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Multinationals and the Shutdown of State-Owned Enterprises

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Abstract

This paper examines the relationship between multinational enterprises (MNEs) and the shutdown of state-owned enterprises (SOEs) in transitional economies. First, a two-country model of oligopoly in partial equilibrium is developed to show how productivity of SOEs and international trade costs influence the shutdown of SOEs after privatization. Under Cournot competition, the model predicts that if MNE's acquisition of the SOE leads to higher productivity gains by the SOE, then local production is profitable for the MNE and the SOE is less likely to be shutdown. Furthermore, if SOE's productivity is expected to rise only under MNE's ownership, then a rival domestic private firm can acquire and shutdown the SOE; the domestic private firm may prevent MNE's ownership of the SOE and thus reduce competition in the post-privatization market. Second, using firm-level privatization data from Central and Eastern Europe, it is found that MNEs' ownership of former SOEs significantly reduces the probability of shutdown of former SOEs, whereas domestic private ownership increases the probability of shutdown. It is also found that pre- and post-privatization productivity levels do not significantly differ between SOEs acquired by MNEs versus domestic private firms. As productivity levels of SOEs rise after privatization, the probability of their shutdown decreases. These findings support theoretical predictions outlined in the paper.

Keywords: shutdown, privatization, multinational enterprises, cross-border acquisition, state-owned enterprises

JEL classification paper: D21, F22, F23, L22, O19, P31

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1 Introduction

Despite many mass privatization programs over the last two decades, state-owned enterprises (SOEs) still constitute a substantial part of many transitional economies. According to the 2004 World Bank report in Central and Eastern Europe and Central Asia, the government had a 20 to 50 percent ownership share of GDP in 2002 in 22 countries and in 4 countries SOEs contribution to GDP was higher than 50 percent[1]. As part of the transition from a state to a market economy, governments have used privatization as means to encourage inflow of foreign direct investment (FDI) by multinational enterprises (MNEs)[2,3]. MNEs have taken advantage of privatization and acquired many SOEs in order to gain quick access to the local market and avoid international trade costs. However, there is a concern in transitional economies that the hasty divestment of SOEs to MNEs has exposed SOEs to the prospects of shutdown and liquidation. Anecdotal evidence suggests that MNEs acquire SOEs in order to eliminate potential competition and gain market share.

This paper examines the relationship between multinational enterprises (MNEs) and the shutdown of state-owned enterprises (SOEs) in transitional economies. A two country model of oligopoly in partial equilibrium is developed to show how

[1] According to World Bank document on Economies in Transition: An OED Evaluation of World Bank Assistance (2004), in 2002, SOEs share of GDP was: in Czech Republic 20%, in Poland 25%, in Latvia 30%, in Romania 35%, in Croatia 40%, in Ukraine 35%, in Uzbekistan 55%, and in Belarus 80%.

[2] For example, World Investment Report 2005 reports that in South-East Europe large privatization has contributed to FDI inflows by $11 billion in 2004.

[3] For a review of the theory on multinational enterprises and foreign direct investment see Markusen (1995).

MNEs impact shutdown of SOEs. The model incorporates productivity of SOEs and international trade costs. The privatization process is modeled as a second-price auction and permits strategic interaction between firms in order to analyze the decision to shutdown SOEs. The model predicts that increasing productivity of SOEs and increasing international trade costs provide incentives for the MNEs to produce locally and this decreases the likelihood of SOEs shutdown.

The predictions of the model are tested using novel firm-level privatization data from Central and Eastern Europe. Controlling for SOEs productivity, age, and size, the results show that SOEs acquired during privatization by MNEs have a significantly lower probability of shutdown as compared to SOEs acquired by domestic private firms. The data also shows that higher levels of SOEs productivity are associated with lower probability of SOEs shutdown, both by MNEs and domestic private firms.

This work adds to the emerging international trade literature on MNEs and the shutdown of firms. While many of the theoretical arguments for MNE involvement in firm shutdowns are inconclusive, this model provides arguments that MNEs have incentives for long commitments to sustain SOEs. Empirical findings from Central and Eastern Europe support the theoretical predictions of the model and contradict previous empirical studies conducted in developed and developing countries that have found evidence that MNEs ownership is positively associated with exit of local firms[4].

[4]See Bernard and Jensen (2007), Görg and Strobl (2003), Van Beveren (2006) on studies done in developed countries. For evidence from developing countries see Bernard and Sjöholm (2003)

This paper also contributes to the industrial organization and privatization literature. The results highlight the importance of studying firm exit in transitional economies. Privatization is still an ongoing issue and these findings should have genuine policy implications for governments that are still in the process of privatization.

2 Literature Review: Firm Shutdown and Privatization

This paper contributes to the small and growing literature in international trade that examines MNEs behavior towards domestic local firms. Recent papers have found that domestic local firms owned by MNEs have higher exit rates when compared to local firms that are not owned by MNEs. Bernard and Jensen (2007) demonstrate that plants owned by U.S. multinationals and plants part of a multi-plant firm have a higher probability of being shut down. Görg and Strobl (2003) study of Ireland's manufacturing sector and Van Beveren's (2006) study of Belgian firms find similar results. Developing countries have also been examined in Bernard and Sjöholm's (2003) study of Indonesian firms, and similar results were found. Only Alvarez and Görg's (2005) study of Chilean firms finds no conclusive evidence that MNEs ownership leads to higher exit of domestic firms.

In contrast, this paper looks at transitional economies and more specifically at

study of Indonesian manufacturing. Also, Alvarez and Görg (2005) show that in Chile MNEs exit first when economy is in a downturn.

SOEs that were directly sold in the privatization process. A model incorporating international trade costs and productivity of SOEs is developed to provide theoretical predictions on the shutdown of SOEs. Privatization data from Central and Eastern Europe is then used to show that SOEs owned by MNEs have a lower probability of shutting down than SOEs acquired by domestic firm. Transitional economies and SOEs have not been previously studied in this context. Evidence in this paper supports the notion that FDI has a positive effect on SOEs.

This paper also expands the work on privatization. The interaction between privatizing firms and foreign MNEs has received little attention as compared to the literature on privatization and performance of SOEs[5]. The literature on SOEs performance can be classified into two categories. The first string of privatization literature compares pre- and post-privatization performance of SOEs. The second compares the performance of SOEs to privately owned firms. A summary of these studies can be found in Megginson and Netter (2001). There are relatively few studies that look specifically at how post-privatization ownership of SOEs affects the performance of SOEs. Studies that do compare performance of SOEs based on foreign or domestic ownership limit the domestic post-privatization ownership to management or non-managerial employees, i.e. SOEs are taken over by former management and employees from the government (Frydman et al. 1999). This paper contributes and expands this literature by examining SOEs shutdown probability as

[5]For one of the few studies that analyzes MNEs and privatization see Norbäck and Persson (2004).

a result of foreign ownership. Prior to privatization, the decision to shutdown SOEs was strictly in government's control. After privatization, shutdown of SOEs has become a real issue and it is crucial for governments to know who will be a reliable buyer and owner.

3 Theoretical Model

A partial-equilibrium framework is developed. There are two large countries, a foreign (F) country and a transitional home (H) country. There are also three firms, a MNE (M) located in country F, a domestic private firm (D) located in country H, and a SOE (asset k) located in country H. Firms M and D each produce a homogenous good denoted by q_M and q_D, respectively. Goods q_M and q_D will only be sold in country H where the aggregate supply will be $q_M + q_D = Q$. Asset k is initially owned by the government of country H and it will be sold via a second-price sealed-bid auction to either firm M or D.

