because of imperfect financial contractibility credit institutions can expect to be repaid by firms with probability $\delta_y, \delta_g \in (0,1)$, which embodies the strength of financial institutions or their willingness to enforce credit contracts.

Assumption 2 (credit constraint). Credit constraints are stronger for POEs than from SOEs: $\delta_y < \delta_g$.

This assumption conveys the idea that financial institution are more soft in enforcing credit contracts with SOEs, which results in an easier access to credit for these firms compared to POEs.

3.2 Equilibrium analysis

Next we derive the equilibrium properties of the model and analyse the effects of trade liberalization.

Firm behavior: production. Since the two countries are perfectly symmetric, we can focus on one of them. Moreover, the optimal production choice of POEs and SOEs is similar, hence it suffices to derive only one of them in detail. For simplicity we focus on POEs. The household problem is straightforward and it is described in the appendix; here we go directly to optimal firm behavior. Each POE firm producing the same variety with productivity $\tilde{z}$ behaves non-cooperatively and maximizes its net cash flow, subject to a demand and a quantity constraint. Each firm solves the following

[23] In purchasing intermediate inputs, paying salaries to workers, and paying rents for land use and equipment, firms often have to incur in expenses previous to production and sales.

problem:

$$\max_{q_{D,}^{D}q_{D}^{F},F} \pi_y(\tilde{z}) = \left(p_D - \frac{1}{\tilde{z}}\right) q_D^D + \left(p_F - \frac{\tau}{\tilde{z}}\right) q_D^F - (1-d)\lambda - \delta_y F(\tilde{z}) - (1-\delta_y) t\lambda$$

$$s.t.$$

$$p_D = \frac{(1-\gamma) E_D}{Y_D^{\alpha}} y_D^{\alpha-1} \quad \text{and} \quad p_F = \frac{(1-\gamma) E_F}{Y_F^{\alpha}} y_F^{\alpha-1}, \tag{2}$$

$$y_D = \hat{y}_D^D + q_D^D + y_F^D \quad \text{and} \quad y_F = \hat{y}_D^F + q_D^F + y_F^F,$$

$$LC: \quad \left(p_D - \frac{1}{\tilde{z}}\right) q_D^D + \left(p_F - \frac{\tau}{\tilde{z}}\right) q_D^F - (1-d_y)\lambda \geq F(\tilde{z})$$

$$PC: \quad -d_y\lambda + \delta_y F(\tilde{z}) + (1-\delta_y) t_y \lambda \geq 0$$

where p_j, E_j and Y_j are the domestic price, expenditure and total quantity of the composite good respectively for country $j = D, F$. The profit function shows that only a fraction $(1-d)$ of the fixed cost is financed internally, and that if the contract is enforced firms must pay $F(\tilde{z})$ to the financial institution, while in case of default firms lose the collateral. The first constraint is the indirect consumer demand for each differentiated good in countries D and F, and $E = P_g G + P_y Y$ is the total expenditure in the differentiated goods sector X. The second is the quantity constraint: each firm shares the global market with its domestic and foreign competitors. The total quantity sold in market D, y_D, is the sum of q_D^D, the quantity sold to destination country D from a firm in source country D. $\hat{y}_D^D$ is the quantity sold to destination D by the other $n_y - 1$ firms in country D, and y_F^D is the quantity sold to D by firms from country F. The quantity constraint in market F is defined similarly. Since the two countries are symmetric, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \breve{q}$, $y_D = y_F \equiv y$, $E_D = E_F = E$, $Y_D = Y_F = Y$, and $p_D = p_F = p_y$. As q and $\breve{q}$ are the quantities sold by a POE in the domestic and in the export markets, $y = n(q + \breve{q})$ is the total quantity sold in a market. Moreover, the liquidity constraint (LC) implies that in case of repayment firms can pay up to their net revenues. Finally, the participation constraint (PC) implies that the financial institution is willing to enter the contract only if the expected returns exceed the outside option, which for simplicity is normalized to zero.

The solution to the firm problem (2) yields the following equilibrium price

$$p_y = \frac{\tilde{z}^{-1}}{\theta_{d,y}} = \frac{\tau \tilde{z}^{-1}}{\theta_{f,y}}, \tag{3}$$

where $\theta_{d,y} = (2n + \alpha - 1)/n(1 + \tau)$ and $\theta_{f,y} = \tau\theta_{d,y}$, are the inverse of the markups charged in the domestic and foreign markets. A reduction in trade costs τ raises $\theta_{d,y}$ because foreign competition makes the domestic market more competitive, but reduces $\theta_{f,y}$ because shipping goods abroad becomes cheaper. As the trade cost declines, firm reduces their domestic markup and increase their export markup. Intuitively, a reduction in trade costs implies that exporters face a cost reduction while their direct local competitors in the foreign market do not experience any cost change. Hence, exporters can afford not to pass the whole cost reduction due to lower trade costs onto foreign consumers.

The equilibrium variable costs are

$$\tilde{z}^{-1}(q + \tau\breve{q}) = \theta_{\tau,y}(1 - \gamma)\frac{E}{n_y M_y}\frac{z}{\bar{z}_y}, \tag{4}$$

where $z \equiv \tilde{z}^{\frac{\alpha}{1-\alpha}}$, $\bar{z}_g \equiv \frac{1}{M_g}\int_0^{M_g} z_j \mathrm{d}j$ is the average productivity and

$$\theta_{\tau,y} = \frac{2n_y - 1 + \alpha}{n_y(1 + \tau)^2(1 - \alpha)}\left[\tau^2(1 - n_y - \alpha) + n_y(2\tau - 1) + (1 - \alpha)\right] \tag{5}$$

is the inverse of the average markup charged by a firm in both the domestic and foreign markets. Since SOEs solve an identical problem, their markup $\theta_{\tau,g}$ has the same structure as $\theta_{\tau,y}$, with n_g in place of n_y. By assumption 1, $n_g \geq n_y$, and from (5) it follows that $\theta_{\tau,y} > \theta_{\tau,g}$, which in turn implies that the markup for SOEs is higher than for POEs. The amount of labor resources allocated to a firm in (4) is the product of the average expenditure per firm, the inverse of the markup and the relative productivity of the variety the firm produces. When the environment becomes more competitive, $\theta_{\tau,i}$ increase, prices lower, the quantities produced increase, and firms demand more inputs.

We now turn to explore the role of credit constrains. The optimal decision of firms is to adjust their payment F to take the investors to their participation constraint, which in equilibrium holds with equality. Substituting this into the liquidity constraint (LC) and using (4) we can determine the following cutoff condition for POEs,

$$(1 - \gamma)E = \frac{\frac{\hat{\lambda}_y}{z_y^*/\tilde{z}(z_y^*)}}{1 - \theta_{\tau,y}} n_y M_y. \tag{EC}$$

where $\hat{\lambda}_y = \left[1 + \frac{1-\delta_y}{\delta_y}(d - t)\right]\lambda$ captures the additional cost of financing firms' fixed operations in an

environment with credit constraints. Proceeding similarly for SOEs, we obtain the cutoff condition

$$\gamma E = \frac{\frac{\hat{\lambda}_g}{z_g^*/\bar{z}(z_g^*)}}{1-\theta_{\tau,g}} n_g M_g. \qquad (\mathrm{EC}_g)$$

As an implication of stronger credit constraints, POEs end up paying larger fixed operating costs, $\hat{\lambda}_y > \hat{\lambda}_g$. Thus, easier access to credit for SOEs represents a de facto subsidy on the cost of their fixed operations.

Entry. In each product line and in each sector, at entry firms draw a productivity z from a distribution $\Gamma(z)$ common to both SOEs and POEs. To keep the model tractable, we assume that when a product line z is created, all n_i, $i = g, y$, oligopolistic firms enter together. Due to the presence of fixed operating costs, there exists a cutoff productivity (product line) z_i^* below which firms do not break even and therefore exit. Similar to entry, exit takes place simultaneously, that is, the oligopolistic firms whose productivity is below the survival cutoff all exit together.[24] We assume that there is a mass one of potential product lines entering; hence, the mass of active lines is $M(\ z_i^*) = 1 - \Gamma(z_i^*)$, an inverse function of the productivity cutoff.

Let us denote by $\mu(z)$ the equilibrium density distribution defined on the z domain. The exit process related to the cutoff point z^* implies that $\mu(z) = 0$ for all $z < z^*$. Consequently, the equilibrium distribution is a truncation of the entry distribution, $\mu_i(z) = f(z)/(1-\Gamma(z_i^*))$, for $z \geq z_i^*$, with $i = g, y$, where f is the density associated with the entry distribution Γ. We can write $\bar{z}$ as a function of z^*, $\bar{z}_i(z^*) = \int_{z_i^*}^{\infty} z\mu_i(z)\ \mathrm{d}z$.

Labor market clearing and equilibrium. To close the model, we need to consider the labor market clearing condition:

$$n_g M_g \int_{z_g^*}^{\infty} \left(\theta_{\tau,g} \frac{\gamma E}{n_g M_g}\ \frac{z}{\bar{z}_g} + \hat{\lambda}_g\right)\ \mu_g(z)dz + n_y M_y \int_{z_y^*}^{\infty} \left(\theta_{\tau,y} \frac{(1-\gamma)E}{n_y M_y}\ \frac{z}{\bar{z}_y} + \hat{\lambda}_y\right)\ \mu_y(z)dz + \beta E = 1,$$

[24] The assumption of simultaneous exit and entry in oligopostic trade models with firm heterogeneity is removed in Impullitti and Licandro (2015). This extension severely affects the model's tractability, and does not change the key selection effects we focus on here.

where we use the equilibrium labor demands derived above. The total labour endowment is allocated to production of the composite goods by SOEs and POEs, and to the homogeneous good βE. Since $\int_{z^*}^{\infty} \mu(z)\,\mathrm{d}z = \int_{z^*}^{\infty} z/\bar{z}\,\mu(z)\,dz = 1$, after integrating over all sectors we obtain

$$E = \frac{1 - \left[\hat{\lambda}_g n_g M_g(z_g^*) + \hat{\lambda}_y n_y M_y(z_y^*)\right]}{[\gamma\theta_{\tau,g} + (1-\gamma)\theta_{\tau,y}] + \beta}. \tag{MC}$$

Equations (EC)-(EC$_g$) and (MC) yield the equilibrium vector (E, z_g^*,z_y^*) in this economy. In order to obtain a clear characterization of the equilibrium properties and of the effects of trade liberalization we now specify the initial productivity distribution.

Assumption 3. At entry, firms draw from a Pareto distribution of productivities, with scale $z_{\min}$, and shape κ.

This assumption implies that equilibrium productivity density is $\mu_i(z) = \kappa z_i^{*\kappa} z^{-\kappa-1}$, the mass of firms is $M(\ z_i^*) = (z_i^*/z_{\min})^{-\kappa}$ and the average productivity is $\bar{z}_i = [\kappa/(\kappa-1)]\, z_i^*$. The equilibrium cutoff conditions (EC) and (EC$_g$) become

$$(1-\gamma)E = \frac{\kappa}{\kappa-1}\frac{\hat{\lambda}_y n_y}{1-\theta_{\tau,y}}\left(\frac{z_{\min}}{z_y^*}\right)^{\kappa} \tag{6}$$

$$\gamma E = \frac{\kappa}{\kappa-1}\frac{\hat{\lambda}_g n_g}{1-\theta_{\tau,g}}\left(\frac{z_{\min}}{z_g^*}\right)^{\kappa}, \tag{7}$$

Dividing these equations we obtain the ratio of the two cutoffs

$$\left(\frac{z_y^*}{z_g^*}\right)^{\kappa} = \frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\frac{1-\theta_{\tau,g}}{1-\theta_{\tau,y}} > 1, \tag{8}$$

where the inequality follows from the stronger market power of SOEs coming from the restricted entry assumption, $n_y > n_g$ and $\theta_{\tau,y} > \theta_{\tau,g}$, and from the easier access to credit $\hat{\lambda}_g < \hat{\lambda}_y$. Hence barriers to entry and lower credit constraint make SOEs survival easier, ultimately leading to lower average productivity compared to POEs. This is in line with evidence in Figure 2. Substituting (6) and (7) into the labor market clearing condition (MC) we obtain a closed form expression for expenditure

$$E = \left[\beta + \frac{\gamma\theta_{\tau,g}}{\kappa} + \frac{(1-\gamma)\,\theta_{\tau,y}}{\kappa} + \frac{\kappa-1}{\kappa}\right]^{-1}. \tag{9}$$

Next, we use these equilibrium conditions to characterize the selection and productivity effects of trade

liberalization.

Trade liberalization. Equations (6), (7) and (9) show that a change in trade costs only affects equilibrium selection through its effect on markups. In (5) we can see that $\theta_{\tau,y}$ is decreasing in variable trade costs τ, with $\theta_{\tau,y}$ reaching its maximum value $\theta_{\tau,y\max} \equiv (2n_y - 1 + \alpha)/2n_y$ when $\tau = 1$, the polar case of no iceberg trade costs. The autarky value $\theta^A_{\tau,y} = (n_y - 1 + \alpha)/n_y$ is reached when $\tau = \bar{\tau} \equiv n_y/(n_y + \alpha - 1)$, the alternative polar case of prohibitive trade costs, implying that neither economy has any incentive to trade. An economy with costly trade is characterized by a level of product market competition higher than in autarky, with $\theta_{\tau,y} > \theta^A_{\tau,y}$ for both POEs and SOEs, due to the participation of foreign firms in the domestic market. Differentiating $\theta_{\tau i}$ with respect to τ we obtain

$$\frac{\partial \theta_{\tau,i}}{\partial \tau} = -\frac{2(\tau - 1)(2n_i - 1 + \alpha)^2}{n_i (1 + \tau)^3 (1 - \alpha)} \leq 0,$$

which shows that incremental trade liberalization increases product market competition. When trade is completely free, $\tau = 1$ and product market competition reaches its maximum level, $\theta_{\tau,i\max} \equiv (2n_i - 1 + \alpha)/2n_i$, with $i = y, g$. Notice that $\theta_{\tau,i\max}$ has the same functional form as the inverse of the markup in autarky but with the number of firms doubled.

Although trade affects POEs and SOEs similarly, the strength of the pro-competitive effect of trade depends on the pre-liberalization level of competition. The trade costs elasticity of markups is increasing in n, and is higher for POEs then for SOEs. Differentiating the absolute value of (5) with respect to n we obtain

$$\frac{\partial \left(|\partial \theta_{\tau,i}/\partial \tau|\right)}{\partial n_i} = \frac{2(\tau - 1)}{n_i^2 (1 + \tau)^3 (1 - \alpha)} \left[4n_i^2 - (1 - \alpha)^2\right] \geq 0. \tag{10}$$

Hence, reductions in trade costs produce stronger competition effects the lower the oligopolistic inefficiency in the product line. Let $\varepsilon_i \equiv |\partial \theta_{\tau i}/\partial \tau|$ be the elasticity of markups to the trade cost. Our restricted entry assumption implies $\varepsilon_y > \varepsilon_g$: trade liberalization has a stronger pro-competitive effects for POEs than for SOEs. Equation (10) shows that for very high values of restricted entry, a number of firms $\underline{n} = (1 - \alpha)/2$, the pro-competitive effect of trade vanishes and $\varepsilon_g = 0$. This effect rests on the interaction between trade costs and entry barriers. High domestic barriers to entry tame the

pro-competitive effect of lower variable trade costs.[25]

Having established the effects of trade on markups, we need to analyze the role of trade-induced markup changes on the survival cutoffs. Expression (9) shows that trade liberalization, by reducing markups, reduces the total nominal expenditure on the differentiated good E. Turning to the cutoff conditions (6) and (7), we can see that trade liberalization increases equilibrium cutoffs z_y^* and z_g^*,

$$-\frac{\partial z_y^*}{\partial \tau} = \frac{\kappa}{(1-\gamma)\,E\,(\kappa-1)}\frac{\hat{\lambda}_y n_y}{1-\theta_{\tau,y}}\left(\underbrace{\frac{\partial E}{\partial \tau}\frac{1}{E}}_{\texttt{Indirect}} - \underbrace{\frac{1}{1-\theta_{\tau,y}}\frac{\partial \theta_{\tau,y}}{\partial \tau}}_{\texttt{Direct}}\right) > 0 \tag{11}$$

$$-\frac{\partial z_g^*}{\partial \tau} = \frac{\kappa}{\gamma E\,(\kappa-1)}\frac{\hat{\lambda}_g n_g}{1-\theta_{\tau,g}}\left(\underbrace{\frac{\partial E}{\partial \tau}\frac{1}{E}}_{\texttt{Indirect}} - \underbrace{\frac{1}{1-\theta_{\tau,y}}\frac{\partial \theta_{\tau,y}}{\partial \tau}}_{\texttt{Direct}}\right) > 0, \tag{12}$$

where the inequality signs come from $\partial E/\partial \tau > 0$ and $\partial \theta_{\tau,y}/\partial \tau < 0$. The second element in brackets is the direct impact of the reduction in SOE and POE markups on the survival cutoffs. The first is the general equilibrium effect through the reduction in spending E. Intuitively, an increase in product market competition in a sector leads to tougher selection in this sector. As a result both of lower markups and of stronger firm selection in that sector, the aggregate price index in the economy drops, thereby increasing the real wage.[26] A higher real wage, in turn, leads to an increase in production costs for all firms across sectors and triggers selection in all sectors.

Since, as we saw above, the effect of a reduction in trade costs on the markup is stronger for POEs than for SOEs ($\varepsilon_y > \varepsilon_g$), the direct effect will be stronger for private firms. In the extreme case where barriers to entry are very high in SOE sectors, $n_y = \underline{n}$, the direct effect is zero for these firms. Moreover, (9) shows that since SOE markups are less responsive to reductions in trade costs, the indirect effect is weaker the larger the share of total expenditure going to SOEs γ.