There is also a representative consumer located in country H whose preferences are given by a quasi-linear utility function over Q :

$$U(Q, z) = u(Q) + z, \tag{1}$$

where z is the numeraire good and the $u(Q)$ is quadratic[6]:

$$u(Q) = \alpha Q - \frac{\beta Q^2}{2}. \tag{2}$$

The maximization problem yields the representative consumer's demand function which is then solved for the inverse demand function:

$$p = \alpha - \beta Q. \tag{3}$$

Initially, firms M and D each have a single plant in their own countries where they produce their good and then sell it in country H. To produce the good in their own country firms incur marginal cost of production c_i, where i denotes firms M and D. In order sell good q_M in country H, firm M exports and pays trade costs $t \geq 1$. Trade costs are assumed to increase marginal costs of production so that when firm M exports to country H its marginal cost is $c_M t$. Producing at their home plants, firms have unique levels of productivity where productivity of firm M is $\theta > 0$ and productivity of firm D is $\lambda > 0$. It is assumed that productivity lowers marginal costs of production for each firm. Denote each firm's overall marginal cost function by c^*_{il}, where again $i = \{M, D\}$ and $l = \{k, o\}$, where k means that firm i will use asset k to produce and o means that firm i will use its own plant for production. When firms

[6] Assume that parameters α and β are such that consumer does not attain a satiation point. Furthermore, the quadratic utility function assumes that the marginal utility of income is fixed. By adding the numeraire good z, the utility function becomes quasi-linear and the marginal utility of income is then unity.

use their own production plant to produce, firm $M's$ overall marginal cost function is $c^*_{Mo} = c_M t - \theta$ and firm $D's$ overall marginal cost function is $c^*_{Do} = c_D - \lambda$.

The government of country H will auction off asset k allowing the winning firm to produce using asset $k's$ plant. When using asset k to produce, the winning firm will face marginal cost of s and benefit from asset $k's$ productivity $\rho_i > 0$, where $i = \{M, D\}$. The overall marginal cost function for the winning firm when producing with asset $k's$ plant will be $c^*_{ik} = s - \rho_i$. The productivity parameter ρ_i will differ depending on the acquirer as it is assumed that each acquirer will combine its own unique knowledge and technical know-how with asset k to affect productivity.

The interaction will take place in three stages where firms first decide on acquisition of asset k, then decide either to shutdown k or to produce with k, and subsequently play a Cournot-Nash game in output quantity. The profit of each firm will be denoted by $\pi_i = (p - c^*_{il})q_i$, where $i = \{D, M\}$. Figure 1 provides a graphical depiction of the three stages along with marginal cost functions faced by each firm for a given outcome of the game.

Consider the third stage where there are four outcomes as shown in Figure 1. Firms compete via Cournot fashion where each firm makes a best response to the other firm's output. Firms maximize profits while holding the other firm's output at

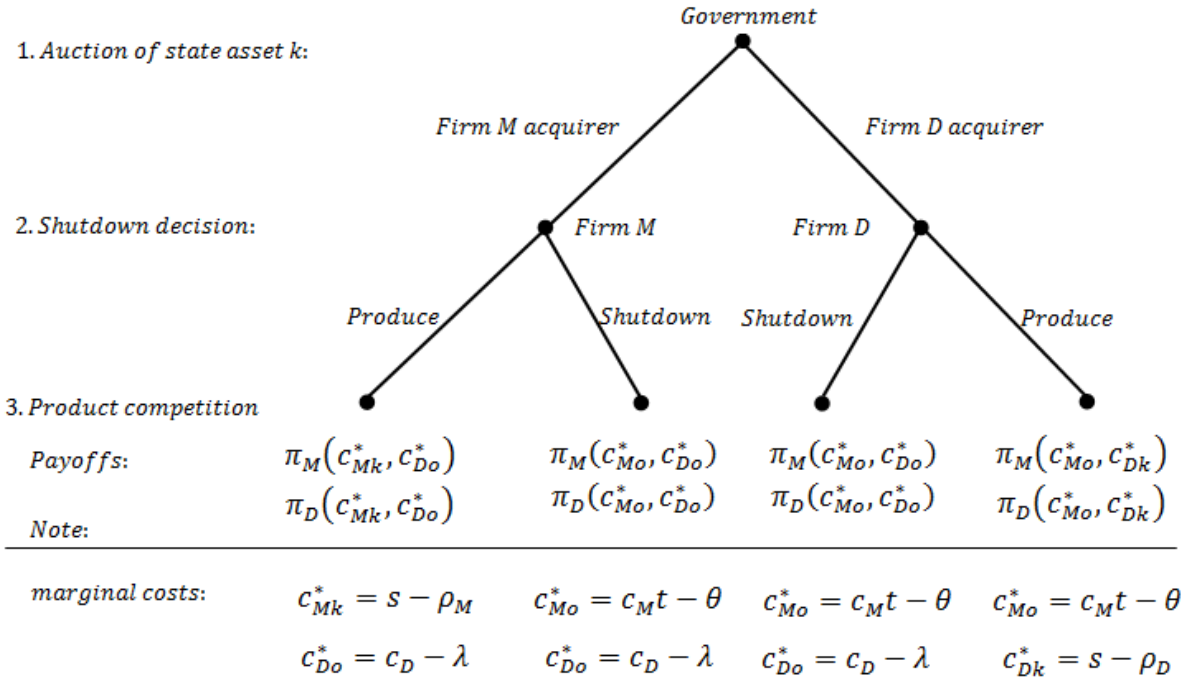

Figure 1: Three stage game

a fixed level. The maximization problem for each firm is:

$$\begin{aligned} \max_{q_M} \pi_M &= \max_{q_M} [p(Q)q_M - c^*_{Ml} q_M] \\ \max_{q_D} \pi_D &= \max_{q_D} [p(Q)q_D - c^*_{Dl} q_D] \end{aligned} \tag{4}$$

Where the Cournot equilibrium outputs supplied by each firm are:

$$\begin{aligned} q_M &= \frac{\alpha - 2c^*_{Ml} + c^*_{Dl}}{3\beta} \\ q_D &= \frac{\alpha - 2c^*_{Dl} + c^*_{Ml}}{3\beta} \end{aligned} \tag{5}$$

It can then easily be shown that the equilibrium profits are:

$$\begin{aligned} \pi_M(c^*_{Ml}, c^*_{Dl}) &= \beta(q_M)^2 \\ \pi_D(c^*_{Ml}, c^*_{Dl}) &= \beta(q_D)^2 \end{aligned} \tag{6}$$

Using this method third stage profits for each outcome are obtained.

In the second stage, the winning firm will decide to either shutdown asset k or to use asset k for production in country H. After the auction, the winning firm's decision to shutdown asset k will depend on the relative differences between marginal costs and productivity levels at their own plant and at $k's$ plant. For firm M, the decision to shutdown or produce locally in H will also hinge on the level of existing trade costs between the two countries. The following proposition summarizes the

necessary condition in order for the winner to shutdown asset k:

Proposition 1 *The foreign MNE will shutdown the SOE after acquisition iff* $(s - c_M t) + \theta > \rho_M$. *The domestic firm will shutdown the SOE after acquisition iff* $(s - c_D) + \lambda > \rho_D$.

Proof: See the Appendix.

By acquiring asset k, firm M carries out horizontal FDI where production of q_M is now performed locally in country H. According to Proposition 1, horizontal FDI will only be successful if the difference between marginal costs at the two plants plus productivity at its own plant is lower than productivity established by M at k, i.e. $(s - c_M t) + \theta > \rho_M$. It has been previously established in literature that FDI in carried out by firms with high productivity levels (Merlitz 2003). However, by Proposition 1, for successful FDI to take place, high productivity of the acquiring firm is not enough. FDI carried out through acquisition can only be successful if productivity of the acquired firm is also high; otherwise the acquired firm will be shutdown and export will be the preferred method of market entry.