Finally, we analyse how the presence of credit constraints shapes the selection effects of trade

[25] In a more sophisticated model where the number of firms would be pinned down by a free entry condition, the fixed cost of entry would be a direct measure of entry barriers. Hence, the competition effect of trade liberalization would be shaped by the interplay between variable trade costs and fixed entry costs. The higher the latter, the lower the competition effect of a reduction of the former. Our reduced-form modeling of entry barriers (fixed n) is a simple way to embed this mechanism in a tractable framework. Fully modeling entry barriers through a free entry condition would make this mechanism more transparent at the cost of reducing tractability.

[26] Recall that the nominal wage is pinned down by the price of the homogeneous good, the numeraire of this economy.

liberalization. Let $Z = \left(z_y^*/z_g^*\right)^{\kappa}$ be a measure of the relative cutoff, from (8) we obtain

$$-\frac{\partial Z}{\partial \tau} = \frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\left[\frac{\partial \theta_{\tau,g}/\partial \tau}{(1-\theta_{\tau,g})} - \frac{\partial \theta_{\tau,y}/\partial \tau}{(1-\theta_{\tau,y})}\right] > 0,$$

where the inequality derives from $\theta_{\tau,y} > \theta_{\tau,g}$, $|\partial \theta_{\tau,y}/\partial \tau| > |\partial \theta_{\tau,g}/\partial \tau|$, which clearly shows that $-\partial^2 Z/\left(\partial \tau \partial(\hat{\lambda}_y/\hat{\lambda}_g\right) > 0$. This suggests that the larger cost wedge produced by credit frictions for POEs leads to stronger selection effects of trade liberalization. Larger fixed costs imply that firm survival is more sensitive to the cash flow reductions brought about by trade-induced increases in competition. Hence, better access to credit allows SOEs to weather international competition better than POEs.

It is also worth noticing that the other special features of SOEs discussed in Section 2, such as access to land and preferential access to public procurement, would affect trade-induced selection through a similar mechanism. Preferential access to land can reasonably entail lower fixed operating costs and, similarly to better access to banks, weaken the selection effects of trade. Preferential access to public procurement and any other subsidy could undo the impact of trade on firms' market shares and total profits, thereby taming the effects of foreign competition.

The results above suggest that due to restricted entry and easier access to credit, the selection effects of trade are stronger for POEs than for SOEs. Hence, less efficient POEs are more likely to exit the market when trade barriers fall than low productive SOEs. As in most standard models of trade with firm heterogeneity, selection leads to aggregate efficiency gains by increasing the level of aggregate productivity: average productivity in both the SOE- and POE-dominated sectors, $\bar{z}_i = [\kappa/(\kappa-1)]\, z_i^*$, increases. However, the entry and exit protection granted to SOEs, implies that aggregate productivity gains from trade are lower compared to those we could expect in an economy in which only private firms operate. Below we summarize the predictions of the stylized model that we will test in the empirical analysis. As multilateral trade liberalization kicks in:

H1: The probability of exiting the market increases more for POEs than SOEs.

H2: The probability of exiting the market scales with productivity more for POEs than SOEs.

H3: Markups decrease in POE-dominated sectors, but to a lesser extent or not at all for SOEs.

H4: Easier access to credit tames the selection effect for SOEs.

H5: Average productivity increases more in POE-dominated sectors than SOE-dominated sectors.

3.3 Discussion

Before moving to the empirical analysis, we briefly discuss the robustness of the theoretical results to removing some simplifying assumptions of the baseline model. First we show that the main results hold in an economy where POEs and SOEs do not operate in separate sectors. Second, we discuss how removing the assumption of symmetric countries would affect the results.

Mixed industries. The descriptive analysis in Section 2 suggests that there SOEs and POEs do not necessarily operate in separate sectors. Here we briefly extend the model to capture those industries where both types of firms compete directly for market shares. The structure of the model remains mostly unchanged with the sole exception that the differentiated good X is now produced with the following technology

$$X = \left(\int_0^{M_g} g_j^{\alpha} \, \mathrm{d}j + \int_0^{M_y} y_j^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}} . \tag{13}$$

In the appendix we show that the mixed industry does not change the key results, as the only implication of allowing direct competition between the two different types of firms is to increase the substitutability between POEs and SOEs varieties. Trade still generates more selection for private firms because of restricted entry and easier access to credit for SOEs, although now the SOEs experience a stronger selection through the general equilibrium channel compared to the baseline model. Because of the stronger pro-competitive effect experienced by private firms, the prices of their goods drop more than those produced by SOEs, and consumers shift their demand toward POEs varieties.

Asymmetric countries. In order to keep the model tractable, in the baseline model we assumed that countries are symmetric. This assumption is restrictive because it implies that Vietnamese firms open up to an economy similarly populated with SOEs and POEs. As a consequence Vietnamese SOEs compete with foreign SOEs which are similarly protected from entry and enjoy a similar preferential access to credit. How would the key results change if we remove this assumption? One could argue that if the foreign country is populated only with private firms operating in a highly competitive

markets, then the pro-competitive effect of trade on all Vietnamese firms will be high. This would imply amending the model assuming that Vietnam's trading partners are mostly firms from advanced countries with low domestic barriers to entry. Hence, we could assume that the number of foreign firms is larger than the number of domestic firms: $n^* > n_y > n_g$. In this case the pro-competitive effect of trade liberalization would indeed be stronger for both SOEs and POEs in Vietnam compared to our benchmark economy, but as long as we keep the assumption that domestic market entry is more restricted for SOEs than for POEs, $n_y > n_g$, trade liberalization would still have a stronger pro-competitive and selection effects on POEs compared to SOEs.

Alternative modelling Here we discuss our modeling choice. We ask how our results would be affected if instead of chosing the "road less travelled" of oligopoly trade, we would adopt the standard model of trade and firm heterogeneity with variable markups of Melitz and Ottaviano (2008) (MO henceforth). Variable markups are obtained replacing CES preferences with a particular quadratic structure of preferences in a monopolitically competitive economy. We introduce credit constraints in the basic MO model and analyse their role together with the role of entry barriers in shaping the selection effect of trade.

First we explore the role of entry barriers in the basic MO model, then we introduce credit constraints. In order to stay close the original notation let the cost draw of a firm $c = 1/z$, the survival cost cutoff for firms in the Home country

$$c_D^H = \left(\frac{\gamma}{L^H}\right)^{\frac{1}{k+2}} \left[\frac{1}{1-\rho^2}\phi^H - \frac{\rho}{1-\rho^2}\phi^F\right]^{\frac{1}{k+2}}, \tag{14}$$

where $\rho \equiv (\tau)^{-k} < 1$ indicating the freeness of trade, and $\phi^j = 2(\kappa+1)(\kappa+2)\left(c_M\right)^{\kappa} f_E^j$ with $j = H, F$, for the home and foreing country respectively; f_E^H is the sunk entry cost, different across countries, $c_M = 1/z_{\min}$, κ is the shape of the Pareto distribution, and L^H is the size of the home country.[27]

It is easy to see that, trade liberalization, an increase in ρ, has a selection effect on home firms, that is it reduces the minimum suvival cost, and this effect is weaker the higher the barriers to entry. This is in line with what we find in our model and summarize in H1 above. Lower trade costs lead

[27] We consider the case of symmetric trade costs, since the WTO implies multilateral trade liberalization.

to entry of more domestic and foreign firms which in turn leads to lower markups and more selection. If a country has high barriers to entry, the pro-competitive effect of trade is hampered and selection will be weaker. The mechanism is similar in our model but we obtain it in a more reduced-form way because we do not have free entry. Because the MO stays tractable with free entry, it is helpful to illustrate our the full economic mechanism. Hence, the model predictions based on the different entry barriers for SOEs and POEs in our model, which we later test in the data, can be obtained in the standard MO model.

We now move to the role of credit constraint. Here the comparison between our model and MO is less clean because the latter cannot accomodate credit constraints on firms fixed operating costs.[28] Credit constraint are introduced in a similar manner as in our model, and in line with Bonfiglioli, Crino', and Gancia (2016), who introduce credit constraints in the entry cost in an otherwise standard Melitz (2003) economy. For simplicity we assume that the firm finances the whole entry cost f_e externally. The financial institution, or investor, expect to be repayed, and therefore obtain the full value of the average firm $\bar{\pi}$ with probability δ, and with probability $1-\delta$ the manager of the firm will hide part of the profits and pay only a fraction t of them.[29] Assuming that the investor has an outside option of zero, the free entry condition is $E(\bar{\pi}) = \delta\bar{\pi} + (1-\delta)\, t\bar{\pi} = f_e$

$$\bar{\pi} = \frac{1}{\delta + (1-\delta)\, t} f_e = \hat{f}_e.$$

The presence of the credit constraints increases the sunk cost of entry, $\hat{f}_e > f_e$. It is easy to show that the survival cost cutoff can be expressed exactly like in (14) with the exception of $\phi^j = 2(\kappa + 1)(\kappa + 2)\,(c_M)^{\kappa}\, \hat{f}_E^j$, which now accounts for the presence of credit constraints. The cutoff condition (14) shows that higher credit constraints for the home firms reduce the selection effect of trade, which is the opposite of what happen in our model. Intuitively, credit constraints in MO generate larger

[28] MO does not consider fixed operating costs, because their preference structure generates a 'choke price' that is independent of any fixed costs. This price limit pins down the survival cutoff and adding a fixed production costs does not affect it. Hence we are forced to introduce the credit constraint on the entry cost, a departure from our exercise which, as we show below, has important consequences.

[29] The expected profit at entry is

$$\bar{\pi} = \int_0^{c_D^H} \pi_D^H(c) dG(c) + \int_0^{c_X^H} \pi_X^H(c) dG(c)$$

where $G(c)$ is the cost/productivity distribution.

entry barriers, therefore they play the same role for trade-induced selection. As we will see later, Hyphothesis 4 produced by our model will be confirmed by the data which show that due to stronger credit constraints POEs experience a stronger selection effect than SOEs.

Taking stock, although Melitz and Ottaviano (2008) generate the same prediction our model regarding the role of entry barriers, it is does not allow the introduction of credit constraints in fixed operating costs. Introducing credit constraints in the fixed entry cost generate predictions that are at odds with the empirical results. Although we cannot distinguish in the data the credit obtained to start the firm from the credit used to keep it operative, our empirical analysis show a robust negative correlation between access to credit and the selection effect of trade. This constitutes the main reason for us to use our model, over the standard MO, as a theoretical guideline for the empirical work. The model shed an important light on the role of behind-the-border barriers which have been receiving lots of attention in the policy debate but they're still underexplored in trade theory and empirics.

4 Empirical analysis

In what follows, we test the main propositions of our model using the Vietnamese firm-level data described in Section 2. Data cover only manufacturing industries. The core of the empirics focuses on the firm-level analysis to test H1, H2, H3, and H4. In the last part of the empirics, using industry-level analysis we test the effect of WTO on productivity at the industry level (H5), and by mean of a simple counterfactual exercise we provide a first, partial, assessment of the foregone productivity gains from trade due to the presence of SOEs.

4.1 Firm-Level Analysis

Main Variables and Sample. In line with our hypotheses, we have two dependent variables: *Exit* and *ln(Markups)*, described in the Section 2. Our main independent variables are a dummy scoring one if a firm is private (POE_{fi}), MFN tariff cuts ($\Delta\tau_{i,t}$), which are the tariff cuts implemented by the Vietnamese government after the accession to the WTO, and their interaction. Not all tariff cuts were implemented in the same year as the accession, and a tariff transition period was granted to many industries. Therefore, MFN tariff cuts vary over time in the post-WTO period. Importantly, we

include a dummy for foreign firms in every models so that the baseline is always SOEs.[30] We expect POE exits to increase as MFN tariff cuts increase, whereas we expect the relationship between exits and tariff cuts to be weaker or even not statistically significant for SOEs (H1). Similarly, we expect that POE markups decline as MFN tariff cuts increase, whereas the relationship between markups and tariff cuts to be weaker or even not statistically significant for SOEs (H3).

To test H2 and H4, we rely on triple interaction terms. Specifically, we interact $POE_{fi} \times \Delta\tau_{i,t}$ with $TFP_{fi,t}$ to test H2. According to our theory, *Exit* should be higher for less productive POEs but not necessarily for SOEs. Moreover, we interact $POE_{fi} \times \Delta\tau_{i,t}$ with $Firm's\ Debt_{fi,t}$ to test the role of credit constraints (H4). Because of easier access to credit, we expect that SOE's debt decreases the probability of exiting the market, whereas POE's debt increases the probability of exiting the market.

In our most extensive analysis, we estimate a sample of 52,488 Vietnamese firms between 2006 and 2012 for *Exit*. We analyze the effect of trade liberalization on up to 118 manufacturing products (ISIC 4-digit) for which tariff data are available. Our main models are estimated using OLS regression with robust standard errors, clustered by industry at ISIC 4-digit level.

Econometric Strategy. Our empirical strategy boils down to a difference-in-differences with elasticities. *POE* is our treatment, which distinguishes firms according to the type of ownership. $\Delta\tau$ captures the magnitude of trade liberalization for each industry i, which kicks in after the accession to the WTO, i.e. after 2007.

Our firm-level analysis faces several identification challenges. The first threat to inference we face is the large difference in the covariates observed between private firms and SOEs. Indeed, our preliminary look at the data in Section 2 has shown that the SOEs tend to be larger than private firms; we also find that they are more capital intensive and have more assets than POEs.[31] In econometric terms, the observations are unbalanced with respect to the dummy variable *SOE*. This poses a threat to our conclusions if these observed differences are also correlated with differences in the probability of exiting the market, or if they proxy for unobserved differences that might drive the correlation. To overcome

[30] In the main models we do not include the interaction terms of foreign firms to ease the interpretation of the main coeifficients of interest. However, all the main results are virtually the same if we include the interaction terms of foreign firms (see Figures A4, A5, A6, and A7 in the appendix).

[31] Table A2 (top) in the Appendix shows how the relevant covariates are unbalanced between POEs and SOEs.

this issue, we rely on entropy balancing (Hainmueller, 2012). This technique is similar to propensity matching, but it has the welcoming feature that unbalanced observations are not dropped from the analysis. Specifically, by using entropy balancing observations are re-weighted with respect to the treatment (i.e. SOE) so that all the relevant covariates are balanced (i.e. they have the same mean). In econometric terms, entropy balancing reweights the observations to statistically generate a region of common support where private and public companies are comparable on structural covariates.[32]

Table A2 (bottom) in the appendix shows the means of private goods and state goods before and after balancing. By using entropy balancing, the difference in means between private goods and state is substantially reduced and is never statistically significantly different from zero.[33] Importantly, we balance all the *exogenous* control variables with respect to POE, i.e. Size, Assets, Capital-labor ratio, MFN tariff, Exports, U.S. PTA, Age, and Age^2. The endogenous variables, e.g. markups and firm's debt, *are not* included in entropy balancing. Then we run our main models using the weights obtained from entropy balancing.

Second, following Angrist and Pischke (2009), we include an industry-specific (4-digit) time trend to check if the parallel trend assumption holds. The inclusion of such variables accounts for sectorial growth trends which might be related to MFN tariff cuts. For instance, declining industries with a large number of firms exiting might have higher tariffs and hence deep MFN cuts.

Third, in order to further account for sources of industry-level heterogeneity, we include time-varying industry (4-digit) fixed effects to control for time-varying unobserved factors. Such fixed effects account for industry-specific demand and supply shocks, which in turn might affect the probability of exiting the market.

Fourth, following Trefler (2004), we include controls of business condition built at the industry level to account for the 2008 global economic crisis. Specifically, these controls are built by regressing the number of exiting firms in industry i at time t over Vietnam's GDP and Vietnam's real interest rate, including industry and year fixed effects.[34] These regressions generate a time-varying industry-specific

[32]Entropy balancing does this by directly incorporating covariate balance into the weight function that is applied to the sample units. The net result is that we can compare SOEs to a comparable counterfactual of private firms. We perform this exercise using 'ebalance', the software created by Hainmueller (2012)

[33]We use the command `ebalance` in Stata 14. We adjust the covariates using the first moment, i.e. we set target equal to one.

[34]We are unable to use the real exchange rate instead of the real interest rate due to a lack of data.

prediction ($\widehat{Exit}$) of the effect of business conditions on the WTO-period probability of exiting for firm *f*. We include these predicted values on the right-hand side of some models and bootstrap standard errors to address the fact that the predicted values have standard errors that are not asymptotically efficient.

Finally, we address the concern of a possible endogeneity of MFN tariff cuts, which could potentially invalidate our empirical strategy. In line with Topalova and Khandelwal (2011), we show that TFP and markups do not predict MFN tariff cuts, i.e. neither productivity nor markups are statistically significant in estimations in which MFN cuts are the outcome variable (see Table A3 in the Appendix). This is the case even when we interact both productivity and markups with *SOE Labor Share*. Hence, it does not seem to be the case that trade liberalization is greater in industries in which the anticipated gains from trade are higher. These results seem to indicate that Vietnam had to meet externally imposed benchmarks in order to join the WTO, requiring the implementation of a demanding trade liberalization (Pelc, 2011). The strong bargaining power of the WTO paired with the relatively weak bargaining position of Vietnam mitigates concerns that MFN cuts are endogenous to firm-level and industry-level characteristics.[35]

H1: Exit and MFN Tariff Cuts. In line with Bernard et al. (2006), for the exit probability of firm f in industry i at time $t+1$ we estimate the following model:

$$Pr(Exit_{fi,t}=1) = \beta_0 + \beta_1 POE_{fi} + \beta_2 \Delta\tau_{i,t-1} + \beta_3 POE_{fi} \times \Delta\tau_{i,t-1} + \beta_4 X_{fi,t} + \beta_5 W_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}, \quad (15)$$

where δ_i are industry (HS 4-digit) fixed effects to account for heterogeneity across products, and δ_t are year fixed effects. The key coefficient of interest is β_3 , which should be positive. X and W are vectors including respectively firm-level and industry-level covariates. Following on Bernard et al. (2006), we control for a set of confounding factors which might affect *Exit* and are correlated with our main

[35]Part of the WTO accession requirements was about the reform of SOEs and other corporate governance measures. Since Vietnam accession to the WTO was negotiated for a number of years and firms have started readjusting their operations in advance, we acknowledge that this may pose a threat to our identification strategy. However, since our key independent variables are interaction terms between a dummy for SOEs and other covariates such as tariff cuts, productivity, and markups, it is unlikely that the endogeneity of SOEs affects our results.

independent variables.