According to Anderson and van Wincoop (2004) trade costs that exist between countries are very large and linked to economic policies such as the country's transport infrastructure, law enforcement, property rights, and regulation. By carrying out FDI, firm M can save on trade costs by closing down its export activities. Acquiring asset k should help to reduce many of the mentioned barriers to trade, as asset k can provide firm M with direct access to the government of country H. Therefore,

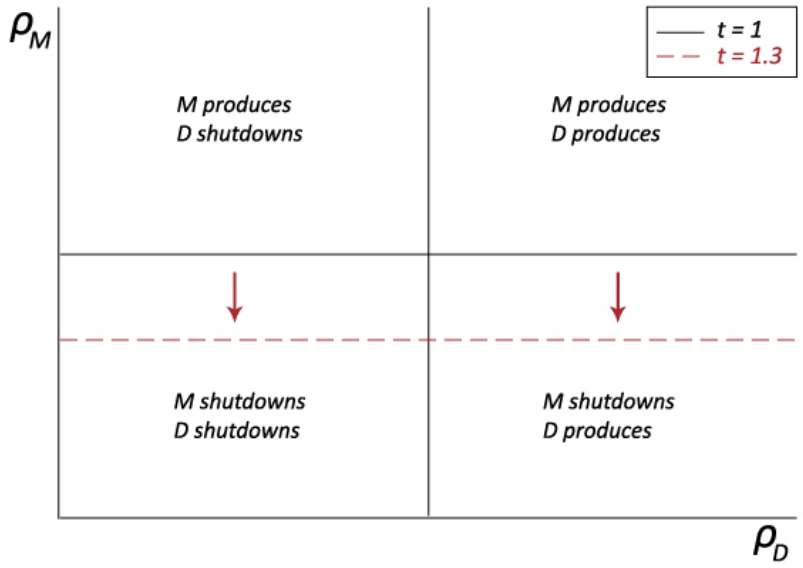

Figure 2: The decision to shutdown for each firm displayed in the productivity space ρ_M and ρ_D of asset k. Other parameters are set as follows: $\alpha = \beta = 1, c_D = c_M = 0.2$, $\theta = \lambda = 0.3$, $t = 1$, and $s = 0.2$.

trade costs play an important role in the decision to shutdown asset k after acquisition takes place. Figure 2 simulates Proposition 1 in the space of productivities ρ_M and ρ_D. There are four different regions. First, when ρ_M and ρ_D are low, production with k will not be the preferred method to serve the market. Second, when ρ_M and ρ_D rise, both firms will have incentives to produce using asset k. Trade costs impact the level of productivity at which firm M is willing to produce with asset k. When trade costs go up from $t = 1$ to $t = 1.3$ firm M will produce with lower ρ_M.

Trade costs do not impact the level of productivity at which firm D will produce with asset k. Firm D already possesses its own production plant in country H and it will only use asset k if it is more cost effective then to use its own plant. By acquiring

asset k, firm D captures market share in country H and also forces firm M to export and incur trade costs.

In the first stage, the government will sell asset k through second-price sealed-bid auction where the highest bidder wins and pays a price equal to the second highest bid. In a second-price auction each bidder will bid their true valuation for asset k. If the bids are the same, then each firm wins asset k with equal probability. Denote the valuation of each bidder by v_i, where $i = \{M, D\}$. Also define π_{ii} as the profit of firm i when firm i wins the auction and π_{ij} as the profit of firm i when firm j wins the auction. Valuation that each firm has for asset k is then equal to $v_i = \pi_{ii} - \pi_{ij}$.

Lemma 2 *Let firm i be the firm with the highest valuation. The asset k is then acquired by firm i, at price equal to firm j's valuation of obtaining the state asset instead of firm i, v_j.*

Proof: See Appendix.

3.1 Equilibrium

Solving the three stage game via backward induction, the equilibrium buyer, price, and shutdown decision are obtained. In the third stage, equilibrium profits for each firm under each outcome were obtained. In the second stage, the necessary conditions for shutdown were derived. In the first stage, asset k was auctioned off to the highest bidder where it was shown that if $v_i > v_j$, then firm i wins asset k and pays a price equal to v_j. Rewriting $v_i - v_j > 0$, and defining ρ_D^*, ρ_M^*, and $\left(\frac{\rho_D}{\rho_M}\right)^*$ as the level of

$k's$ productivity under $D's$ acquisition, under $M's$ acquisition, and the ratio of $D's$ productivity to $M's$ productivity, respectively, that makes $v_i - v_j = 0$, the equilibrium can be summarized by:

Proposition 3 *The equilibrium buyer, the equilibrium price, and the equilibrium shutdown decision are as follows:*

1. *If* $(s - c_M t) + \theta > \rho_M$ *and* $(s - c_D) + \lambda > \rho_D$, *then firm* M *and* D *obtain asset* k *with equal probability at price* $v_M = v_D = 0$ *and asset* k *is shutdown after the auction.*

2. *If* $(s - c_M t) + \theta > \rho_M$ *and* $(s - c_D) + \lambda < \rho_D$, *then for* $\rho_D > \rho_D^*$ *firm* D *wins asset* k *at price* v_M *and produces with it; and for* $\rho_D < \rho_D^*$ *firm* M *acquires asset* k *at a price* v_D *and shuts it down.*

3. *If* $(s - c_M t) + \theta < \rho_M$ *and* $(s - c_D) + \lambda > \rho_D$, *then for* $\rho_M > \rho_M^*$ *firm* M *wins asset* k *at price* v_D *and produces with it; and for* $\rho_M < \rho_M^*$ *firm* D *acquires asset* k *at price* v_M *and shuts it down.*

4. *If* $(s - c_M t) + \theta < \rho_M$ *and* $(s - c_D) + \lambda < \rho_D$, *then for* $\left(\frac{\rho_D}{\rho_M}\right) < \left(\frac{\rho_D}{\rho_M}\right)^*$ *firm* M *wins asset* k *at a price of* v_D *and produces with it; and for* $\left(\frac{\rho_D}{\rho_M}\right) > \left(\frac{\rho_D}{\rho_M}\right)^*$ *firm* D *acquires asset* k *at a price* v_M *and produces with it.*

Proof: See the Appendix.

The equilibrium regions of Proposition 3 are simulated in the space of ρ_M and ρ_D in Figure 3. When productivity levels of asset k after acquisition are below ρ_D^* and

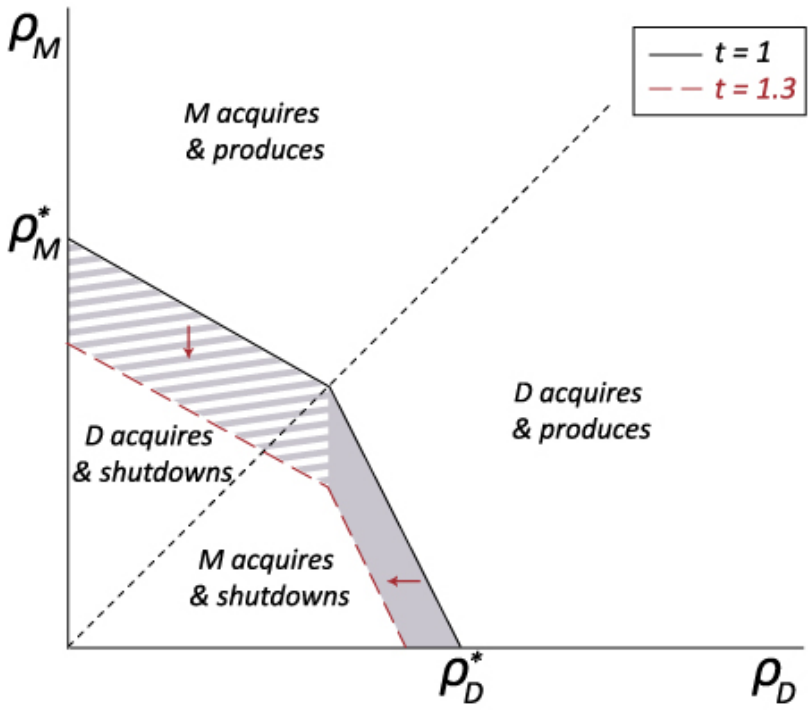

Figure 3: The equilibrium acquirer of asset k and the the shutdown decision displayed in the productivity space ρ_M and ρ_D of asset k. Other parameters are set as follows: $\alpha = \beta = 1, c_D = c_M = 0.2$, $\theta = \lambda = 0.3$, $t = 1$, and $s = 0.2$.

ρ_M^*, neither firm will want to produce with asset k. It is more cost-effective for firm M to export and for firm D to use its own plant. If productivity of k increases only under firm D, then D will want to produce and M will want to shutdown. Similarly, if productivity of k increases only under M, then M will want to produce and D will want to shutdown. Finally, if productivity of k increases under acquisition by both firms, then both firms will want to acquire and produce with k.

Figure 3 displays the four regions and highlights the importance of trade costs on the equilibrium buyer. Higher trade costs provide firm M with greater incentives to acquire asset k. As trade costs increase from $t = 1$ to $t = 1.3$, firm M assigns greater value to asset k and acquires asset k for lower levels of ρ_M. Figure 2 demonstrated that trade costs do not influence $D's$ decision to shutdown, however $D's$ decision to acquire asset k is influenced by higher trade costs. Figure 3 shows that when trade costs rise, firm D will value asset k more and will be willing to acquire asset k for lower levels of ρ_D. Firm $D's$ increased valuation for asset k as a result of higher trade costs is caused by an indirect competition effect. As trade costs increase, it is advantageous for D to acquire asset k in order to force M to export with higher trade costs, which leads to lower competition between firms in the third stage[7].

The equilibrium presents testable hypotheses regarding the shutdown of asset k. First, productivity of asset k after acquisition determines whether or not asset k will

[7]It is assumed in the model that trade costs never reach the level that would prevent M from exporting. However, if trade costs were to pass this level, then M would not be able to export, and if D acquired asset k, then D would be a monopoly in market H.

be used for production. Low levels of asset $k's$ productivity will lead to shutdown and high levels will lead to production. Furthermore, although productivity of asset k prior to acquisition is not modeled, it can be postulated that it is also very important as it should highly influence productivity levels of k after acquisition. Therefore, as productivity of k rises, the likelihood of $k's$ shutdown should decrease.

Trade costs also play a key factor in the shutdown of asset k. As trade costs rise between countries, foreign MNEs have greater incentives to keep local production and therefore, are less likely to shutdown asset k. As shown in Figure 3, domestic firms are also less likely to shutdown asset k as trade costs increase. However, trade costs influence domestic firms decision to shutdown only indirectly through post acquisition competition that ensues between firms. Domestic firms should have less incentives to keep asset k, as they already have local production. Domestic firms acquire asset k for market share and in order to deny local production to MNEs.

4 Data and Empirical Model

The theoretical model highlights the shutdown of SOEs that can be caused by post privatization ownership and by SOEs post privatization productivity. MNEs and domestic firms have incentives to acquire and use SOEs for production but also can shutdown SOEs after acquisition. Again, the hypothesis states that MNEs want to produce locally with the acquired SOEs as these SOEs provide a quick market entry method and allow trade cost savings. Domestic firms do not need the acquired SOEs

for production but are merely interested in gaining market share. Therefore, MNEs acquisition of SOEs should lower the probability of SOEs shutdown, and domestic firms acquisition of SOEs should increase the probability of SOEs shutdown. The model also predicts that as productivity of SOEs increases after acquisition, the likelihood of SOEs shutdown should decrease.

4.1 Data

To test the proposed theory, a sample of firm-level privatization data from 10 Central and Eastern European countries is used[8]. The data only includes SOEs which were privatized via direct sale to either foreign or domestic investor[9]. This method of privatization closely fits with the auction framework presented in the theoretical model where SOEs exchanged ownership only once directly from government to private. The data was obtained from Bureau van Dijk Electronic Publishing. Two separate databases were used. First using Zephyr merger and acquisition database, 562 privatization transactions were identified where SOEs had at least 50 percent of their assets directly sold to either domestic or foreign investors. Considering only SOEs that had more than 50 percent of ownership transferred directly from government to private investors follows the theoretical model and the assumptions of the second-price auction. All the transactions took place between 1998 and 2006 as

[8]Countries include: Bosnia and Herzegowina, Bulgaria, Croatia, Czech Republic, Estonia, Poland, Romania, Slovakia, Slovenia, Ukraine.

[9]There are other forms of privatization that governments used to dispose SOEs including sale to managers and employees and voucher privatization.

these were the only years available in the database. Next, using a firm-level database called Orbis, balance sheets and income statements were gathered for the 562 former SOEs. Combining information from both databases, a firm-level panel data for years 1998 to 2006 was created. Out of the 562 former SOEs, 143 were dropped due either to incomplete information regarding input or output measures, or duplicate record[10]. In the end, 419 former SOEs were included in the analysis.

In order to accurately test the hypothesis, all of the former SOEs that were shutdown after privatization had to be identified. Unfortunately, the data did not provide a clear indication of which of the 419 firms were shutdown. To guarantee accuracy in identifying all the shutdown firms, a detailed search on each of the 419 former SOEs was conducted. Various country databases, news sources, and firm websites were used to identify 44 former SOEs that were shutdown after privatization. Even with this detailed search, the status of 55 former SOEs was uncertain. For those 55 firms, employment was used to determine the operational status of the firm. Mata and Portugal (1994); Mata, Portugal and Guimarães (1995) and Van Beveren (2006) assumed that if employment fell to zero in a particular year, then the firm was considered shutdown. Altering slightly their assumption and considering firms to be shutdown only if employment fell below 10 employees in two consecutive years and this reduction in employment constituted a 1000 percent decrease from previous employment levels, another 9 former SOEs were identified as shutdown. In total, 53

[10]There were 51 duplicate records, and 92 firms didn't report any inputs or outputs, which doesn't allow for these 92 firms to be comparable to the firms in the sample.

former SOEs were shutdown within an average of 2.4 years after acquisition.

4.2 Empirical Model

A probit model is specified to estimate whether foreign MNEs have a higher probability to shutdown former SOEs. This estimation strategy will also reveal how SOEs' productivity affects shutdown probability after privatization. The model is:

$$\Pr(ShutDown_{it} = 1|\mathbf{X}_{it}, \boldsymbol{\gamma}) = \Phi(\mathbf{X}_{it}^{'}\boldsymbol{\gamma}) \tag{7}$$

where the dependant variable is

$$ShutDown_{it} = \begin{cases} 1 \; if \; firm \; i \; was \; shutdown \; in \; year \; t \\ 0 \; if \; firm \; i \; is \; still \; operational \; in \; final \; year \end{cases} \tag{8}$$

One of the limitations of most studies that use privatization data is the potential presence of sample selection bias that can arise as a result of governments privatizing better firm or privatizing better firms first[11]. Better performing firms should have lower probability of shutdown. Therefore, if this type of bias is present and better firms were privatized first, then it can be argued that shutdown rates would be higher among all privatized SOEs. This should not change the results of this study; it should reinforce and strengthen them.

[11] For further discussion on sample selection bias in privatization studies see Megginson and Netter (2001), and Frydman et al. (1999).

The main independent variable of interest will capture the effect of foreign MNEs' ownership on the probability of former SOEs shutdown. The data provides a country of origin for each acquiring firm and country of origin for each acquired former SOE. Any former SOE acquired by a firm from a different country is considered to be acquired by a foreign MNE; otherwise the SOE is acquired by a domestic firm. A dummy variable is constructed such that:

$$ForeignOwnership_{it} = \begin{cases} 1 \;\; if \; SOE \; is \; owned \; by \; foreign \; MNE \\ 0 \; if \; SOE \; is \; owned \; by \; domestic \; firm \end{cases} \tag{9}$$

where i denotes a former SOE acquired in year t.

Another limitation of the data is that it does not provide information on unsuccessful bidders for the SOEs. This is potentially problematic as ownership was assigned in a non-random fashion to the SOEs. This can cause a problem of endogeneity for the $ForeignOwnership$ variable, where $ForeignOwnership$ is also a choice variable as firms non-randomely selected to be acquirers of SOEs. The reasons that an acquiring firm (MNE or domestic) decided to acquire the SOE could be the same reasons that it decided to shutdown the SOE. The current specification of the model does not separate the two effects and potential bias is introduced into the estimation. To address this problem, data on unsuccessful bidders would have to be available. Therefore, all the findings presented are conditional on acquisition initially taking place.

Previous literature on firm shutdown and exit has shown that various firm char-

acteristics lower the probability of shutdown[12]. Without controlling for SOEs characteristics the impact of ownership on shutdown probability would be inaccurate. The following control variables were constructed to control for individual SOEs characteristics:

Total Factor Productivity (TFP_{it}) is obtained by estimating a value added production function using Levinsohn and Petrin's (2003) method where intermediate inputs, i.e. material costs, were used as proxy for unobservable productivity of SOEs. A further discussion of how TFP_{it} is calculated using this method is provided in the Appendix.

Age of SOEs (Age_{it}) is calculated using initial date of incorporation provided for each SOE in the data.