At the firm level, we control for the logged number of employees, which is a proxy for size. We expect that large firms are less likely to exit the market compared to small firms. We also include the log of assets, and the capital-labor ratio, which are proxies for capital intensity. Moreover, as it is customary, we include a variable measuring the number of years since a given firm entered the market and began business operations (i.e. *Age*) and its square value.

At the product level (4-digit), we include (logged) values of exports to capture comparative advantage sectors, which should experience lower rate of exit. Unfortunately, we do not have data on export activities at the firm level. We also include a variable capturing market power, calculated using the Herfindahl–Hirschman index, and preferential tariff cuts implemented in the bilateral trade agreement (BTA) between the US and Vietnam. It has been argued that the BTA was used as a stepping stone for Vietnam's accession to the WTO.[36]

Table 3 shows the main results of this analysis. We estimate several models as from equation 15. We begin with estimates without controls and weights from entropy balancing (columns 1 and 2) and then we include both of them (Models 3 and 4) together with industry-year fixed effects and industry-specific trends (columns 5 and 6). Results indicate that the probability of exiting the market increases with MFN tariff cuts for POEs, whereas it decreases for SOEs, as can be observed from the positive sign of the coefficient of the interaction term (i.e. POE and $\Delta\tau$). Importantly, the interaction term is significant in every estimates (see columns 1-6).

To ease the interpretation of the interaction terms, we rely on Figure 4, which shows the probability of exiting the market for POEs and SOEs at different levels of tariff cuts. While the exit rate for POEs increases with the magnitude of the MFN cuts, the same is not true for SOEs, which display a negative slope. Therefore, our empirical findings are more pronounced than our theory's prediction, which would suggest a flat slope for SOEs. All in all, these results strongly validate our first hypothesis.

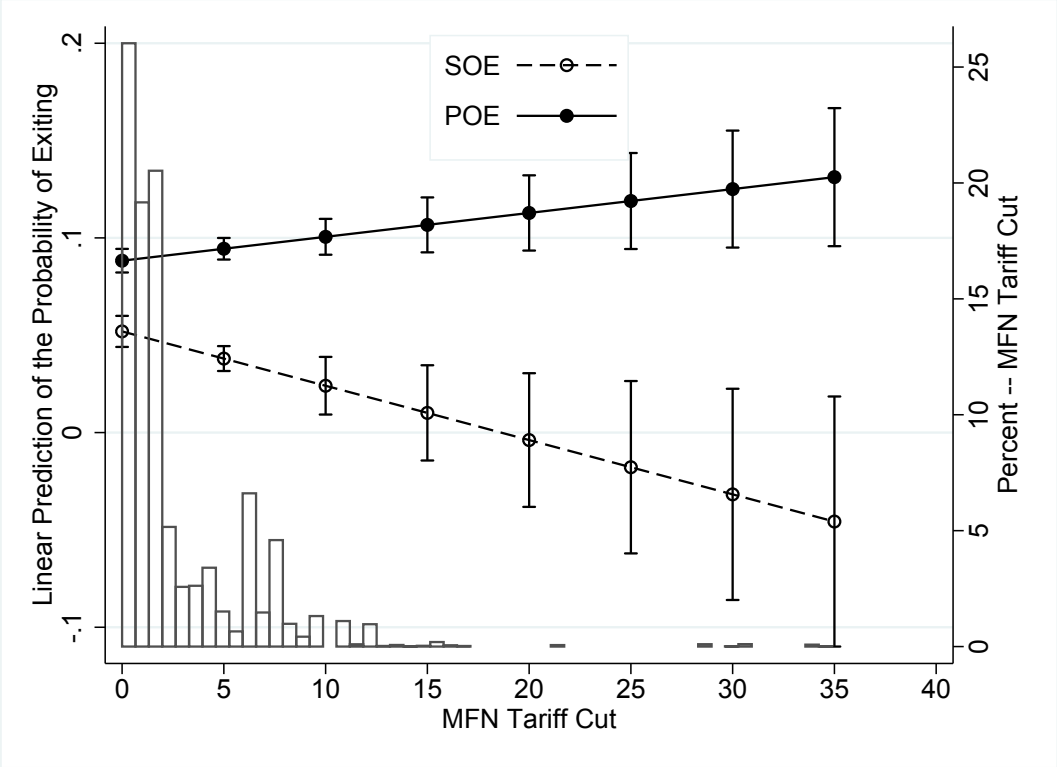
[36]See what the US Ambassador in Vietnam Michael W. Marine says on this issue. The document is available at `http://www.vietnamembassy-algerie.org/en/vnemb.vn/tin_hddn/ns060705093904`. Table A1 in the Appendix shows descriptive statistics of all the variables described above.

Table 3: POE vs. SOE: exit and MFN tariff cuts. OLS regressions with standard errors clustered by HS 4-digit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)
POE	0.026*	0.030***	0.030***	0.031***	0.030***	0.050***	0.051***	0.029**	0.029***	0.027**	0.031***	0.030***
	(0.014)	(0.010)	(0.010)	(0.010)	(0.010)	(0.006)	(0.006)	(0.013)	(0.010)	(0.010)	(0.010)	(0.010)
MFN Tariff Cut	-0.003***	-0.003**	-0.003**	-0.003*	-0.003**	-0.002***	-0.002***	-0.003**	-0.003**	-0.003**	-0.003*	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
							-0.003*	-0.011**	-0.008*	-0.008*	-0.008*	-0.008*
							(0.002)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
POE*MFN Tariff Cut	**0.004*** **	**0.004*** **	**0.004*** **	**0.004*** **	**0.004*** **	**0.002*** **	0.002***	0.004**	0.004***	0.004***	0.004***	0.004***
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
TFP							-0.011**	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*
							(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
POE*TFP							-0.013***	-0.006	-0.007	-0.007	-0.008*	-0.008*
							(0.002)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
MFN Tariff Cut*TFP							0.000	0.000*	0.000	0.000	0.000	0.000
							(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
POE*MFN Tariff Cut*TFP							**-0.001****	**-0.001*** **	**-0.001****	**-0.001****	**-0.001***	**-0.001***
							(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Constant	-0.060***	0.089	0.445	0.180	-122.626***	-0.056***	-0.056***	-0.060***	0.091	0.524	0.188	-126.327***
	(0.005)	(0.090)	(0.307)	(0.119)	(20.196)	(0.005)	(0.005)	(0.005)	(0.090)	(0.322)	(0.120)	(20.224)
Observations	218,779	218,779	218,779	218,779	218,779	231,346	231,346	218,779	218,779	218,779	218,779	218,779
R-squared	0.042	0.095	0.095	0.103	0.103	0.037	0.048	0.053	0.096	0.097	0.105	0.105
rmse	0.247	0.240	0.240	0.239	0.239	0.268	0.266	0.245	0.240	0.240	0.239	0.239
Controls	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES
Business control	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 4: POE vs. SOE: the effect of MFN tariff cuts on firm's exit



Note: The predictions are plotted from column 9 in Table 3. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of $\Delta\tau$.

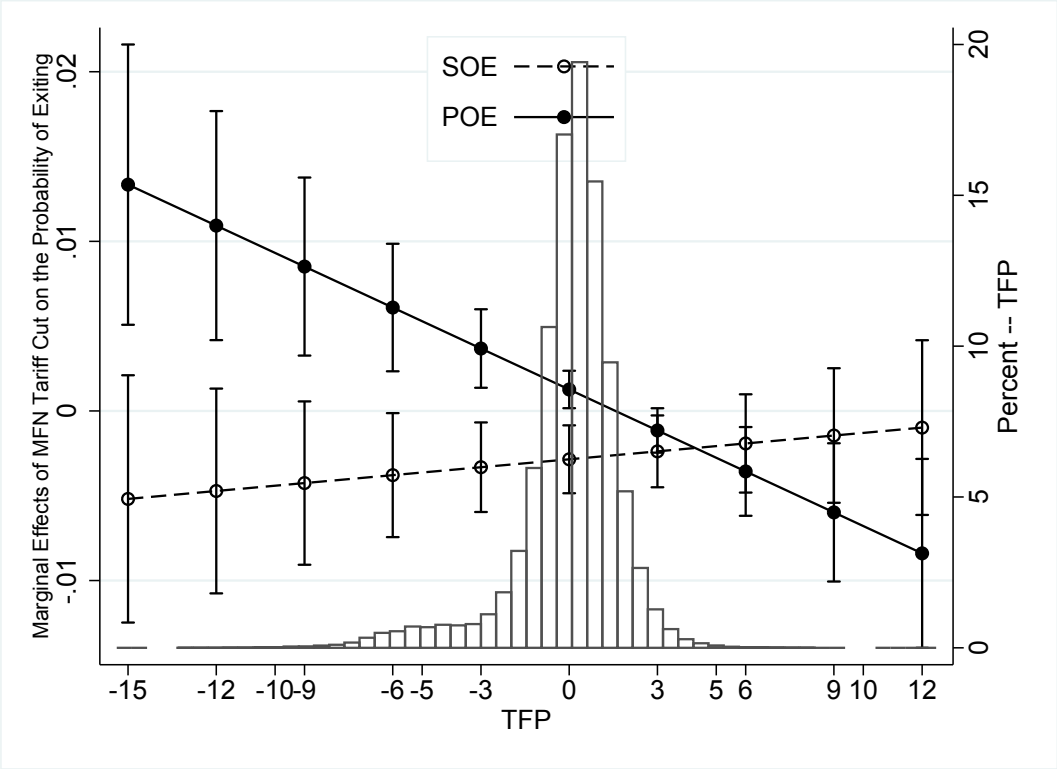
H2: Exit, MFN Tariff Cuts, and Productivity. To test H2, we rely on an augmented version of equation 15 and include a triple interaction term among POE, MFN tariff cuts, and productivity. More formally, we test the following model:

$$\begin{aligned} Pr(Exit_{fi,t} = 1) = \gamma_0 + \gamma_1 POE_{fi} + \gamma_2 \Delta\tau_{i,t-1} + \gamma_3 TFP_{fi,t} + \gamma_4 POE_{fi} \times \Delta\tau_{i,t-1} \\ + \gamma_5 POE_{fi,t} \times TFP_{fi,t} + \gamma_6 \Delta\tau_{i,t-1} \times TFP_{fi,t} + \gamma_7 POE_{fi} \times \Delta\tau_{i,t-1} \times TFP_{fi,t} \\ + \gamma_8 X_{fi,t} + \gamma_9 W_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}, \end{aligned} \tag{16}$$

where we add double interaction terms for each combination of POE, $\Delta\tau$, and TFP. Moreover, we include the same controls X and W as in equation 15. The key coefficient of interest is γ_7 , which should be negative. Table 3 shows the results of equation 16. Even in this case we begin with estimating models without controls and weights from entropy balancing (columns 7 and 8) and we then add them (columns 9 and 10) together with industry-year fixed effects and trends in subsequent

estimates (Models 11 and 12). The coefficient of the triple interaction term has the expected negative sign and is significant in every estimate (columns 7-12).

Figure 5: POE vs. SOE: The marginal effect of MFN tariff cuts on firm's exit at different values of productivity



Note: The predictions are plotted from column 3 in Table 3. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of TFP.

Figure 5 reports the marginal effect of $\Delta\tau$ for POEs and SOEs at different values of productivity. The slopes show that the probability of exiting the market scales with productivity for POEs, but not for SOEs. In fact, the slope is basically flat for SOEs, i.e. after trade liberalization the probability of exiting the market does not depend on SOE's productivity. Finally, we note that the coefficient of productivity is negative and statistically significant in every model, adding further plausibility to our results. Taken together, these findings are largely in line with our second hypothesis. The first two hypotheses highlight that the selection effect of trade is much stronger for POEs than SOEs.

H3: Markups and MFN Tariff Cut. To test H3 we switch the outcome variable from *Exit* to *Markups*. The empirical strategy remains the same, i.e. a difference-in-differences with elasticity. Formally, we estimate the following model:

$$ln(Markups_{fi,t}) = \zeta_0 + \zeta_1 POE_{fi} + \zeta_2 \Delta\tau_{i,t-1} + \zeta_3 POE_{fi} \times \Delta\tau_{i,t-1} + \zeta_4 X_{fi,t} + \delta_i + \delta_t + \epsilon_{i,t}, \quad (17)$$

where the key coefficient of interest is ζ_3 , which should be negative. We include controls that affect *ln(Markups)* and correlate with our main independent variables. More specifically, we include productivity, measures of capital-intensity (log of assets and capital-labor ratio), and a proxy for firm's size (logged number of employees). All these controls are at the firm-level.

As in the previous estimates, we start running OLS regressions with robust standard errors clustered by industry at ISIC 4-digit level for our baseline models. However, not controlling for lagged markup in equation 17 is inconsistent with the assumption that markups follow a Markov process in the estimation of the production function (Topalova and Khandelwal, 2011). Therefore, to address the potential problem of serial correlation in relation to *ln(Markups)*, we include a lagged dependent variable on the right-hand side in some estimates. Including a lagged dependent variable with fixed effects in a short time series is problematic (Nickel, 1981). As such, we switch from OLS to GMM regressions that instrument the lagged dependent variable with one or two lags (Arellano and Bond, 1991).[37]

Table 4 shows the results of equation 17. Throughout all the estimates the coefficient of the interaction between *POE* and $\Delta\tau$ is always negative and statistically significant as expected. This is the case for OLS regressions and for GMM regressions with the lagged dependent variable. Remember that the number of observations is lower in these models since we dropped the firms with negative markups.

Figure 6 shows the graphical interpretation of the interaction term, which refers to column 5. When tariff cuts increase, POE's markups decline significantly. On the contrary, the slope for SOEs is flat, i.e. tariff cuts have no effect on markups. In short, for SOEs trade liberalization does not trigger higher product market competition. This result validates our fourth hypothesis, showing that the pro-competitive effect of trade is hampered by the presence of SOEs.

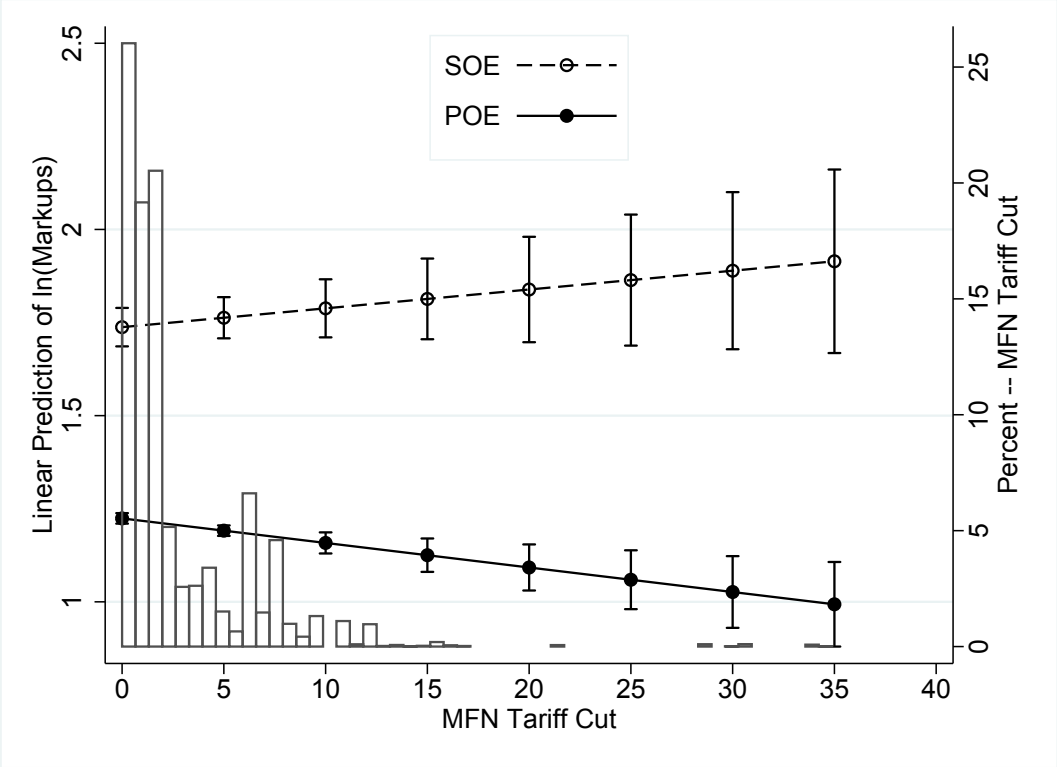
[37] In the appendix we show that results are similar if we run OLS regressions with lagged dependent variable and fixed-effects (see Table A4). Moreover, Table A5 shows that results are similar if we double-difference both dependent and independent variables.

Table 4: POE vs. SOE: markups and MFN tariff cuts. OLS regressions with standard errors clustered by HS 4-digit (columns 1, 3, 5, 7, 9 ,11) and GMM regressions with lagged dependent variable and standard errors clustered by HS 4-digit (columns 2, 4, 6, 8, 10, 12)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
VARIABLES	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)
POE	-0.399***	-0.237***	-0.360***	-0.244***	-0.342***	-0.215***	-0.342***	-0.215***	-0.355***	-0.214***	-0.348***	-0.198***
	(0.032)	(0.025)	(0.067)	(0.053)	(0.070)	(0.053)	(0.070)	(0.000)	(0.061)	(0.050)	(0.065)	(0.054)
MFN Tariff Cut	0.003	0.006***	0.010	0.006	0.011	0.005	0.011	0.005	0.012	0.005	0.010	0.009
	(0.003)	(0.001)	(0.009)	(0.005)	(0.008)	(0.004)	(0.008)	(0.004)	(0.007)	(0.005)	(0.007)	(0.015)
POE*MFN Tariff Cut	**-0.009****	**-0.010*****	**-0.021****	**-0.012*****	**-0.021*****	**-0.012*****	**-0.021*****	**-0.012*****	**-0.021*****	**-0.013*****	**-0.019*****	**-0.012*****
	(0.004)	**(0.002)**	**(0.008)**	**(0.004)**	**(0.008)**	**(0.004)**	**(0.008)**	**(0.004)**	**(0.007)**	**(0.004)**	**(0.007)**	**(0.005)**
ln(Markups) -- lagged		0.221***		0.221***		0.237***		0.237***		0.238***		0.294***
		(0.013)		(0.040)		(0.039)		(0.039)		(0.038)		(0.070)
Constant	3.402***	0.651***	3.395***	1.437***	3.454***	1.132***	3.440***	1.404***	3.273***	0.000	3.741***	0.000
	(0.078)	(0.182)	(0.070)	(0.014)	(0.284)	(0.091)	(0.257)	(0.256)	(0.407)	(0.000)	(0.330)	(0.000)
Observations	147,844	66,724	142,630	66,390	142,630	66,390	142,630	66,390	142,630	66,390	142,630	66,390
R-squared	0.127		0.164		0.172		0.172		0.191		0.185	
rmse	0.888	.	0.971	.	0.966	.	0.966	.	0.955	.	0.959	.
AR(1)		-19.65***		-10.59***		-10.82***		-10.81***		-11.03***		-0.89
AR(2)		0.94		-0.19		-0.23		-0.23		-0.22		0.28
Controls	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO
Trends	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 6: POE vs. SOEs: The effect of MFN tariff cuts on firm's markups



Note: The predictions are plotted from column 6 in Table 4. GMM regression with lagged dependent variable, industry (4-digit) fixed effects, and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of TFP.

H4: Exit, MFN Tariff Cut, and Firm's Debt. A key difference between POEs and SOEs is that SOEs have lower credit constraints than POEs. To directly test the mechanism highlighted by the model, we estimate the following model, which includes a triple interaction term between POE, tariff cuts, and firm's debt:

$$\begin{aligned} Pr(Exit_{fi,t}=1) = \kappa_0 &+ \kappa_1 POE_{fi,t} + \kappa_2 \Delta\tau_{i,t-1} + \kappa_3 ln(Firm's\ Debt)_{fi,t} + \kappa_4 POE_{fi,t} \times \Delta\tau_{i,t-1} \\ &+ \kappa_5 POE_{fi,t} \times ln(Firm's\ Debt)_{fi,t} + \kappa_6 \Delta\tau_{i,t-1} \times ln(Firm's\ Debt)_{fi,t} \\ &+ \kappa_7 POE_{fi,t} \times \Delta\tau_{i,t-1} \times ln(Firm's\ Debt)_{fi,t} + \kappa_8 X_{fi,t} + \kappa_9 W_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}, \end{aligned} \tag{18}$$

where the key coefficient of interest is κ_7, which is expected to be positive. As it is common practice with a triple interaction term, and similarly to equation 16, we include double interaction terms for each combination of *POE*, $\Delta\tau$, and *Firm's Debt*. Moreover, we include the same controls X and W as in equations 15 and 16, since the outcome variable is the same.

Results of equation 18 are reported in Table 5. Before estimating the triple interaction term, we start running a model with a simple interaction term between $\Delta\tau$ and *Firm's Debt*. The coefficient of this interaction term is negative and statistically significant, implying that access to credit reduces the probability of firms exiting the market (column 1). Columns 2-7 show the results of the triple interaction term, which is always positive (as expected) and significant. As for the previous hypothesis, we start running a simple model with no controls and then add them together with weights from entropy balancing, fixed-effects, and trends in subsequent estimates.

The crucial test is reported in Figure 7, which refers to Model 4 and plots the marginal effect of MFN tariff cut on the probability of exiting. For POEs *Firm's Debt* increases the probability of leaving the market in case of trade liberalization, though the significance is weak. On the contrary, as *Firm's Debt* increases, the probability of SOEs exiting the market decreases in case of trade liberalization and the effect is statistically significant. In other words, when tariff cuts kick in, SOEs are less likely to leave the market as they face lower credit constraints and, in turn, lower fixed costs than POEs do.

Finally, we include the interactions of both POE and tariff cut and firm's debt and tariff cut on the right hand-side of the model (column 8). The rationale is that we try to "kill" the interaction between POE and tariff cut with what our model suggests being the mechanism that shelters SOEs from trade liberalization. Indeed, while the coefficient of the interaction between POE and tariff cut loses significance, the coefficient of the interaction between firm's debt and tariff cut remains negative and significant. This test allows us to pin down the key difference between POEs and SOEs, i.e. access to credit, which generates a diverging selection effect in the case of trade liberalization. Our results strongly validate H4: access to credit is the mechanism explaining why POE and SOEs behave differently in case of trade liberalization.

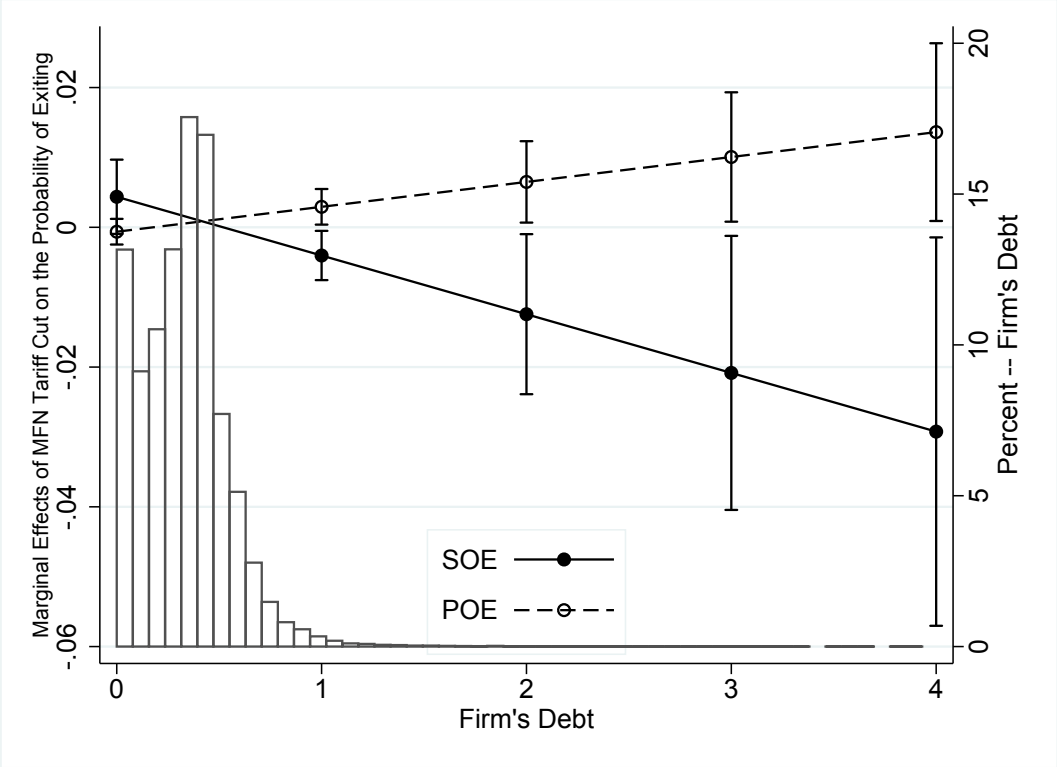
Robustness Checks. We perform several tests to check the robustness of our results. First, a characteristic of Vietnamese POEs is that the state might own a percentage of their capital. In other words, there are some POEs that rely on exclusive private capital and others that rely on a mix of private and public capital. We re-estimate the main models distinguishing between these two types of POEs. Results from these models are reported in Tables A6, A7, and A8 in the appendix.

Table 5: POE vs. SOE: exit, MFN tariff cuts, and firm's debt. OLS regressions with standard errors clustered by HS 4-digit

VARIABLES	(1) OLS PR(Exit=1)	(2) OLS PR(Exit=1)	(3) OLS PR(Exit=1)	(4) OLS PR(Exit=1)	(5) OLS PR(Exit=1)	(6) OLS PR(Exit=1)	(7) OLS PR(Exit=1)	(8) OLS PR(Exit=1)
POE	0.053***	0.078***	0.072***	0.033***	0.033***	0.033***	0.031***	0.053***
	(0.010)	(0.006)	(0.008)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)
MFN Tariff Cut	0.002**	-0.002**	0.002	0.003*	0.003*	0.003*	0.002	0.002*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Firm's Debt	0.039***	0.012***	0.013	0.020	0.020	0.020	0.019	0.039***
	(0.011)	(0.004)	(0.016)	(0.015)	(0.015)	(0.015)	(0.014)	(0.011)
POE*MFN Tariff Cut		0.000	-0.003	-0.003	-0.003	-0.003	-0.002	**0.000**
		(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	**(0.001)**
POE*Firm's Debt		0.042***	0.050**	0.057***	0.057***	0.057***	0.058***	
		(0.012)	(0.021)	(0.017)	(0.017)	(0.017)	(0.016)	
MFN Tariff Cut*Firm's Debt	**-0.004****	-0.001*	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*	**-0.004****
	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	**(0.002)**
POE*MFN Tariff Cut*Firm's Debt		**0.007*****	**0.010*****	**0.008****	**0.008****	**0.008****	**0.008****	
		(0.002)	**(0.004)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	
Constant	0.003	-0.110***	-0.082***	0.019	0.030		-30.530***	0.003
	(0.020)	(0.007)	(0.008)	(0.019)	(0.055)		(4.430)	(0.020)
Observations	127,575	129,875	127,575	127,575	127,575	127,575	127,575	127,575
R-squared	0.103	0.050	0.069	0.105	0.105	0.105	0.115	0.103
rmse	0.219	0.268	0.223	0.219	0.219	0.219	0.218	0.219
Controls	YES	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	NO	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	NO	YES	NO

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 7: POE vs. SOE: The effect of firm's debt on firm's exit



Note: The predictions are plotted from column 4 in Table 5. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of $ln(Firm's Debt)$.

Especially for TFP, the effects of POEs that are only owned by private capital are stronger than effects of POEs that are partially owned by the state. This additional evidence reinforces our claim that the combination of productivity and ownership affect the way in which firms respond to trade liberalization.

Second, we estimate the models with *Exit* as outcome variable, using survival analysis. Survival analysis allows to estimate the duration of firms surviving (i.e. not exiting) in the market. We expect that $POE \times \Delta\tau$ shortens the survival of firms, whereas $POE \times \Delta\tau \times TFP$ increases the survival of firms. The main advantage of survival model over OLS is that they have a better handle on the right and left censoring problem.[38] We rely on a parametric survival model using a Weibull distribution, which allows us to estimate accelerated failure time models.[39] Our main results remain unchanged (see Table A9).

[38]Left censoring refers to the fact that firms might exit the market before 2006, i.e. before our time span begins. Right censoring refers to the fact that firms might exit the market after 2012, i.e. after the end of our time span.

[39]The Weibull model is the most appropriate model according to the Akaike information criterion.

Third, our results are similar if we use Propensity Score Matching (PSM) as Tables A10-A12 show in the appendix.[40] Note that our sample shrinks when we use PSM, which drops unmatched observations. Finally, since MFN tariff are cut after the WTO accession, we interact each of the control with a dummy scoring one after 2007.[41] Even in this case our main results hold (see Table A13).

4.2 Industry-Level Analysis

Main Variables and Sample. The firm-level analysis provides robust evidence supporting H1, H2, H3, and H4. We now move to the industry-level analysis to test H5. The dependent variable is *TFP* in industry i. We calculate this as the weighted average value of TFP for all the firms f operating in industry i in time t.[42] *TFP* reports data at the beginning of the year.

Our main independent variables are MFN tariff cuts, a dummy for SOE-dominated sector, and their interaction. While we have already described the first variable, i.e. $\Delta\tau_{i,t}$, remember that $SOE-dominatedSector$ is a dummy scoring one if an industry has more than 40 percent of workers employed in SOEs. Noet that we use the percentage of workers in the pre-WTO accession period, i.e. in 2006.[43] The large *SOE Labor Share* is, the more an industry is "owned" by the state.[44] As we showed above, both POEs and SOEs operate in the vast majority of industries. Therefore, we are unable to compare industries in which only SOEs operate and for which we have data, as we would be left with only few industries.[45]

We estimate a sample of (up to) 632 industries (ISIC 4-digit) between 2006 and 2012 for which data on tariffs are available.[46] We rely on OLS regressions with robust standard errors clustered by

[40] We use the Stata 14 command `psmatch2`, which implements full Mahalanobis matching (Leuven and Sianesi 2003). We use the single nearest-neighbor (without caliper) matching method and rely on standard errors as in Abadie and Imbens (2006).

[41] For a similar approach, see Gentzkow (2006).

[42] The average value of each firm-level variable is weighted by share of firm size by industry, i.e. number of employees. We rely on size rather than revenue for the same reason that we explained above: POEs tend to under-report sales to evade taxes (whereas SOEs do not). Therefore weighting on revenue would lead us to under-estimate POEs in moving from firm-year to industry-year as unit of analysis.

[43] Data of workers employed in SOEs are reported at the beginning of the year.

[44] Results are similar if we use different thresholds, e.g. 35 percent or 45 percent of workers employed in SOEs.

[45] Given the distribution of the continuous measure of SOE labor share, using a dummy variable to indentify SOE-dominated sectors seems appropriate (Figure A8). In any case Table A14 shows that results are similar if we use a continuous measure of SOE labor share (2006 data).

[46] We are able to estimate up to 117 industries in a given year. There are 120 industries at the 4-digit level, which would result in 840 observations in seven years, 2006-2012. However, we have missing values for some covariates, which reduces our total number of observations. Moreover, when we include the lagged dependent variable on the right hand-side of the

industry at ISIC 4-digit level for our baseline models. As in the case of markups, not controlling for lagged productivity generates the potential problem of serial correlation. As such, we include a lagged dependent variable on the right-hand side of some models. A lagged depenent variable with a short time span and fixed effects is problematic (Nickel, 1981). Thus, in some models, we double-difference both dependent and independent variables to take care of dynamic panel estimation problems (Arellano and Honoré, 2001; Trefler, 2004).[47]

Econometric Strategy. The challenges we face in the industry-level analysis are similar to those we faced in the firm-level analysis. A first concern is that there are differences in the covariates observed between SOE-dominated industries and POE-dominated industries, as shown in the descriptive section. For instance, compared to POE-dominated industries, SOE-dominated industries tend (1) to be more capital-rich industries; (2) to have a significantly lower number of firms; and (3) to have larger firms. To tackle this issue, we again rely on entropy balancing. Specifically, we balance out a set of *exogenous* covariates with the respect to $SOE-dominatedSector$. We can thus compare SOE-dominated sectors with a comparable counterfactual of POE-dominated sectors, running our main models with the weights obtained from entropy balancing.

Second, similarly to the firm-level analysis, we include Trefler (2004) business condition controls. In this case, the business conditions controls are built by regressing $TFP_{i,t}$ over Vietnam's GDP, and the real interest rate, including industry and year fixed effects. These regressions generate time-varying industry-specific prediction ($\widehat{TFP}$) of the effect of business conditions on the WTO-period productivity and markups. Hence, we include these values on the right-hand side of the models with bootstrapped standard errors. Third, we include an industry-specific (2-digit) time trend to check if the parallel trend assumption holds.

H5: Productivity, MFN Tariff Cuts and SOE Labor Share. Formally, we estimate the following main model:

model, we lose observations in the first year in which industries appear in the dataset. Since our dataset is unbalanced, we do not only lose observations in 2006, but also in subsequent years.

[47] We are unable to use GMM estimates, since common diagnostic tests fail, e.g. Hansen's J statisitic and Sargan test. This is because the lagged dependent variable is never significant, a point to which we will return below.

$$TFP_{i,t} = \lambda_0 + \lambda_1 SOE - dominated\ Sector_{i,pre-WTO} + \lambda_2 \Delta\tau_{i,t-1} + \\ \lambda_3 SOE - dominated\ Sector_{i,pre-WTO} \times \Delta\tau_{i,t-1} + \lambda_4 X_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}, \tag{19}$$

where the key coefficient of interest is λ_3, which is expected to be negative. X includes a set of control variable at the industry-level. More specifically, we control for (logged) values of exports at the industry level, for the number of POEs, SOEs, and foreign firms operating in each industry. Furthermore, we include the proportion of POEs and SOEs exiting the market in each industry. In addition, we control for the logged number of employees and profit, market concentration (calculate as Herfindahl–Hirschman index of revenue), percentage of capital owned by the state in POEs, and for the capital-labor ratio, which are calculated as average values for all the firms operating in a given industry i.[48] Furthermore, we include both 2-digit or 4-digit industry fixed effect, δ_i. Since our time span is quite short, i.e. seven years, there is very little variation left to be explained with 4-digit industry fixed effects, which is therefore a very demanding test of our fifth hypothesis.