Size of SOEs ($Size_{it}$) is proxied by the natural log of number of employees for each SOEs in a given year.

Acquisition Cost ($Acquisition\ Cost_{it}$) is the amount paid by acquiring firm for the SOE in the privatization process. It was given as the total deal value in the mergers and acquisitions database. Industry fixed effects are also used to control for the heterogeneity in acquisition costs by industry.

Shareholder's Funds ($Shareholder's\ Funds_{it}$) is the total assets of a firm less total liabilities.

Profit and Loss before Tax ($P/L\ before\ Tax_{it}$) is the firm's revenues less all

[12]For examples see Bernard and Jensen (2004), Görg and Strobl (2003), Van Beveren (2006), and Bernard and Sjöholm (2003).

expenses before taxes are taken out.

Furthermore, two control variables of the acquiring firms are also included in the estimation:

Acquirer's Age ($Acquirer's\ Age_{it}$) is calculated using the initial date of incorporation provided for each acquiring firm.

Acquirer's number of Subsidiaries ($Acquirer's\ num.\ of\ Subsid_{it}$) is a proxy for the size of the acquiring firm.

A full set of year and country dummies is also used, as well as, industry controls using single digit USSIC codes.

Finally, to address the hypothesis of whether rise in SOEs' productivity under domestic and MNEs ownership leads to lower probability of shutdown, the data is split into two samples. The first sample includes only SOEs acquired by domestic firms and the second sample includes SOEs only acquired by MNEs. The model is then estimated and the impact of TFP_{it} on shutdown is obtained.

4.3 Summary Statistics

Table 1 in the Appendix summarizes shutdown statistics for the 419 former SOEs. Out of the 419 privatized SOEs, 53 were shutdown and 366 remained operational at the end of 2006. In Table 1, former SOEs acquired by domestic private firms are defined as Domestic and former SOEs acquired by foreign MNEs are defined as Foreign. Out of 53 shutdown former SOEs, 41 or 77 percent were shutdown by

domestic private acquirers and 12 or 23 percent were shutdown by foreign MNEs. Domestic private firms acquired 249 or 70 percent of all the privatized SOEs and foreign MNEs acquired 117 or 30 percent. Calculating a simple ratio of shutdown SOEs to total acquired SOEs for domestic private firms and MNEs, it is found that domestic private firms shutdown 16.5 percent of acquired SOEs and foreign MNEs shutdown 10.3 percent of acquired SOEs. The statistics in this table suggest that foreign MNEs are less likely to shutdown former SOEs.

Table 2 provides acquisition statistics for former SOEs based on industry classifications. The SOEs are categorized into manufacturing and service industry classification. Manufacturing SOEs engage in manufacturing, construction, and agricultural business. Service SOEs engage in various service-related industries including financial, wholesale, retail, communication, and utilities. Subdividing the SOEs into two industry classifications allows for more precise estimates of TFP as it is expected that TFP differs within industries[13]. Coefficient estimates on labor and capital used in obtaining TFP are provided in Table 3.

Table 4 compares characteristics of former SOEs acquired by domestic private firms versus foreign MNEs. In this table, privatization date is ignored and characteristics are compared for the entire life span of the SOE in the data. Means for revenue, capital, employment, age, TFP, acquisition cost, shareholder's funds, and profit and loss before tax are given as well as t-statistics comparing the two groups of

[13]For example see Levinsohn and Petrin 2003.

SOEs[14]. These statistics show that on average SOEs acquired by foreign MNEs were older, more productive, had higher revenues and lower profits. However, looking at Tables 5 and 6, where using date of privatization SOEs characteristics are divided by pre- and post-privatization, respectively, there is no significant difference in many of SOEs characteristics. Table 5 shows that employment, TFP, shareholder's funds, and profit and loss before tax were no different between SOEs acquired by domestic versus foreign MNEs. This implies that privatizing governments were not selling better performing SOEs to foreign MNEs.

Tables 5 and 6 provide information about the growth of TFP after privatization. Before privatization, TFP for SOEs that were going to be acquired by domestic firms was 15.28 as compared to 15.32 after privatization. SOEs acquired by foreign MNEs had an average TFP of 17.60 before privatization and 18.66 after privatization. Although by statistically insignificant amounts, TFP increased for both groups of SOEs after privatization[15].

Tables 7 and 8 show SOEs' characteristics before and after privatization, respectfully, for the 366 SOEs that were not shutdown. It is interesting to observe that before privatization, domestically acquired SOEs had insignificantly higher employment levels as compared to SOEs acquired by foreign MNEs. After privatization,

[14]Revenue, capital, shareholder's funds, and profit and loss before tax are all in thousand Euro. Capital is defined as total assets minus total cash flows, which provides a measure of total value of machinery, buildings and land. TFP is given in levels.

[15]This evidence supports one of the assumptions made in the theoretical model where it was assumed that productivity of the SOE is impacted differently by the MNE and domestic firm after privatization.

employment levels fall by more than 50 percent at SOEs that were domestically acquired. Whereas after privatization, employment goes up at foreign acquired SOEs. Privatization effects on employment is one of the main concerns of policy makers and this evidence should alleviate fears of selling SOEs to foreign MNEs.

Tables 9, 10 and 11 compare the characteristics of SOEs that were shutdown to SOEs that remained operational. Table 9 ignores privatization effect on these characteristics, whereas tables 10 and 11 consider pre- and post-privatization differences in SOEs. It is clear that operational SOEs on average are better performers. Operational SOEs are older, more productive, and have higher revenues and profits than shutdown SOEs.

5 Estimation Results

The main estimation results are provided in Table 12, where coefficients give marginal effects of changing the independent variable. There are five columns, where independent variables used in estimation encompass pre- and post-privatization data. Also, country, year, and industry controls are used for each estimation. In column I, for comparison purpose, the dependent variable is regressed only on $ForeignOwnership_{it}$. The coefficient on $ForeignOwnership_{it}$ is -0.0962 and very significant. This means that conditional on acquisition taking place, MNEs ownership reduces the probability of SOEs shutdown by 9.62 percent as compared to domestic firms. Adding SOEs control variables such as *TFP*, *Size*, *Age*, and *Acquisition Cost* reduces the coefficient

to -0.0447 where it still remains highly significant (column II). All of the coefficients on the independent variable are negative and significant. This is expected as all these control variables should reduce the probability of shutdown. The coefficient on $ForeignOwnership_{it}$ remains negative and significant even after controlling further for SOEs characteristics, i.e. *Shareholder's Funds* and *Profit and Loss before Tax* (column III). Column IV includes *Acquirer's Age* and *Acquirer's number of Subsidiaries* as two controls for acquiring firms characteristics. Comparing column I and IV, the coefficient on $ForeignOwnership_{it}$ becomes even more negative. Finally, in column V, all the control variables are included and the result does not change as the coefficient on $ForeignOwnership_{it}$ remains negative and significant.

Table 12 provides clear evidence that MNEs ownership of former SOEs reduces the probability of shutdown of these SOEs. However, the table provides mixed results regarding the impact productivity has on shutdown probability. The hypothesis from the theoretical model states that as productivity of SOEs increases, the probability of shutdown should decrease. In column II of Table 12, the coefficient on TFP is negative and significant. In column III after adding more control variables the TFP coefficient, although small, becomes positive and significant. Finally, in column V the coefficient is not significant. Therefore, the effect of productivity on SOEs probability of shutdown is inconclusive from these results[16].

Another approach to identify the role of productivity in the shutdown of SOEs

[16] Other empirical studies find that as productivity increases probability of shutdown decreases, see for example Bernard and Jensen 2007.

is to split the data into two subsamples. The first sample contains only SOEs that were acquired by MNEs and the second sample contains SOEs acquired by domestic firms. The same probit model is estimated on the two subsamples and the results are provided in Table 13. In both columns, the coefficient on *TFP* is negative and significant. This provides some support for the theory that regardless of acquiring firms origin, if productivity of SOEs increases then the probability of shutdown decreases.