As said, we estimate also first-difference models to account for serial correlation:[49]

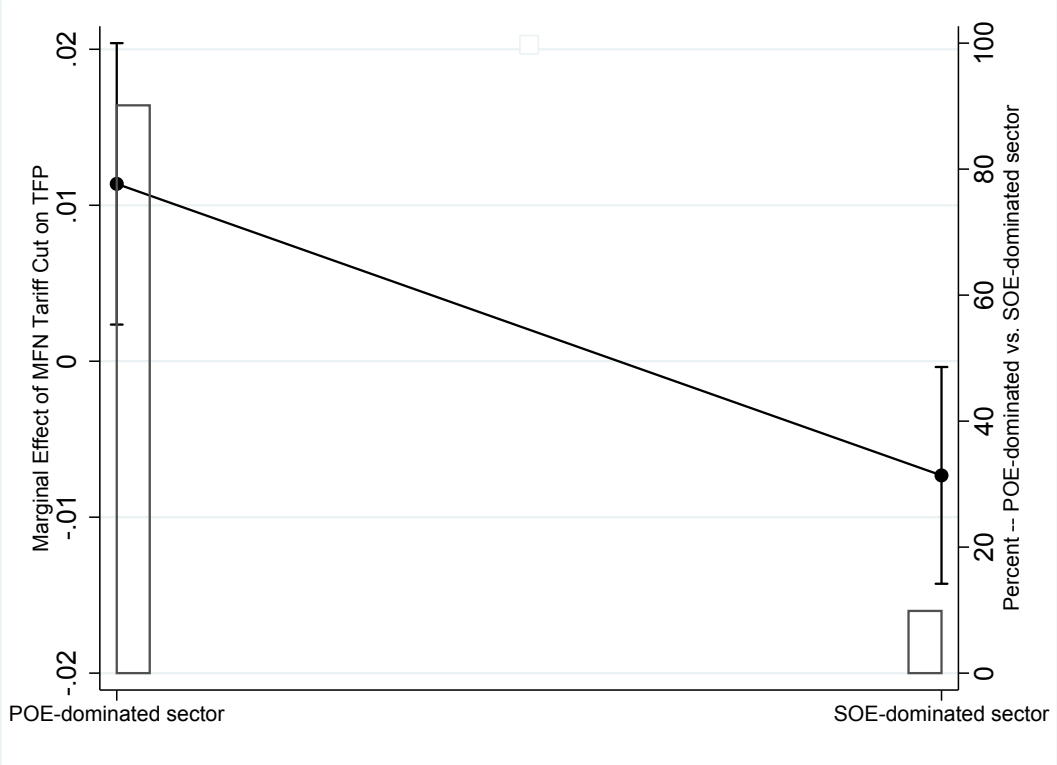
$$\Delta TFP_{i,t} = \lambda_0 + \lambda_1 SOE - dominated\ Sector_{i,pre-WTO} + \lambda_2 \Delta\tau_{i,t-1} + \\ \lambda_3 SOE - dominated\ Sector_{i,pre-WTO} \times \Delta\tau_{i,t-1} + \lambda_4 \Delta X_{i,t} + \delta_t + \Delta\epsilon_{i,t}, \tag{20}$$

The interaction between *SOE-dominated Sector* and MFN tariff cuts is always negative and statistically significant in every model (see Table 6). Importantly, the interaction term is significant even when we include 4-digit fixed effects (columns 2, 4, 6, 8, 10, and 12). Moreover, the coefficient of $\Delta\tau$ is always positive. Figure 8 shows the marginal effect of MFN cuts for POE-dominated sectors versus SOE-dominated sectors. While multilateral trade liberalization increases TFP in industries POE-dominated sectors, the marginal effects of MFN cuts becomes negative in SOE-dominated sectors. In other words, in SOE-dominated sectors productivity gains from trade are absent and, if anything, are negative. This is consistent with our fifth hypothesis. Moreover, our findings demonstrate that the effects of trade liberalization diverge strikingly from the predictions of Melitz's model when a large

[48] Table A2 in the Appendix shows descriptive statistics of all the variables described above.
[49] We do not first-difference *SOE-dominated Sector* since its values are at the baseline.

chunk of the economy is owned by the state.[50]

Figure 8: POE-dominated sectors vs. SOE-dominated sectors: The effect of MFN tariff cuts on firm productivity



Note: The marginal effects are plotted from Model 5 in Table 6. OLS regression with industry (2-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of *SOE-dominated Sector*.

We note a couple of further findings. First, our results are robust to the inclusion of the lagged dependent variable, which is often not significant (columns 3, 4, 7, 8). The fact that the lagged dependent variable is not significant may be explained by our relatively short time span by the fact that accession to the WTO has been a shock for the Vietnamese economy. Second, our results are similar if we include industry-specific trends (columns 13 and 14), which is a very conservative test of H5.

A counterfactual exercise. Our analysis has showed that the presence of SOEs tames the competition, selection and productivity effect of trade. Although our reduced-form empirical approach does not allow us to account for general equilibrium interactions, we can use regression coefficients to perform partial equilibrium calculations and get a sense of the magnitude of the foregone productivity

[50]The results are substantially similar if we replace TFP with labor productivity.

Table 6: TFP, MFN tariff cuts, and SOE labor share: OLS regressions with standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	ΔTFP	ΔTFP
MFN Tariff Cut	0.007	0.002	0.006	0.003	0.011**	0.010**	0.017***	0.012*	0.011**	0.010**	0.008*	0.005	0.014*	0.014*
	(0.005)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)	(0.003)	(0.008)	(0.008)
SOE-dominated Sector	0.078	0.057	0.041	0.349	0.150**	0.058	0.056	0.816	0.150**	0.058	0.162**	0.295**	0.050	0.050
	(0.068)	(0.088)	(0.055)	(0.373)	(0.060)	(0.125)	(0.062)	(0.528)	(0.060)	(0.125)	(0.066)	(0.138)	(0.056)	(0.056)
MFN Tariff Cut*SOE-dominated Sector	**-0.012***	**-0.010****	**-0.014*****	**-0.010*****	**-0.019*****	**-0.015*****	**-0.020*****	**-0.013****	**-0.019*****	**-0.015*****	**-0.014*****	**-0.008***	**-0.022****	**-0.022****
	(0.006)	**(0.004)**	**(0.005)**	**(0.003)**	**(0.005)**	**(0.006)**	**(0.007)**	**(0.007)**	**(0.005)**	**(0.006)**	**(0.004)**	**(0.005)**	**(0.010)**	**(0.010)**
TFP (lagged)			0.364***	0.053			0.166	-0.032						
			(0.089)	(0.058)			(0.123)	(0.121)						
Constant	-0.505	-0.142	0.045	0.010	0.033	0.682	0.150	-0.346	-15.510***	-15.795**	-0.266	0.49	-0.006	-0.127
	(0.370)	(0.716)	(0.239)	(0.527)	(0.798)	(1.682)	(0.540)	(1.241)	(4.848)	(6.700)	(0.919)	(1.928)	(0.066)	(0.143)
Observations	632	632	490	490	632	632	490	490	632	632	490	490	488	488
R-squared	0.365	0.612	0.522	0.678	0.584	0.719	0.616	0.731	0.584	0.719	0.616	0.731	0.256	0.425
rmse	0.391	0.333	0.346	0.310	0.361	0.323	0.363	0.332	0.361	0.322	0.421	0.421	0.342	0.299
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry 2-digit fixed effects	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	NO	NO
Industry 4-digit fixed effects	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	NO
Industry-specific trends	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

gains from trade due to the presence of SOEs.

We start showing the gains in trade from Vietnam's accession to the WTO (see Table 7). Specifically, we rely on column 5 in Table 6, and focus on POE-dominated industries (i.e. *SOE-dominated Sector*= 0) and estimate the predicted values before and after trade liberalization, keeping all the covariates at their average values. We operationalize trade liberalization looking at substantive MFN tariff cuts, tariff reductions greater than 3 percent (i.e. $\Delta\tau > 3$).[51] Then, we take the ratio of two predicted values, POE-dominated sector before and after trade liberalization, to calculate the productivity growth as a result of the WTO accession. In these industries, the post-WTO tariff reduction produce an average increase in TFP of 46 percent. Since these industries account for about 11 percent of Vietnam's manufacturing output, overall manufacturing productivity increases by 6 percent.[52]

Table 7: Gains from trade for the Vietnamese economy with and without SOE-dominated sectors.

	POE-dominated Sector		
	$\Delta\tau$ =0 $\rightarrow \Delta\tau > 3$	Output	Aggregate productivity gains
Productivity gains	31%	13%	4%
	Couterfactual analysis		
	$\Delta\tau > 3$		
	SOE-dominated $\rightarrow$ *POE-dominated*		
Productivity gains	15%		
	$\Delta\tau > 4$		
	SOE-dominated $\rightarrow$ *POE-dominated*		
Productivity gains	31%		
	$\Delta\tau > 7$		
	SOE-dominated $\rightarrow$ *POE-dominated*		
Productivity gains	60%		

To get a sense of the loss of efficiency produced by strong SOEs presence, we implement the

[51] We take the average value of positive tariff cuts.

[52] POE-dominated industries account for 90 percent of the Vietnam's manufacturing output, but only 13 percent of these industries faces tariff cuts larger than three percent.

following simulations. We look at all those industries facing substantive tariff cuts (i.e. $\Delta\tau > 3$, $\Delta\tau > 4$, and $\Delta\tau > 7$). For the other covariates we use their average values. Next, we build our counterfactual by replacing the value of *SOE-dominated Sector* with zero, keeping all the other covariates at the same level. In other words, we estimate what, according to our empirical model, would be the effect of trade liberalization on TFP if the industries with high presence of SOEs were replaced by the same industries but with low or no presence of SOEs. Finally, we take the ratio of the two predicted values (i.e. when *SOE-dominated Sector*=1 and *SOE-dominated Sector*=0) to capture the lower productivity gains from trade in industries with a large presence of SOEs.

Table 7 shows the result of this simulation. When $\Delta\tau > 3$, the average overall productivity gains would have been 13 percent larger in a counterfactual Vietnamese economy without SOE-dominated sectors. Similarly, when $\Delta\tau > 4$, the average overall productivity gains would have been 24 percent larger in a counterfactual Vietnamese economy without SOE-dominated sectors. When $\Delta\tau > 7$, the average overall productivity gains would have been 35 percent larger in a counterfactual Vietnamese economy without SOE-dominated sectors. In sum, we find that the presence of SOEs has substantively hampered productivity growth in Vietnam after the accession to the WTO.

5 Concluding Remarks

In this paper we have presented a theory of trade with firm heterogeneity in productivity and ownership to study the effects of trade liberalization in an economy with a strong presence of state-owned enterprises. Our model suggests that due to barriers to entry and easier access to credit, a de facto barrier to exit, the presence of SOEs can hamper the competition and selection effects of trade, thereby severely reducing the productivity gains of openness.

We have tested the model's predictions using a new data set of Vietnamese firms to assess the effects of the 2007 WTO entry on Vietnam's economy. Our firm-level analysis shows that the post-WTO probability of exiting the market is much larger for private firms than for state-owned firms. Moreover, the selection effect scales with productivity for POEs, whereas it does not for SOEs. Importantly, our empirical analysis supports the theoretical prediction that two distinguishing features of SOEs, entry barriers and preferential access to credit, are key in shaping their response to the product market

liberalization brought about by WTO access.

Moreover, in the industry-level analysis, we show that trade liberalization leads to sizable productivity gains in POE-dominated industries, while productivity does not increase in SOE-dominated industries. Finally, with a simple counterfactual exercise we have shown that the presence of SOEs leads to sizable reductions in the aggregate productivity gains from trade, amounting to roughly 50 percent of the potential gains in those industries facing substantive trade liberalization.

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Appendix: for Online Publication

A1: Baseline model

Households problem. Households maximize utility subject to its budget constraint. The consumer problem can be separated in three problems: the choice between X and O, the choice between G and Y, and the allocation of expenditures across different product lines within G and Y. The standard utility maximization problem leads to the following equilibrium demand choice

$$\begin{aligned} O &= \beta E, \\ G &= \gamma E / P_g \\ Y &= (1-\gamma) E / P_y \\ p_{g,j} &= \frac{\gamma E}{G^{\alpha}}\, g_j^{\alpha-1}, \\ p_{y,j} &= \frac{(1-\gamma) E}{Y^{\alpha}}\, y_j^{\alpha-1}, \end{aligned}$$

where $p_{i,j}$ is the price of good j in sector i, P_i is the price index of sector i, $E = P_g G + P_y Y$ is total expenditure on the differentiated goods sector X. Because of log preferences, total spending in the homogeneous good is β times total spending in the differentiated good, this is shown in the first condition. The second and third conditions simply show the Cobb-Douglas demand for the public and private aggregate of differentiated goods. The final two conditions show the inverse demand for each differentiated good in the two sectors.

Firm problem in open economy. The first order conditions of the firm problem (2) are

$$\left[(\alpha-1)\frac{q_D^D}{y_D}+1\right] p_D = \frac{1}{\tilde{z}} \tag{21}$$

$$\left[(\alpha-1)\frac{q_D^F}{y_D}+1\right] p_F = \frac{\tau}{\tilde{z}} \tag{22}$$

Since the two countries are symmetric, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \breve{q}$, $y_D = y_F \equiv y$, $E_D = E_F$, $Y_D = Y_F$, $p_D = p_F = p_y$. From (21) and (22) and using $q/y + \breve{q}/y = 1/n$ we get

$$\left[(\alpha-1)\frac{q}{y}+1\right] = \frac{2n_y - 1 + \alpha}{n_y(1+\tau)} \equiv \theta_{d,y} \tag{23}$$

$$\left[(\alpha-1)\frac{\breve{q}}{y}+1\right] = \tau\frac{2n_y - 1 + \alpha}{n_y(1+\tau)} \equiv \theta_f = \tau\theta_{d,y} \tag{24}$$

which allows us to express the price of exported goods as

$$p_y = \frac{\tilde{z}^{-1}}{\theta_{d,y}} = \frac{\tau\tilde{z}^{-1}}{\theta_{f,y}}$$

where θ_D, y and θ_f are the markups charged in the domestic market and in the export market, respectively. We can now rewrite (21) and (22) as follows

$$\theta_{d,y}\frac{(1-\gamma)E}{Y^{\alpha}}\ y^{\alpha-1}=\frac{1}{\tilde{z}}\ \text{ and }\tau\theta_{d,y}\frac{(1-\gamma)E}{Y^{\alpha}}\ y^{\alpha-1}=\frac{\tau}{\tilde{z}}.$$

Multiplying the above equations by q and $\breve{q}$ and summing up we obtain

$$\frac{q+\tau\breve{q}}{\tilde{z}}=n_y\left[\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}\right]\frac{(1-\gamma)E}{n_y}\left(\frac{y}{Y}\right)^{\alpha}. \tag{25}$$

Let us define the inverse of the average markup,

$$\theta_{\tau,y}\equiv\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}=\frac{\theta_{d,y}q+\theta_{f,y}\breve{q}}{q+\breve{q}}.$$

Notice that using (21) and (22) it is easy to show that $\theta_{\tau,y}$ is

$$p=\frac{1}{\theta_{\tau,y}}\frac{1}{\tilde{z}}\left(\frac{q+\tau\breve{q}}{q+\breve{q}}\right)$$

indeed the inverse of the average markup. Using $y=\left\{\left[1/\tilde{z}\right]\left(Y^{\alpha}/\left(\theta_{D,y}(1-\gamma)E\right)\right)\right\}^{\frac{1}{\alpha-1}}$, it is easy to prove that $(y/Y)^{\alpha}=\tilde{z}/\left(M\bar{z}_y\right)$. From (23) and using $q/y+\ \breve{q}/y=1/n_y$ we obtain

$$\frac{q+\tau\breve{q}}{\tilde{z}}=\theta_{\tau,y}\frac{(1-\gamma)E}{n_yM_y}\frac{z}{\bar{z}_y} \tag{26}$$

where

$$\theta_{\tau,y}=\frac{2n_y-1+\alpha}{n_y\left(1+\tau\right)^2(1-\alpha)}\left[\tau^2\left(1-n_y-\alpha\right)+n_y\left(2\tau-1\right)+1-\alpha\right]$$

is the inverse of the markup in the open economy. Similarly, we can derive the expression

$$\frac{q+\breve{q}}{\tilde{z}}=\theta_{d,y}\frac{(1-\gamma)E}{n_yM_y}\frac{z}{\bar{z}_y}$$

which together with (26) allow us to obatin (EC).

A2. Mixed market model

Demands from the differentiated good becomes $p_g=\left(E/X^{\alpha}\right)g^{(\alpha-1)}$ and $p_y=\left(E/X^{\alpha}\right)y^{(\alpha-1)}$ where total expenditure in the differentiated goods industry is

$$E=\left(\int_0^{M_g}p_{gj}g_j\ \mathrm{d}j+\int_0^{M_y}p_{yj}y_j\ \mathrm{d}j\right).$$

The firm problem is similar to the previous one in (2), yielding exactly the same first order conditions (23) and (24). The only difference is that, due to the different demand structure, (25) becomes

$$\frac{q+\tau\breve{q}}{\tilde{z}} = n_y\left[\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}\right]\frac{E}{n_y}\left(\frac{y}{X}\right)^{\alpha},$$

where

$$\left(\frac{y}{X}\right)^{\alpha} = \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{z}{\bar{z}M},$$

$M = 1-F\left(\min(z_g^*, z_y^*)\right)$ and

$$\bar{z}(z_g^*, z_y^*) = \frac{1}{M}\left(\theta_{d,g}^{\frac{\alpha}{1-\alpha}}\int_{z_g^*}^{z_y^*} z\mu_i(z)dz + \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\int_{z_y^*}^{\infty} z\mu_i(z)dz\right).$$

This leads to the following variable labour demand

$$\frac{q+\tau\breve{q}}{\tilde{z}} = \theta_{\tau,y}\theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{E}{n_y M}\frac{z}{\bar{z}}$$

which is similar to (4) except for the slightly different expression for the inverse of the markup which is now $\theta_{X,y}\equiv\theta_{\tau,y}\theta_{D,y}^{\frac{\alpha}{1-\alpha}}$ instead of $\theta_{\tau,y}$. Proceding as before the labour demand relative to the total amount sold is

$$\frac{q+\breve{q}}{\tilde{z}} = \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{E}{n_y M}\frac{z}{\bar{z}}.$$

Using these conditions and the fact that firms bring investors to the participation constraint into the liquidity constraint we can derive the cutoff conditions,

$$E = \frac{\hat{\lambda}_y n_y M}{(1-\theta_{\tau,y})\,\theta_{d,y}^{\frac{\alpha}{1-\alpha}}}\frac{\bar{z}(z_g^*, z_y^*)}{z_y^*,}. \tag{27}$$

$$E = \frac{\hat{\lambda}_g n_g M}{(1-\theta_{\tau,g})\,\theta_{d,g}^{\frac{\alpha}{1-\alpha}}}\frac{\bar{z}(z_g^*, z_y^*)}{z_g^*} \tag{28}$$

where $\bar{z}$ is weighted average productivity,

$$\bar{z}(z_g^*, z_y^*) = \frac{1}{M}\left(\theta_{d,g}^{\frac{\alpha}{1-\alpha}}\int_{z_g^*}^{z_y^*} z\mu(z)dz + \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\int_{z_y^*}^{\infty} z\mu(z)dz\right),$$

written the case where surviving is harder for POEs, that is if $z_y^* > z_g^*$, and the equilibrium distribution is $\mu(z) = f(z)/(1-\Gamma(z_g^*))$. Using (27) and (28) we obtain

$$Z \equiv \frac{z_y^*}{z_g^*} = \left(\frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\right)\left[\frac{(1-\theta_{\tau,g})\,\theta_{d,g}^{\frac{\alpha}{1-\alpha}}}{(1-\theta_{\tau,y})\,\theta_{d,y}^{\frac{\alpha}{1-\alpha}}}\right]. \tag{29}$$

Our assumption 1 ($n_y > n_g$) implies that $\theta_{\tau,y} > \theta_{\tau,g}$ but also that $\theta_{d,y} > \theta_{d,g}$, hence it is not sufficient to establish that selection is tougher for POEs, as the non-linear term in θ_d generates an ambiguity. In order to focus on the empirically relevant case, we assume that the differential access to credit implies that $\hat{\lambda}_y/\hat{\lambda}_g$ is large enough to guarantee equilibria where $z_y^* > z_g^*$.

Labor market clearing closes the model,

$$n_g M \int_{z_g^*}^{z_y^*} \left(\frac{g + \tau \breve{y}}{\tilde{z}} + \lambda_g \right) \mu(z)dz + n_y M \int_{z_y^*}^{\infty} \left(\frac{y + \tau \breve{y}}{\tilde{z}} + \lambda_y \right) \mu(z)dz + \beta E = 1,$$

which leads to

$$E = \frac{1}{\left(\overline{\overline{z}} + \beta\right)} \left[1 - \frac{\lambda_g n_g \left(F\left(z_y^*\right) - F(z_g^*) \right) + \lambda_g n_g \left(1 - F(z_y^*) \right)}{1 - F(z_g^*)} \right], \qquad \text{(MC mix)}$$

where

$$\overline{\overline{z}} = \theta_{\tau,g} \theta_{D,g}^{\frac{\alpha}{1-\alpha}} \int_{z_g^*}^{z_y^*} z \mu_i(z) dz + \theta_{\tau,y} \theta_{D,y}^{\frac{\alpha}{1-\alpha}} \int_{z_y^*}^{\infty} z \mu_i(z) dz.$$

First we can show that, as in the baseline model, the pro-competitive effect of trade is stronger for POEs than for SOEs. Differentiating the average markup with respect to the trade cost and the number of firms yields

$$-\frac{\partial \theta_{X,i}}{\partial \tau \partial n_i} = -\left(\frac{\partial \theta_{\tau,i}}{\partial \tau \partial n_i} \theta_{D,i}^{\frac{\alpha}{1-\alpha}} + \frac{\alpha}{1-\alpha} \theta_{d,i}^{\frac{2\alpha-1}{1-\alpha}} \frac{\partial \theta_{D,i}}{\partial \tau \partial n_i} \right) > 0.$$

As in the previous section, the first component $-\partial \theta_{\tau,i} / \left(\partial \tau \partial n_i\right) > 0$. The second term $-\partial \theta_{D,i}/\partial \tau \partial n_i = \left(1-\alpha\right) / \left(n^2 \left(1+\tau\right)\right) > 0$. Hence the pro-competitive effect is larger the stronger is the pre-liberalization level of competition. We can also show that this implies that the selection effect of trade is stronger for POEs than for SOEs. Using (29) we obtain

$$-\frac{\partial \ln Z}{\partial \tau} = \frac{\partial \theta_{\tau,g}/\partial \tau}{\left(1 - \theta_{\tau,g}\right)} - \frac{\partial \theta_{\tau,y}/\partial \tau}{\left(1 - \theta_{\tau,y}\right)} + \frac{\alpha}{1-\alpha} \left(\frac{\partial \theta_{d,y}/\partial \tau}{\theta_{d,y}} - \frac{\partial \theta_{d,g}/\partial \tau}{\theta_{d,g}} \right) > 0,$$

where the inequality derives from $\theta_{\tau,y} > \theta_{\tau,g}$, $|\partial \theta_{\tau,y}/\partial \tau| > |\partial \theta_{\tau,g}/\partial \tau|$, and $\left(\partial \theta_{d,y}/\partial \tau\right)/\theta_{d,y} = -\left(1+\tau\right)^{-1}$, which makes the term in brakets equal to zero. This suggests that a reduction in the variable trade costs increases the survival cutoff more for POEs than for SOEs and, as a consequence, selection and exit will be more pronounced for private firms. Moreover, since we have established that the the term in square brackets in (29) is increasing when the trade cost declines, the positive effect of trade liberalization on the relative cutoff Z is larger the larger is the difference in access to credit $\hat{\lambda}_y/\hat{\lambda}_g$. Hence, due to stronger credit constraint, trade-induced selection will be stronger for POEs than for SOEs.

A3: Data

The data sources have been already described in the text, but we add some further details here.

- **General Statistics Office of Vietnam** : data include the entire sample of Vietnamese firms that report their information to the GSO. The data do not include firms that operate in the informal economy. The variables are reported in Vietnamese language and translated in English by us. The trade categorization of the survey follows ISICv4. We created a cross-walk from the four-digit Vietnam Standard Industrial Classiffication (VSIC) and ISIC revision 3, and then from ISIC revision 3 to 6-giti HS to merge the GSO data with tariff data.

- **Import and export** : data come from COMTRADE and are at the HS 6-digit level. To merge 6-digit COMTRADE data with 4-digit Vietnamese firm-level data, we take the average value of import and export.

- **MFN** : data come from TRAINS (WITS) and are at the HS 6-digit level. To merge 6-digit WTITS data with 4-digit Vietnamese firm-level data, we take the average value of MFN tariffs.

- **US − Vietnam BTA** : data come from TRAINS (WITS) and are at the HS 6-digit level. To merge 6-digit COMTRADE data with 4-digit Vietnamese firm-level data, we take the average value of preferential tariffs.

A4: Other Figures and Tables

Figure A1: MFN tariffs after WTO accession by 2-digit industries.

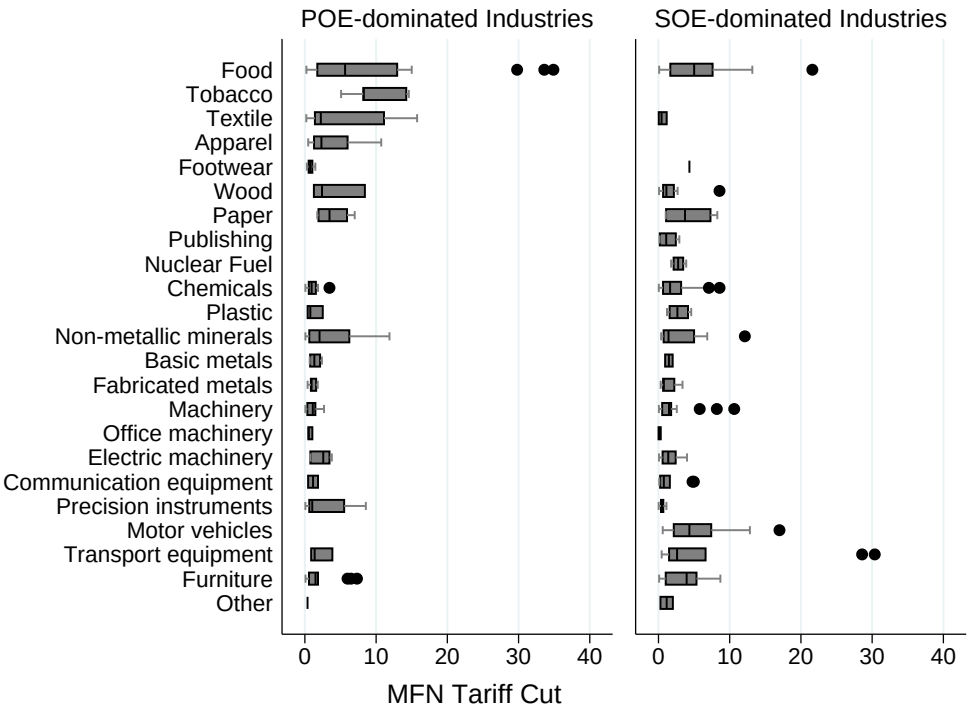


Figure A2: Bias toward SOEs.

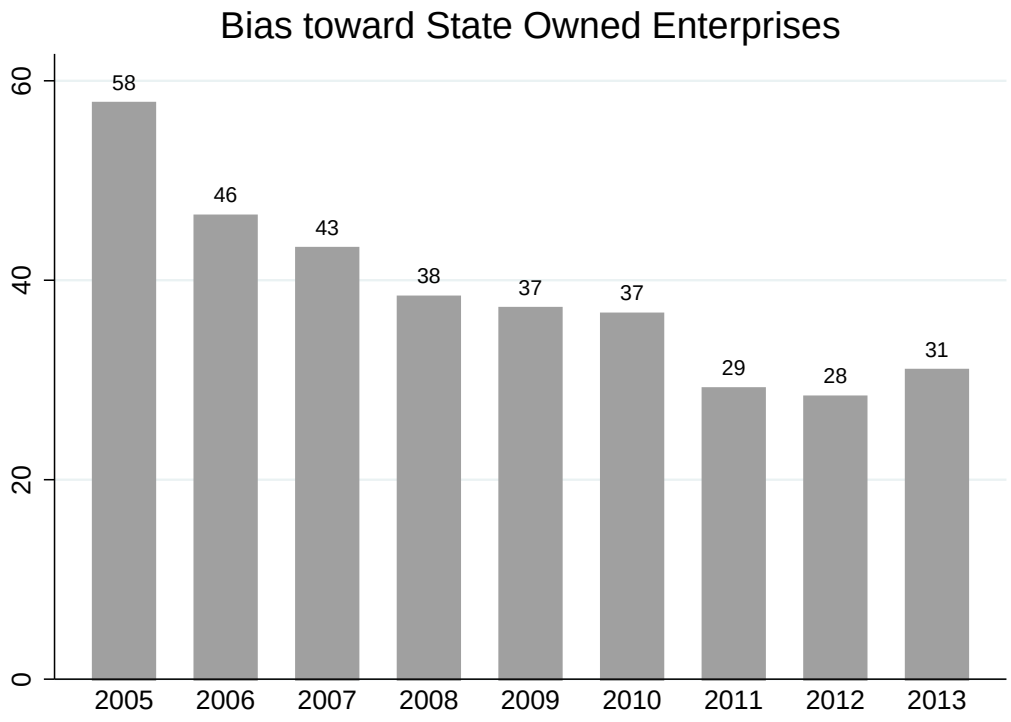


Figure A3: Types of bias toward SOEs.

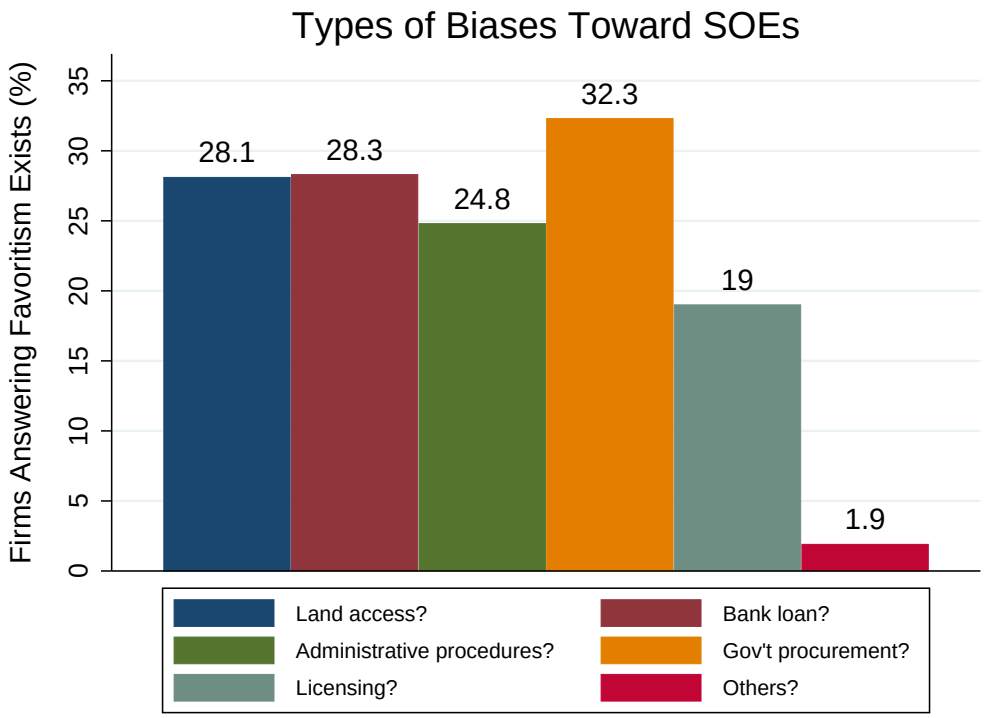
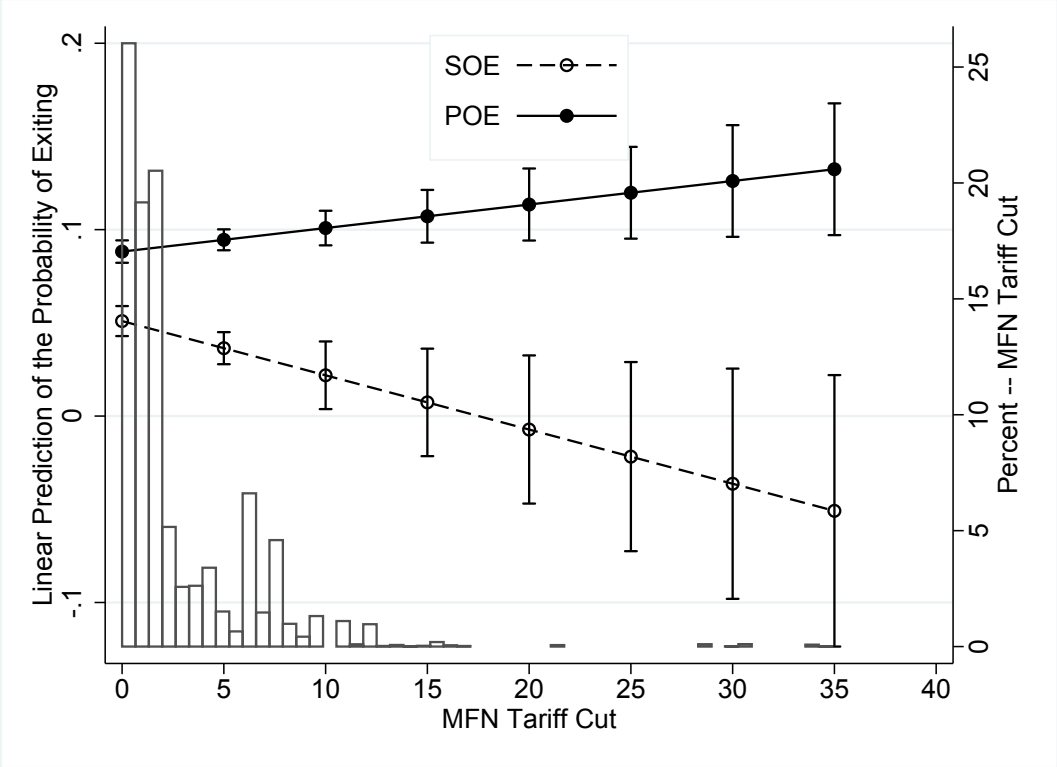
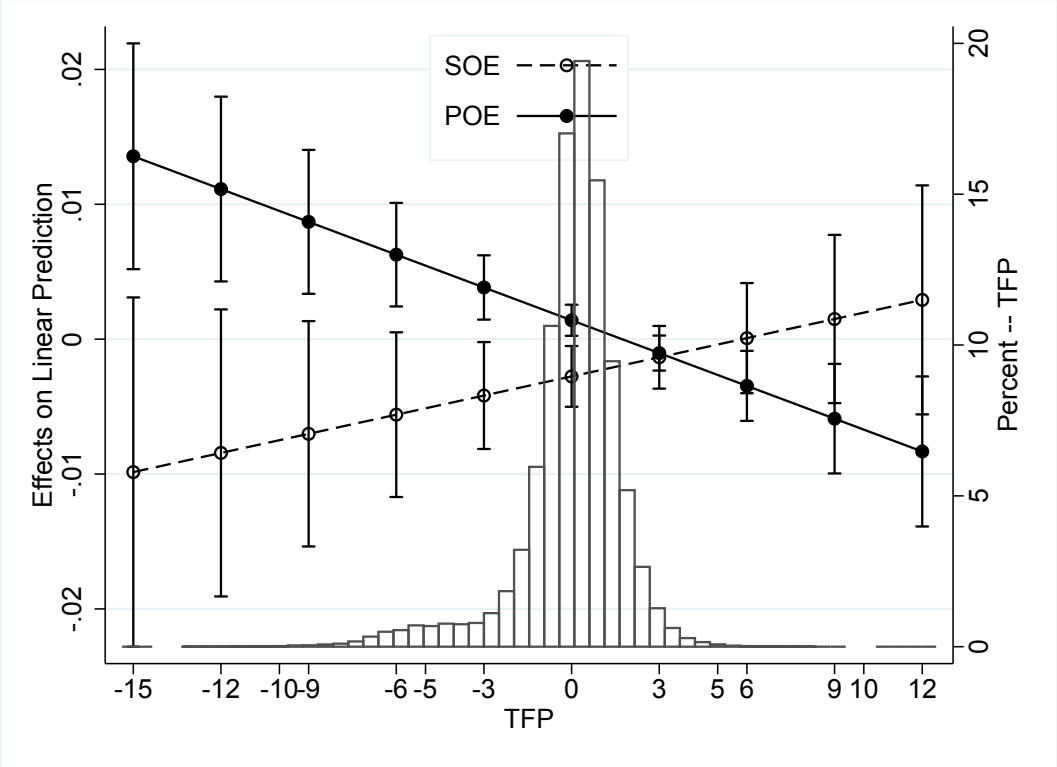