6 Conclusion

Privatization of SOEs in transitional economies is an ongoing process. MNEs are using privatization to acquire SOEs in order to gain quick market entry and avoid international trade costs. Increased MNEs activity in transitional economies has led to concerns that MNEs may be acquiring and shutting down SOEs. Although these concerns are justified by anecdotal evidence, there is no statistical evidence that this is true. This paper investigates how MNEs ownership of former SOEs impacts the likelihood of shutdown. A theoretical model is developed where it is shown that MNEs have incentives to produce locally with the SOEs, especially when international trade costs are high and the SOEs have higher productivity. The implications of the model are then tested using privatization data from Central and Eastern Europe. It is found that former SOEs owned by MNEs have significantly reduced probability of shutdown as compared to SOEs owned by domestic firms.

The results of this paper are important from a policy standpoint. Governments going through a privatization process should make every effort to consider MNEs offers for acquisition of SOEs. Policy makers should design privatization processes that encourage MNEs to invest in SOEs since acquisition behavior of MNEs is found to be beneficial to home countries.

Finally, although no formal analysis is conducted on growth rates of productivity and employment, evidence from summary statistics suggests that productivity growth is higher for SOEs under MNEs ownership versus domestic ownership. Employment levels rise for SOEs owned by MNEs and fall for SOEs owned by domestic firms. These findings are also policy relevant and should help to promote FDI in transitional countries.

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Appendix

Proof of Proposition 1:

The proof is derived from analyzing the optimal actions of both firms in the second stage. First, assume that firm M is the winner of the auction. Then firm M will choose to shutdown asset k if profits obtained in the third stage are higher under export than local production, i.e. $\pi_M(c^*_{Mo}, c^*_{Do}) > \pi_M(c^*_{Mk}, c^*_{Do})$. Using the profits derived in the third stage we see that this inequality holds iff

$$\frac{[\alpha + c_D - 2c_D t + 2\theta - \lambda]^2}{9\beta} > \frac{[\alpha + c_D - 2s - \lambda + 2\rho_M]^2}{9\beta} \tag{10}$$

simplifying this expression gives the necessary condition for firm M to shutdown asset k :

$$(s - c_M t) + \theta > \rho_M. \tag{11}$$

Similarly, the necessary condition for firm D to shutdown asset k can be shown. Assume that firm D is the winner of the auction, then firm D will choose to shutdown asset k if profits obtained in the third stage are higher under production with own plant than with asset k, i.e. $\pi_D(c^*_{Mo}, c^*_{Do}) > \pi_D(c^*_{Mo}, c^*_{Dk})$. This inequality holds iff

$$\frac{[\alpha - 2c_D + c_M t - \theta + 2\lambda]^2}{9\beta} > \frac{[\alpha - 2s + c_M t - \theta + 2\rho_D]^2}{9\beta} \tag{12}$$

simplifying this expression gives the necessary condition for firm D to shutdown asset

k :

$$(s - c_D) + \lambda > \rho_D. \tag{13}$$

■

Proof of Lemma 2

Let $v_i > v_j$ without loss of generality. First, consider the equilibrium candidate where firm i acquires asset k. Consider the equilibrium bid b^*, where $b_i^* > b_j^*$, $j \neq i$. Let firm i be the owner obtaining asset k. Note that $b_i^* > v_i^*$ is a weakly dominated strategy, since no firm will post a bid over its maximum valuation of obtaining the assets. If $b_i^* < v_j^*$, firm j benefits from deviating to $b_j^{**} = b_i^* + \varepsilon$, since it then obtains the assets and pays a price for the assets lower than its valuation of obtaining them. Last, consider bid $b_i^* = v_j^*$, $b_j^* = v_j - \varepsilon$. Then, no firm has an incentive to deviate. Thus, this is a Nash Equilibrium (NE) and the only NE where firm i obtains asset k.

It can be shown that it is the only NE. First, consider the situation where firm j obtains asset k. Consider the equilibrium bid b^*, where $b_j^* > b_i^*$, $j \neq i$. But it is known that in equilibrium, $b_j^* < v_j$, since firm j otherwise plays a weakly dominated strategy. But if $b_j^* < v_j$, firm i benefits from deviating to $b_i^{**} = b_j^* + \varepsilon$, since it then obtains asset k and pays a price which is lower than its valuation of obtaining asset k. Thus, firm j obtaining asset k is not an equilibrium.

Second, note that the situation where firms i and j do not obtain the assets cannot occur if there is no reservation price at the auction. ■

Proof of Proposition 3:

Starting with outcome 1 in Proposition 3, in this market structure both firms decide to shutdown asset k after acquisition, i.e. $(s-c_M t)+\theta > \rho_M$ and $(s-c_D)+\lambda > \rho_D$. Profits for both firms are: $\pi_M(c^*_{Mo}, c^*_{Do}) > \pi_M(c^*_{Mk}, c^*_{Do})$ and $\pi_D(c^*_{Mo}, c^*_{Do}) > \pi_D(c^*_{Mo}, c^*_{Dk})$. Valuation each firm has for asset k is defined by $v_i = \pi_{ii} - \pi_{ij}$, where $i = \{M, D\}$. Because firm's profits are higher under shutdown of asset k, valuation can be written as:

$$v_M = \pi_M(c^*_{Mo}, c^*_{Do}) - \pi_M(c^*_{Mo}, c^*_{Do}) = \tag{14}$$

$$\frac{[\alpha + c_D - 2c_M t + 2\theta - \lambda]^2}{9\beta} - \frac{[\alpha + c_D - 2c_M t + 2\theta - \lambda]^2}{9\beta} = 0$$

$$v_D = \pi_D(c^*_{Mo}, c^*_{Do}) - \pi_D(c^*_{Mo}, c^*_{Do}) = \tag{15}$$

$$\frac{[\alpha - 2c_D + c_M t - \theta + 2\lambda]^2}{9\beta} - \frac{[\alpha - 2c_D + c_M t - \theta + 2\lambda]^2}{9\beta} = 0$$

Again, by Lemma 2, if the valuation of firm i is greater than valuation of firm j, then firm i wins the auction and pays price equal to firm $j's$ valuation, and $i \neq j$. That it, if $v_i > v_j$, then firm i wins and pays price v_j. Writing $v_i > v_j$ as $v_i - v_j > 0$, if $v_i - v_j > 0$ holds true then firm i wins the auction and acquires asset k. In this situation

$$v_M - v_D = 0 \tag{16}$$

and both firms win with equal probability and the acquisition price is equal to $v_M = v_D = 0$. This is the situation when not a single firm wants produce with asset k and

privatization of asset k is not optimal for the government as asset k will be shutdown by both bidders after the auction.

In outcome 2 of Proposition 3, if $(s - c_M t) + \theta > \rho_M$ and $(s - c_D) + \lambda < \rho_D$ then by Proposition 1 firm M will shutdown asset k after acquisition but firm D will use asset k to produce. Each firm's valuation for asset k is:

$$v_M = \pi_M(c^*_{Mo}, c^*_{Do}) - \pi_M(c^*_{Mo}, c^*_{Dk}) = \tag{17}$$

$$\frac{[\alpha + c_D - 2c_M t + 2\theta - \lambda]^2}{9\beta} - \frac{[\alpha + s - 2c_M t + 2\theta - \rho_D]^2}{9\beta} =$$

$$-\frac{1}{9\beta}(s + \lambda - \rho_D - c_D)(s + 4\theta + 2\alpha - \lambda - \rho_D + c_D - 4c_M t).$$

$$v_D = \pi_D(c^*_{Mo}, c^*_{Dk}) - \pi_D(c^*_{Mo}, c^*_{Do}) = \tag{18}$$

$$\frac{[\alpha - 2s + c_M t - \theta + 2\rho_D]^2}{9\beta} - \frac{[\alpha - 2c_D + c_M t - \theta + 2\lambda]^2}{9\beta} =$$

$$-\frac{4}{9\beta}(s + \lambda - \rho_D - c_D)(\alpha - \theta - s + \lambda + \rho_D - c_D + c_M t).$$

and the equilibrium buyer will be obtain based on the sign of $v_M - v_D$, which when simplified is:

$$v_M - v_D = \frac{1}{9\beta}(s + \lambda - \rho_D - c_D)(2\alpha - 8\theta - 5s + 5\lambda + 5\rho_D - 5c_D + 8c_M t) \tag{19}$$