Figure A4: POE vs. SOE: the effect of MFN tariff cuts on firm's exit



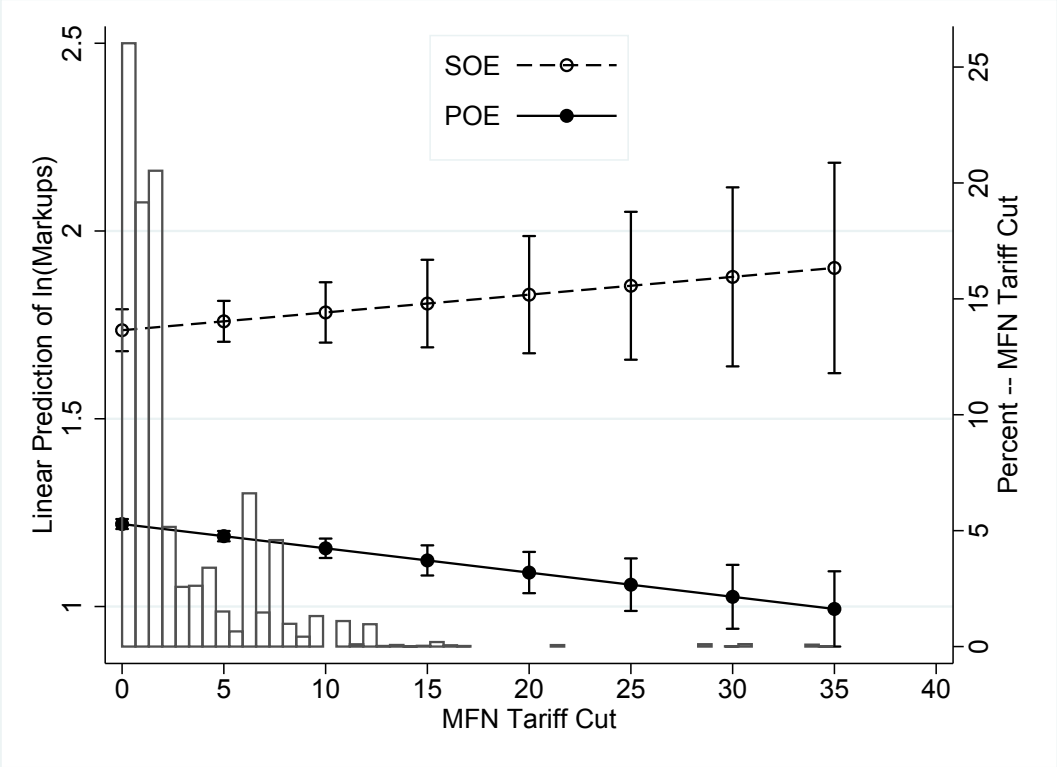
Note: The predictions are plotted from column 3 in Table 3 including the interaction term between a dummy of foreign firms and *MFN Tariff Cut*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of $\Delta\tau$.

Figure A5: POE vs. SOE: The marginal effect of MFN tariff cuts on firm's exit at different values of productivity



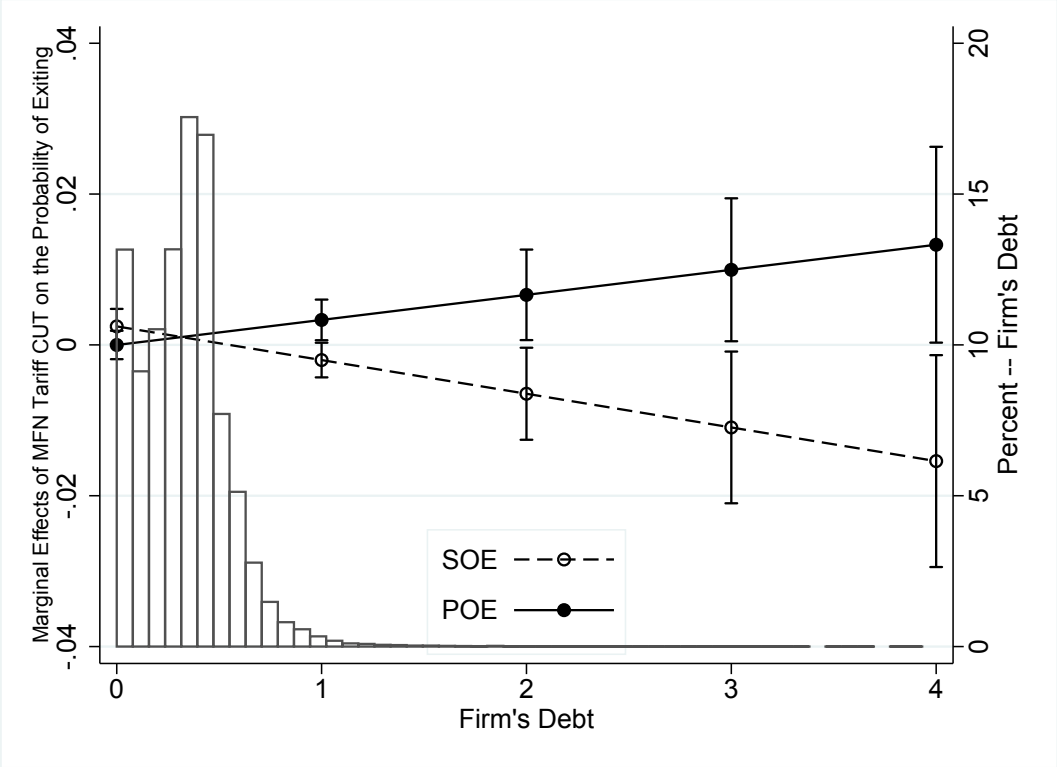
Note: The predictions are plotted from column 9 in Table 3 including triple and double interaction terms between a dummy of foreign firms, *MFN Tariff Cut*, and *TFP*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of TFP.

Figure A6: POE vs. SOEs: The effect of MFN tariff cuts on firm's markups



Note: The predictions are plotted from column 6 in Table 4 including the interaction term between a dummy of foreign firms and *MFN Tariff Cut*. GMM regression with lagged dependent variable, industry (4-digit) fixed effects, and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of TFP.

Figure A7: POE vs. SOE: The effect of firm's debt on firm's exit



Note: The predictions are plotted from column 4 in Table 5 including triple and double interaction terms between a dummy of foreign firms, *MFN Tariff Cut*, and *Firm's Debt*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered by industry (4-digit). The histogram shows the distribution of $ln(Firm's Debt)$.

Figure A8: Distribution of SOE Labor Share

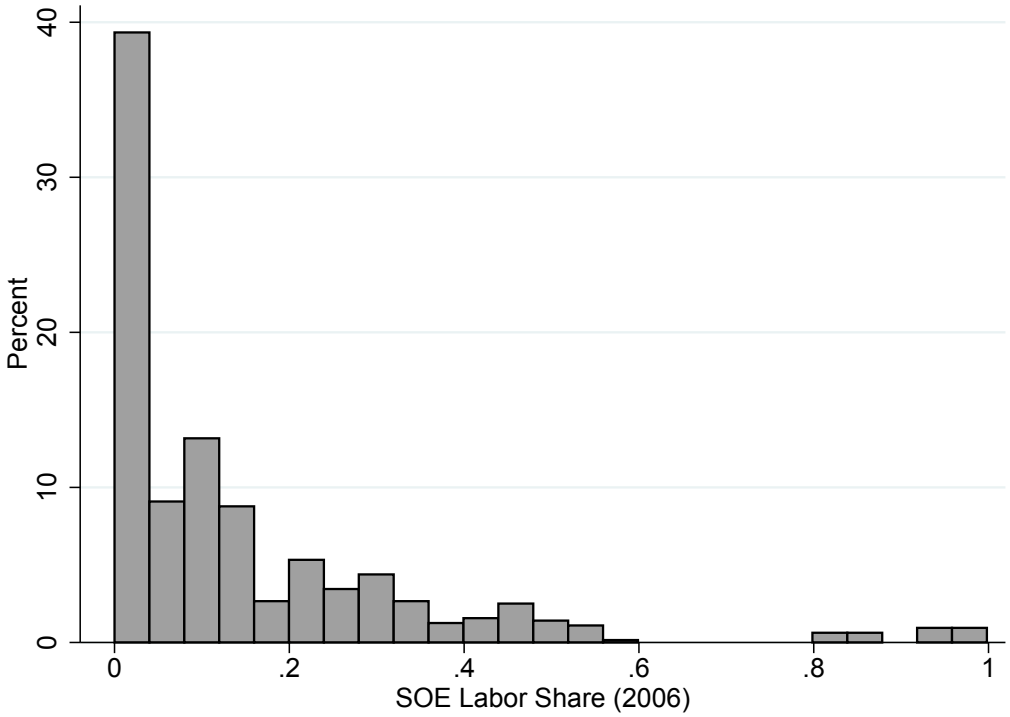


Table A1: Descriptive statistics.

Firm-level analysis				
Variable	Mean	Std. Dev.	Min	Max
Exit	0.07	0.25	0	1
MFN Tariff Cut	1.37	1.43	-28.82	34.89
POE*Post-WTO	0.78	0.42	0	1
POE*Post-WTO (2008)	0.10	0.30	0	1
POE*Post-WTO (2009)	0.12	0.33	0	1
POE*Post-WTO (2010)	0.12	0.32	0	1
POE*Post-WTO (2011)	0.13	0.34	0	1
POE*Post-WTO (2012)	0.15	0.36	0	1
POE	0.91	0.29	0	1
Foreign firm	0.07	0.25	0	1
TFP	0.04	1.69	-15.40	12.50
ln(Markup)	0.74	0.96	-11.19	12.21
HHI	0.06	0.12	0	1
ln(Number of Employees)	3.05	1.46	0	11.46
ln(Assets)	8.54	1.84	0	19.35
ln(K\L)	5.43	1.32	0	13.74
ln(Exports)	9.72	9.54	0	21.74
Age	42.69	27.70	0	69
Age squared	2592	1837	1	4761
Preferential Tariff Cut	0.01	0.38	0	20
MFN Tariff	11.10	7.67	0	91.39

Industry-level analysis				
Variable	Mean	Std. Dev.	Min	Max
TFP	-0.16	0.50	-2.13	1.41
ln(Markup)	1.46	0.47	0.01	3.32
MFN Tariff Cut	1.27	4.77	-28.82	34.89
SOE Revenue Share	0.11	0.19	0	1
ln(Number of Employees)	5.55	1.17	1.60	10.30
ln(K\L)	5.80	0.83	0	9.11
Exit	30.00	94.00	0	924
Age	50.00	7.00	1	69
ln(Exports)	10.74	9.38	0	21.74
Capital owned by state	3.89	5.80	0	35.08
Number of SOEs	9	19	0	224
Number of Semi-POE	223	500	0	5046.00
Number of POEs	393	906	1	8048
Number of Foreign Firms	29	88	0	927
MFN Tariff	9.98	11.08	0	91.39

Table A2: Differences between POEs covariates and SOEs covariates.

	POE			SOE		
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour)	2.88	1.73	1.05	4.81	2.59	-0.03
ln(Assets)	8.34	2.91	0.43	10.62	3.68	-0.30
MFN Tariff	10.91	56.99	1.51	13.00	73.46	1.54
ln(Exports)	9.40	90.56	0.07	12.89	84.76	-0.65
ln(K/L)	5.40	1.70	-0.69	5.76	2.12	-0.20
PTA Tariff	0.01	0.14	27.78	0.02	0.21	21.81
Age	41	811	-0.60	55	190	-2.68
Age squared	2529	3563003	-0.46	3216	1071655	-1.80

	POE			SOE		
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour)	2.88	1.73	1.05	2.88	1.97	-0.03
ln(Assets)	8.34	2.91	0.43	8.34	4.91	-0.30
MFN Tariff	10.91	56.99	1.51	10.91	56.10	1.54
ln(Exports)	9.40	90.56	0.07	9.40	95.62	-0.65
ln(K/L)	5.40	1.70	-0.69	5.40	2.97	-0.20
PTA Tariff	0.01	0.14	27.78	0.01	0.14	21.81
Age	41	811	-0.60	41	811	-2.68
Age squared	2529	3563003	-0.46	2529	3549747	-0.51

Table A3: Explaining MFN tariff cuts: OLS with industry (4-digit) fixed effects and robust standard errors by HS 4-digit.