The first term in the equality is $\frac{1}{9\beta} > 0$. The second term $(s + \lambda - \rho_D - c_D) < 0$

follows from the fact that firm D would want to produce using asset k. Therefore, the sign of $v_M - v_D$ is determined by the third term. The third term is $(2\alpha - 8\theta - 5s + 5\lambda + 5\rho_D - 5c_D + 8c_M t)$. Defining the value of ρ_d^* as the level of productivity of firm D that will make $2\alpha - 8\theta - 5s + 5\lambda - 5c_D + 8c_M t + 5\rho_D^* = 0$, and simplifying

$$\rho_D^* = \frac{8\theta + 5s + 5c_D - 5\lambda - 8c_M t - 2\alpha}{5} \tag{20}$$

which then follows that ρ_D^* is the level of $k's$ productivity under $D's$ ownership that makes $v_M - v_D = 0$, and both firms win the auction with equal probability. Now, if $\rho_D > \rho_D^*$ then $(2\alpha - 8\theta - 5s + 5\lambda + 5\rho_D - 5c_D + 8c_M t) > 0$ and $v_M - v_D < 0$. Firm D wins the auction and pays acquisition price equal to v_M. If $\rho_D < \rho_D^*$ then $(2\alpha - 8\theta - 5s + 5\lambda + 5\rho_D - 5c_D + 8c_M t) < 0$ and $v_M - v_D > 0$. Firm M wins the auction and pays acquisition price v_D.

In outcome 3 of Proposition 3, if $(s - c_M t) + \theta < \rho_M$ and $(s - c_D) + \lambda > \rho_D$ then by Proposition 1 firm M will produce using asset k and firm D will shutdown asset k after the auction. Each firm's valuation for asset k is:

$$v_M = \pi_M(c_{Md}^*, c_{Do}^*) - \pi_M(c_{Mo}^*, c_{Do}^*) = \tag{21}$$

$$\frac{[\alpha + c_D - 2s - \lambda + 2\rho_M]^2}{9\beta} - \frac{[\alpha + c_D - 2c_M t + 2\theta - \lambda]^2}{9\beta} =$$

$$-\frac{4}{9\beta}(s + \theta - \rho_M - c_M t)(\theta - s + \alpha - \lambda + \rho_M + c_D - c_M t).$$

$$v_D = \pi_D(c^*_{Mo}, c^*_{Do}) - \pi_D(c^*_{Mk}, c^*_{Do}) = \tag{22}$$

$$\frac{[\alpha - 2c_D + c_M t - \theta + 2\lambda]^2}{9\beta} - \frac{[\alpha - 2c_D + s + 2\lambda - \rho_M]^2}{9\beta} =$$

$$-\frac{1}{9\beta}\left(s + \theta - \rho_M - c_M t\right)\left(s - \theta + 2\alpha + 4\lambda - \rho_M - 4c_D + c_M t\right).$$

and the equilibrium buyer will be obtain based on the sign of $v_M - v_D$. Again, simplifying $v_M - v_D$ and comparing individual terms, the sign of $v_M - v_D$ can be obtained.

$$v_M - v_D = \tag{23}$$

$$-\frac{1}{9\beta}\left(s + \theta - \rho_M - c_M t\right)\left(5\theta - 5s + 2\alpha - 8\lambda + 5\rho_M + 8c_D - 5c_M t\right)$$

The first term is $-\frac{1}{9\beta} < 0$. The second term $(s + \theta - \rho_M - c_M t) < 0$ follows from the fact that firm M would want to produce using asset k after acquisition. Finally, the sign of $v_M - v_D$ is determined by the third term. The third term is $\left(5\theta - 5s + 2\alpha - 8\lambda + 5\rho_M + 8c_D - 5c_M t\right)$. Defining ρ^*_M as the value of firm $M's$ productivity that makes $5\theta - 5s + 2\alpha - 8\lambda + 8c_D - 5c_M t + 5\rho^*_M = 0$, and simplifying

$$\rho^*_M = \frac{5c_M t + 5s + 8\lambda - 8c_D - 5\theta - 2\alpha}{5} \tag{24}$$

which then follows that ρ^*_M is the level of $k's$ productivity under $M's$ ownership that makes $v_M - v_D = 0$, and both firms win the auction with equal probability. Now,

if $\rho_M > \rho_M^*$ then $(5\theta - 5s + 2\alpha - 8\lambda + 5\rho_M + 8c_D - 5c_M t) > 0$ and $v_M - v_D > 0$, which means that firm M wins the auction and pays acquisition price equal to v_D. If $\rho_M < \rho_M^*$ then $(5\theta - 5s + 2\alpha - 8\lambda + 5\rho_M + 8c_D - 5c_M t) < 0$ and $v_M - v_D < 0$, which means that firm D wins the auction and pays acquisition price equal to v_M.

In outcome 4 of Proposition 3, if $(s - c_M t) + \theta < \rho_M$ and $(s - c_D) + \lambda < \rho_D$ then by Proposition 1 M and D want to acquire and produce with asset k. Each firm's valuation for asset k is:

$$v_M = \pi_M(c_{Mk}^*, c_{Do}^*) - \pi_M(c_{Mo}^*, c_{Dk}^*) = \tag{25}$$

$$\frac{[\alpha + c_D - 2s - \lambda + 2\rho_M]^2}{9\beta} - \frac{[\alpha + s - 2c_M t + 2\theta - \rho_D]^2}{9\beta} =$$

$$-\frac{1}{9\beta}\left(\rho_D - 2\theta - \lambda - 3s + 2\rho_M + c_D + 2c_M t\right)\left(s - 2\theta - 2\alpha + \lambda + \rho_D - 2\rho_M - c_D + 2c_M t\right).$$

$$v_D = \pi_D(c_{Mo}^*, c_{Dk}^*) - \pi_D(c_{Mk}^*, c_{Do}^*) = \tag{26}$$

$$\frac{[\alpha - 2s + c_M t - \theta + 2\rho_D]^2}{9\beta} - \frac{[\alpha - 2c_D + s + 2\lambda - \rho_M]^2}{9\beta} =$$

$$-\frac{1}{9\beta}\left(2\rho_D - \theta - 2\lambda - 3s + \rho_M + 2c_D + c_M t\right)\left(s + \theta - 2\alpha - 2\lambda - 2\rho_D + \rho_M + 2c_D - c_M t\right).$$

and the equilibrium buyer will be obtaind based on the sign of $v_M - v_D$. Simplifying $v_M - v_D$ and comparing individual terms the sign of $v_M - v_D$ can be obtained.

$$v_M - v_D = \tag{27}$$

$$-\frac{1}{9\beta}(8s\theta - 8s\lambda - 10s\rho_D + 10s\rho_M + 5\theta^2 - 5\lambda^2 + 5\rho_D^2 - 5\rho_M^2$$

$$+5c_M^2t^2 + 8sc_D - 5c_D^2 + 2\theta\alpha - 2\alpha\lambda - 8\theta\rho_D + 2\alpha\rho_D - 2\alpha\rho_M$$

$$+8\lambda\rho_M + 2\alpha c_D + 10\lambda c_D - 8\rho_M c_D - 8sc_M t - 10\theta c_M t - 2\alpha c_M t + 8\rho_D c_M t).$$

The first term $-\frac{1}{9\beta} < 0$. The sign of $v_M - v_D$ will be determined by the sign of the second term. Simplifying the second term and defining $\left(\frac{\rho_D}{\rho_M}\right)^*$ as the ratio of productivity levels of D and M that makes $v_M - v_D = 0$.

$$\left(\frac{\rho_D}{\rho_M}\right)^* = \frac{(+5\rho_M - 8\lambda + 2\alpha + 8c_D - 10s)}{(5\rho_D - 8\theta + 2\alpha + 8c_M t - 10s)} \tag{28}$$

$$+\frac{(8s\lambda - 8s\theta - 5\theta^2 + 5\lambda^2 - 5c_M^2t^2 - 8sc_D + 5c_D^2 - 2\theta\alpha)}{\rho_M(5\rho_D - 8\theta + 2\alpha + 8c_M t - 10s)}$$

$$+\frac{(2\alpha\lambda - 2\alpha c_D - 10\lambda c_D + 8sc_M t + 10\theta c_M t + 2\alpha c_M t)}{\rho_M(5\rho_D - 8\theta + 2\alpha + 8c_M t - 10s)}$$