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
VARIABLES	MFN Tariff Cut	MFN Tariff Cut	MFN Tariff Cut	MFN Tariff Cut
MFN Tariff Level	-0.528***	-0.527***	-0.530***	-0.610***
	(0.052)	(0.053)	(0.052)	(0.041)
SOE Labor Share	1.735	1.752	-3.498	-2.048
	(1.510)	(1.496)	(2.990)	(3.682)
TFP	0.429	0.610	0.529	0.391
	(0.419)	(0.563)	(0.441)	(0.377)
ln(Markups)	-0.251	-0.248	-0.739	0.649*
	(0.726)	(0.724)	(0.943)	(0.333)
Firm's Debt				0.692
				(1.627)
SOE Labor Share*TFP		-1.427		
		(1.563)		
SOE Labor Share*ln(Markups)			3.066	
			(1.945)	
SOE Labor Share*Firm's Debt				3.676
				(9.884)
Firm's Size	-0.201	-0.224	-0.214	0.061
	(0.384)	(0.402)	(0.386)	(0.202)
POE Exit Rate	0.025	-0.061	-0.137	-0.816
	(1.779)	(1.759)	(1.819)	(1.443)
SOE Exit Rate	0.838	0.278	0.753	11.037
	(1.385)	(1.116)	(1.376)	(27.495)
K/L	0.190	0.177	0.073	-0.444
	(0.471)	(0.469)	(0.476)	(0.369)
Age	-0.030	-0.028	-0.027	-0.003
	(0.030)	(0.029)	(0.029)	(0.015)
HHI	0.802	0.851	0.553	-0.213
	(1.950)	(1.987)	(1.914)	(1.030)
ln(Exports)	-0.036	-0.038	-0.045	-0.009
	(0.076)	(0.077)	(0.079)	(0.049)
Constant	9.733**	9.864**	11.296**	10.136***
	(3.968)	(4.055)	(4.675)	(2.129)
Observations	616	616	616	445
R-squared	0.470	0.470	0.472	0.709
rmse	3.441	3.442	3.437	1.865
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A4: Markups and MFN tariff cut: OLS regression with lagged dependent variable and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)
POE	-0.207***	-0.167***	-0.153**	-0.153**	-0.168***	-0.158***
	(0.024)	(0.053)	(0.059)	(0.059)	(0.049)	(0.052)
MFN Tariff Cut	0.002	0.003	0.003	0.003	-0.001	0.006
	(0.002)	(0.008)	(0.007)	(0.007)	(0.007)	(0.006)
POE*MFN Tariff Cut	**-0.008****	**-0.012**	**-0.012**	**-0.012**	**-0.012***	**-0.013***
	(0.004)	**(0.008)**	**(0.007)**	**(0.007)**	**(0.007)**	**(0.007)**
ln(Markups) -- lagged	0.485***	0.505***	0.496***	0.496***	0.494***	0.492***
	(0.016)	(0.021)	(0.018)	(0.018)	(0.018)	(0.017)
Constant	0.615***	0.509***	0.672***	0.591***	0.548***	0.547***
	(0.041)	(0.057)	(0.078)	(0.163)	(0.073)	(0.067)
Observations	71,769	71,350	71,350	71,350	71,350	71,350
R-squared	0.317	0.370	0.375	0.375	0.385	0.387
rmse	0.791	0.823	0.820	0.820	0.814	0.812
Controls	NO	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES
Business control	NO	NO	NO	YES	NO	NO
Industry-year FE	No	No	No	No	YES	NO
Trends	NO	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5: Markups and MFN tariff cut: OLS regression with first differences and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Δln(Markup)	Δln(Markup)	Δln(Markup)	Δln(Markup)	Δln(Markup)	Δln(Markup)	Δln(Markup)	Δln(Markup)
MFN Tariff Cut	0.003	0.004	-0.000	0.004	-0.004	-0.000	0.003	-0.001
	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)
POE	-0.008	0.008	-0.026	0.008	0.008	-0.025	0.008	-0.029
	(0.027)	(0.028)	(0.051)	(0.028)	(0.028)	(0.051)	(0.025)	(0.048)
MFN Tariff Cut*POE	**-0.009***	**-0.010****	**-0.009**	**-0.010****	**-0.010****	**-0.009***	**-0.011****	**-0.009***
	(0.005)	**(0.004)**	**(0.005)**	**(0.004)**	**(0.004)**	**(0.005)**	**(0.004)**	**(0.006)**
Constant	-0.073*	-0.051	0.000	-0.051	-0.051	-0.008	102.357	18.896
	(0.042)	(0.039)	(0.058)	(0.038)	(0.038)	(0.059)	(107.745)	(122.361)
Observations	71,769	68,282	68,282	68,282	68,282	68,282	68,282	68,282
R-squared	0.006	0.020	0.018	0.020	0.02	0.018	0.026	0.029
rmse	0.901	0.887	0.919	0.887	0.887	0.919	0.884	0.914
Controls	NO	NO	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	NO	YES	NO	YES	NO	YES
Business control	NO	NO	NO	NO	YES	YES	NO	NO
Trends	NO	NO	NO	NO	NO	NO	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A6: Exit and MFN cut: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)
Only POE	0.039**	0.045***	0.045***	0.047***	0.046***
	(0.017)	(0.011)	(0.011)	(0.011)	(0.011)
Semi-POE	0.019	0.022**	0.022**	0.023**	0.022**
	(0.012)	(0.010)	(0.010)	(0.009)	(0.009)
MFN Tariff Cut	-0.003***	-0.003**	-0.003**	-0.003*	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Only POE*MFN Tariff Cut	**0.005*** **	**0.005*** **	**0.005*** **	**0.005*** **	**0.005*** **
	(0.002)	**(0.002)**	**(0.002)**	**(0.001)**	**(0.002)**
Semi-POE*MFN Tariff Cut	**0.004*** **	**0.003** **	**0.003** **	**0.003*** **	**0.003** **
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
Constant	-0.062***	0.091	0.457	0.178	-119.767***
	(0.005)	(0.090)	(0.312)	(0.118)	(20.196)
Observations	218,779	218,779	218,779	218,779	218,779
R-squared	0.043	0.096	0.096	0.104	0.104
rmse	0.247	0.240	0.240	0.239	0.239
Controls	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Industry-year FE	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A7: Exit, MFN Tariff Cut, and TFP: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)
Only POE	0.042***	0.045***	0.045***	0.047***	0.046***
	(0.016)	(0.011)	(0.011)	(0.011)	(0.011)
Semi-POE	0.021*	0.021**	0.021**	0.022**	0.021**
	(0.012)	(0.010)	(0.010)	(0.009)	(0.009)
MFN Tariff Cut	-0.003**	-0.003**	-0.003**	-0.003*	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
TFP	-0.011**	-0.008*	-0.008*	-0.008*	-0.008*
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Only POE*MFN Tariff Cut	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Only POE*TFP	-0.016***	-0.016***	-0.016***	-0.016***	-0.016***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Semi-POE*MFN Tariff Cut	0.003**	0.004***	0.004***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Semi-POE*TFP	0.002	-0.000	-0.000	-0.000	-0.001
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
MFN Tariff Cut*TFP	0.000*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Only POE*MFN Tariff Cut*TFP	-0.001***	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Semi-POE*MFN Tariff Cut*TFP	**-0.002*** **	**-0.001** **	**-0.001** **	**-0.001** **	**-0.001** **
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
Constant	-0.062***	0.095	0.438	0.185	-123.600***
	(0.005)	(0.090)	(0.314)	(0.119)	(20.237)
Observations	218,779	218,779	218,779	218,779	218,779
R-squared	0.056	0.099	0.099	0.107	0.107
rmse	0.245	0.239	0.239	0.238	0.238
Controls	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Industry-year FE	No	No	No	YES	No
Trends	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A8: Markups and MFN Tariff Cut: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
VARIABLES	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)
Only POE	-0.387***	-0.219***	-0.427***	-0.219***	-0.443***	-0.226***	-0.387***	-0.279
	(0.076)	(0.052)	(0.087)	(0.052)	(0.083)	(0.050)	(0.073)	(0.927)
Semi-POE	-0.376***	-0.233***	-0.422***	-0.233***	-0.435***	-0.230***	-0.385***	-0.284
	(0.059)	(0.051)	(0.069)	(0.051)	(0.061)	(0.050)	(0.055)	(0.809)
MFN Tariff Cut	0.011	0.005		0.005		0.005	0.010	0.003
	(0.008)	(0.004)		(0.004)		(0.005)	(0.008)	(0.000)
Only POE*MFN Tariff Cut	**-0.016****	**-0.014*****		**-0.014*****		**-0.013*****	**-0.015****	**-0.009**
	(0.008)	**(0.004)**		**(0.004)**		**(0.004)**	**(0.007)**	**(0.066)**
Semi-POE*MFN Tariff Cut	**-0.024*****	**-0.011*****		**-0.011*****		**-0.014*****	**-0.022****	**-0.017**
	(0.009)	**(0.004)**		**(0.004)**		**(0.004)**	**(0.008)**	**(0.079)**
ln(Markups) -- lagged		0.0229***		0.0229***		0.228***		0.188
		(0.038)		(0.038)		(0.034)		(1.012)
Constant	3.631***	1.021***	3.419***	0.994***	3.608***	1.671***	3.708***	0.000
	(0.360)	(0.193)	(0.278)	(0.192)	(0.921)	(0.247)	(0.490)	(0.000)
Observations	142,630	66,390	142,630	66,390	142,630	66,390	142,630	66,390
R-squared	0.179		0.177		0.195		0.190	
rmse	0.962		0.963		0.953		0.956	
AR(1)		-10.85***		-10.85***		-11.05***		-0.00
AR(2)		-0.27		-0.27		-0.29		-0.08
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	YES	YES	NO	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	YES	NO	NO
Trends	NO	NO	NO	NO	NO	NO	YES	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: Exit, MFN Tariff Cut, TFP, and Firm's Debt: Weibull models with standard errors clustered by HS 4-digit.

VARIABLES	(1) Weibull Pr(Exit=1)	(2) Weibull Pr(Exit=1)	(3) Weibull Pr(Exit=1)	(4) Weibull Pr(Exit=1)	(5) Weibull Pr(Exit=1)	(6) Weibull Pr(Exit=1)	(7) Weibull Pr(Exit=1)
POE	-0.443***	-0.443***		-0.435***	-0.435***		0.277
	(0.133)	(0.133)		(0.133)	(0.133)		(0.259)
MFN Tariff Cut	-0.031***	-0.031***	-0.032***	-0.032***	-0.032***	-0.003	0.043
	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.008)	(0.029)
TFP				-0.109***	-0.109***	-0.095***	
				(0.037)	(0.037)	(0.036)	
Firm's Debt							1.004***
							(0.187)
POE*MFN Tariff Cut	**0.033*** **	**0.033*** **		**0.030*** **	**0.030*** **		-0.062*
	(0.011)	**(0.011)**		**(0.011)**	**(0.011)**		(0.032)
POE*TFP				0.021	0.021		
				(0.036)	(0.036)		
MFN Tariff Cut*TFP				-0.001	-0.001	-0.006***	
				(0.004)	(0.004)	(0.002)	
POE*MFN Tariff Cut*TFP				**-0.004**	**-0.004**		
				(0.004)	**(0.004)**		
MFN Tariff Cut*Firm's Debt							-0.051*
							(0.026)
POE*Firm's Debt							-0.257
							(0.170)
POE*MFN Tariff Cut*Firm's Debt							**0.091*** **
							(0.032)
Only POE			-0.350***			-0.255**	
			(0.125)			(0.112)	
Semi-POE			-0.549***			-0.438***	
			(0.139)			(0.126)	
Only POE*MFN Tariff Cut			0.034***			-0.000	
			(0.011)			(0.006)	
Semi-POE*MFN Tariff Cut			0.035***				
			(0.012)				
Only POE*TFP						-0.010	
						(0.035)	
Semi-POE*TFP						0.034	
						(0.033)	
1.poe1#c.tfpr_final#c.dMFN_mean						0.001	
						(0.002)	
Constant	-12.900***	-22.279***	-12.882***	-14.538***	-23.889***	-14.591***	-4.360***
	(1.205)	(4.800)	(1.220)	(1.208)	(4.784)	(1.219)	(0.277)
ln(p)	0.581***	0.581***	0.578***	0.582***	0.582***	0.578***	0.637***
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)	(0.018)
Controls	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	NO	NO	NO	NO	NO	NO
Business control	NO	YES	NO	NO	YES	NO	NO
Observations	218,779	218,779	218,779	218,779	218,779	218,779	127,575

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A10: Exit and MFN cut: OLS regression with PSM and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	exit	exit	exit	exit	exit
POE	0.055***	0.029***	0.029***	0.028***	0.028***
	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)
MFN Tariff Cut	-0.002*	-0.002**	-0.002**	-0.000	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
POE*MFN Tariff Cut	**0.002***	**0.002****	**0.002****	**0.002****	**0.002****
	(0.001)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
Constant	-0.062***	0.039	0.748***	0.079	0.078***
	(0.007)	(0.038)	(0.246)	(0.100)	(0.028)
Observations	212,602	212,602	212,602	212,602	212,602
R-squared	0.035	0.084	0.084	0.088	0.087
rmse	0.245	0.238	0.238	0.238	0.238
Controls	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
PSM	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Industry-year FE	No	No	No	YES	NO
Trends	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A11: Exit, MFN tariff cut, and TFP: OLS regression with PSM and standard errors clustered by HS 4-digit.

VARIABLES	(1) OLS exit	(2) OLS exit	(3) OLS exit	(4) OLS exit	(5) OLS exit
POE	0.062***	0.028***	0.028***	0.028***	0.027***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
MFN Tariff Cut		-0.002**	-0.002**	-0.000	-0.002**
		(0.001)	(0.001)	(0.001)	(0.001)
TFP	-0.006	-0.004	-0.004	-0.004	-0.004
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
POE*MFN Tariff Cut		0.002**	0.002**	0.002**	0.002**
		(0.001)	(0.001)	(0.001)	(0.001)
POE*TFP	**-0.013*** **	**-0.012*** **	**-0.011*** **	**-0.012*** **	**-0.012*** **
	(0.004)	**(0.004)**	**(0.004)**	**(0.004)**	**(0.004)**
MFN Tariff Cut*TFP		-0.001	-0.001	-0.001	-0.001
		(0.001)	(0.001)	(0.001)	(0.001)
POE*MFN Tariff Cut*TFP		**-0.0002**	**-0.0002**	**-0.0002**	**-0.0002**
		(0.0005)	**(0.0005)**	**(0.0005)**	**(0.0005)**
Constant	-0.066***	0.042	0.836***	0.077	0.079***
	(0.006)	(0.038)	(0.246)	(0.097)	(0.029)
Observations	212,602	212,602	212,602	212,602	212,602
R-squared	0.043	0.086	0.087	0.091	0.090
rmse	0.243	0.238	0.238	0.237	0.238
Controls	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
PSM	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Industry-year FE	No	No	No	YES	NO
Trends	NO	NO	NO	NO	YES

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A12: Markups and MFN tariff cut: OLS regression with PSM and standard errors clustered by HS 4-digit.

	(1) OLS	(2) GMM	(3) OLS	(4) GMM	(5) OLS	(6) GMM	(7) OLS	(8) GMM	(9) OLS	(10) GMM
VARIABLES	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)	ln(Markups)
POE	-0.346***	-0.156**	-0.316***	-0.128**	-0.316***	0.000	-0.331***	-0.137**	-0.325***	0.000
	(0.051)	(0.063)	(0.057)	(0.058)	(0.057)	(0.000)	(0.058)	(0.056)	(0.060)	(0.000)
MFN Tariff Cut	0.007	0.005	0.007	0.005	0.007	0.005	0.010*	0.009*	0.009	-0.014
	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.006)	(0.005)	(0.006)	(0.025)
POE*MFN Tariff Cut	**-0.015****	**-0.017*****	**-0.014****	**-0.016*****	**-0.014****	**-0.016*****	**-0.014****	**-0.018*****	**-0.014****	**-0.006**
	(0.007)	**(0.004)**	**(0.007)**	**(0.004)**	**(0.007)**	**(0.004)**	**(0.006)**	**(0.005)**	**(0.006)**	**(0.015)**
ln(Markups) -- lagged		0.243***		0.250***		0.247***		0.250***		0.246***
		(0.067)		(0.065)		(0.066)		(0.060)		(0.086)
Constant	1.599***	1.025**	1.775***	0.000	1.748***	1.818**	1.468***	1.287***	1.492***	666.528
	(0.051)	(0.494)	(0.089)	(0.000)	(0.075)	(0.830)	(0.105)	(0.299)	(0.125)	(817.445)
Observations	138,651	64,080	138,651	64,080	138,651	64,080	138,651	64,080	138,651	64,080
R-squared	0.154		0.166		0.166		0.180		0.177	
rmse	0.957		0.950		0.950		0.942		0.944	
AR(1)		-6.45***		-6.97***		-6.91***		-6.91***		-0.94
AR(2)		0.47		0.36		0.34		0.34		0.71
Controls	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	YES	YES	YES	NO	YES	NO	YES
Industry-year FE	NO	NO	NO	NO	NO	NO	YES	NO	NO	No
Trends	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A13: Exit and ln(markups): OLS regression with controls interacted by a post-WTO dummy and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	ln(Markups)	Pr(Exit=1)
POE	0.035***	0.034***	-0.386***	0.039***
	(0.010)	(0.010)	(0.062)	(0.012)
MFN Tariff Cut	-0.001	-0.002	-0.013	0.001
	(0.002)	(0.002)	(0.030)	(0.003)
TFP		-0.008*		
		(0.004)		
Firm's Debt				0.025*
				(0.015)
POE*MFN Tariff Cut	**0.004****	0.004***	**-0.020****	-0.004**
	(0.001)	(0.001)	**(0.008)**	(0.002)
POE*TFP		-0.007		
		(0.004)		
POE*Firm's Debt				0.041**
				(0.017)
MFN Tariff Cut*TFP		0.000		
		(0.000)		
MFN Tariff Cut*Firm's Debt				-0.005**
				(0.002)
POE*MFN Tariff Cut*TFP		**-0.001***		
		(0.000)		
POE*MFN Tariff Cut*Firm's Debt				**0.010*****
				(0.003)
Constant	-0.006	-0.006	3.434***	-0.035
	(0.084)	(0.083)	(0.329)	(0.038)
Observations	218,779	218,779	142,630	127,575
R-squared	0.102	0.103	0.185	0.115
rmse	0.239	0.239	0.958	0.218
Controls	YES	YES	YES	YES
Controls*post-WTO dummy	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Balancing	YES	YES	YES	YES
Business control	NO	NO	NO	NO
Industry-year FE	NO	NO	NO	NO
Trends	NO	NO	NO	NO

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A14: TFP and MFN tariff cut (industry-level): OLS regression with entropy balancing and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP	TFP
MFN Tariff Cut	0.013**	0.011**	0.016**	0.011*	0.013**	0.011**	0.016**	0.011*	0.008*	0.005
	(0.005)	(0.006)	(0.007)	(0.007)	(0.005)	(0.006)	(0.007)	(0.007)	(0.005)	(0.005)
SOE-dominated Sector	0.300*	0.151	0.101	1.164	0.300*	0.151	0.101	1.164	0.271	0.400
	(0.176)	(0.347)	(0.177)	(0.755)	(0.176)	(0.347)	(0.177)	(0.755)	(0.197)	(0.507)
MFN Tariff Cut*SOE Labor Share	**-0.028*** **	**-0.020*** **	**-0.021** **	**-0.014** **	**-0.028*** **	**-0.020*** **	**-0.021** **	**-0.014** **	**-0.017* **	**-0.009**
	(0.010)	**(0.007)**	**(0.009)**	**(0.007)**	**(0.010)**	**(0.007)**	**(0.009)**	**(0.007)**	**(0.009)**	**(0.007)**
TFP (lagged)			0.157	-0.043			0.157	-0.043		
			(0.128)	(0.125)			(0.128)	(0.125)		
Constant	0.096	0.828	0.165	-0.518	-14.555***	-15.111**	0.451	-0.135	-0.168	0.484
	(0.809)	(1.653)	(0.539)	(1.173)	(4.893)	(6.318)	(0.533)	(1.102)	(0.930)	(1.975)
Observations	632	632	490	490	632	632	490	490	632	632
R-squared	0.581	0.717	0.612	0.730	0.581	0.717	0.612	0.730	0.637	0.765
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry 2-digit fixed effects	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
Industry 4-digit fixed effects	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Industry-specific trends	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1