If $\left(\frac{\rho_D}{\rho_M}\right) < \left(\frac{\rho_D}{\rho_M}\right)^*$ then $v_M - v_D > 0$ and firm M is the winner of the auction and pays acquisition price equal to v_D. If $\left(\frac{\rho_D}{\rho_M}\right) > \left(\frac{\rho_D}{\rho_M}\right)^*$ then $v_M - v_D < 0$ and firm D is the winner of the auction and pays acquisition price equal to v_M. ■

Productivity Estimation using Levinsohn and Petrin (2003):

The value added Cobb-Douglas production function (gross output net materials)

is estimated

$$v_{it} = \beta_o + \beta_l l_{it} + \beta_k k_{it} + \varpi_{it} + \eta_{it} \tag{29}$$

where v_{it} denotes value added, and l_{it} and k_{it} are labor and capital, respectively. Labor is defined as the natural log of number of employees. Capital, also in natural log, is defined as total assets less total cash flows for a given firm in a given year. The error term is split into the observable firm-level productivity ϖ_{it} and the unobserved error term η_{it} that captures the measurement error and other unexpected circumstances. The main issue in estimating productivity functions is trying to address the fact that unobservable productivity shock can be correlated with firm inputs of production. This method of productivity estimation uses intermediate inputs to production as proxy for the unobservable productivity shocks. After estimating the coefficients on labor and capital, total factor productivity in levels can be back out by

$$TFP_{it}^{j} = \exp(v_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}) \tag{30}$$

where TFP_{it}^{j} is given for each firm i at time t in industry j. For further details on this methodology see Levinsohn and Petrin (2003).

Table 1: Shutdown Statistics of SOEs by Ownership

SOEs acquired by:	**Domestic**	**Foreign**	**Total**
Shutdown SOEs	41	12	53 (13%)
Operational SOEs	249	117	366 (87%)
Total	290 (70%)	129 (30%)	419 (100%)

Note: Domestic firms are SOEs acquired by domestic private firms and Foreign firms are SOEs acquired by foreign MNEs

Table 2: Ownership of SOEs by Industry

SOEs acquired by:	**Domestic**	**Foreign**	**Total**
Manufacturing	197	74	271
Service	93	55	148
Total	290	129	419

Table 3: Productivity Estimates for SOEs

	labor	**capital**
Manufacturing	0.0988*	0.5865***
	(0.0581)	(0.1878)
Service	0.4740***	0.4060***
	(0.0748)	(0.1546)

Note: Standard Errors are given in the parenthesis. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 4: SOEs Characteristics by Ownership

SOEs acquired by:	**Domestic**	**Foreign**	**t-test**
Revenue	101194.3	151719.1	-2.25**
Capital	97453.97	142713.8	-2.8***
Employment	1735	1969	-1.17
Age	25	28.3	-2.4**
TFP	15.29	18.05	-2.28**
Acquisition Cost	18480.25	122430.7	-2.50**
Shareholder's Funds	52249.88	62964.46	-1.18
P/L before Tax	7033.83	3552.96	2.05**

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 5: SOEs Characteristics by Ownership Before Privatization

SOEs acquired by:	**Domestic**	**Foreign**	**t-test**
Revenue	103241.6	149635.2	-1.69*
Capital	95220.84	132879.1	-2.03**
Employment	2023	1879	0.58
TFP	15.28	17.60	-1.54
Shareholder's Funds	44126.42	36495.78	1.02
P/L before Tax	3379.56	1140.44	1.6

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 6: SOEs Characteristics by Ownership After Privatization

SOEs acquired by:	**Domestic**	**Foreign**	**t-test**
Revenue	95748.88	154767.1	-1.57
Capital	104047	157103.9	-1.75*
Employment	1016	2093	-3.50***
TFP	15.32	18.66	-1.51
Shareholder's Funds	73809.44	100076.6	-1.33
P/L before Tax	16769.57	6906.16	2.31**

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 7: Operational SOEs Characteristics by Ownership Before Privatization

SOEs acquired by:	**Domestic**	**Foreign**	**t-test**
Revenue	114467	159662.1	-1.52
Capital	103007.7	142190.5	-1.95*
Employment	2184	1990	0.71
TFP	15.89	18.16	-1.41
Shareholder's Funds	50014.6	38902.32	1.36
P/L before Tax	4151.59	1249.89	1.87*

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 8: Operational SOEs Characteristics by Ownership After Privatization

SOEs acquired by:	**Domestic**	**Foreign**	**t-test**
Revenue	104111.2	167913.5	-1.52
Capital	107851.8	171184.4	-1.86*
Employment	935	2154	-3.71***
TFP	16.18	18.92	-1.1
Shareholder's Funds	82530.07	114051.6	-1.40
P/L before Tax	19359.49	7871.19	2.34**

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 9: SOEs Characteristics by Shutdown

	Shutdown SOEs	**Operational SOEs**	**t-test**
Revenue	30258.45	128221.8	8.9***
Capital	45131.48	120917.7	7.37***
Employment	1120	1904	3.88***
Age	27.05	26.03	-0.45
TFP	11.32	16.80	5.18***
Acquisition Cost	14996.79	55608.04	2.49**
Shareholder's Funds	9518.57	62163.33	11.80***
P/L before Tax	-605.70	6887	7.16***

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro. * significant at 10%, **significant at 5%, *** significant at 1%.

Table 10: SOEs Characteristics by Shutdown Before Privatization

	Shutdown SOEs	**Operational SOEs**	**t-test**
Revenue	24983.07	127287	7.91***
Capital	34900.18	114385.8	7.33***
Employment	895	2128	6.56***
TFP	10.62	16.53	5.01***
Shareholder's Funds	7445.58	46883.13	9.67***
P/L before Tax	-1177.76	3330.92	4.85***

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro.
* significant at 10%, **significant at 5%, *** significant at 1%.

Table 11: SOEs Characteristics by Shutdown After Privatization

	Shutdown SOEs	**Operational SOEs**	**t-test**
Revenue	40954.4	130278.2	4.33***
Capital	65378.68	136259	3.19***
Employment	1527	1435	-0.21
TFP	12.61	17.43	2.30**
Shareholder's Funds	13564.23	95396.8	7.52***
P/L before Tax	505.86	14611.19	5.37***

Note: Means of all values are given, where Revenue, Capital, Acquisition Costs, Shareholder's Funds, and P/L before Tax are in Thousands Euro.
* significant at 10%, **significant at 5%, *** significant at 1%.

Table 12: Probit Results on All SOEs

$Shutdown_{it}$	I	II	III	IV	V
Foreign Ownership	-0.0962***	-0.0447***	-0.0202***	-0.1761***	-0.0323**
	(0.0094)	(0.0112)	(0.0127)	(0.0300)	(0.0520)
TFP		-0.0016***	0.0003**		0.0001
		(0.0004)	(0.0002)		(0.0001)
Size		-0.0119***	-0.0045***		-0.0012***
		(0.0036)	(0.0027)		(0.0034)
Age		-0.0010***	-0.0003**		-0.0001**
		(0.0004)	(0.0002)		(0.0002)
Acquisition Cost		-0.0021**	-0.0008*		-0.0001
		(0.0009)	(0.0005)		(0.0001)
Shareholder's Funds			-0.0031*		0.0007
			(0.0023)		(0.0020)
P/L before Tax			-0.0044***		-0.0015***
			(0.0029)		(0.0042)
Acquirer's Age				-0.0021***	-0.0001**
				(0.0006)	(0.0002)
Acquirer's # of Subsid.				-0.0013***	0.0001
				(0.0003)	(0.0001)

Note: The coefficients provide marginal effects. Each column also includes year, country and industry fixed effects. Acquisition Costs are measured in 10 million Euros. * significant at 10%, **significant at 5%, *** significant at 1%. Standard Errors are given in parenthesis and are robust.

Table 13: Probit Results on SOEs

$Shutdown_{it}$	SOEs Acquired by MNEs	SOEs Acquired by Domestic Firms
TFP	-0.0010**	-0.0019***
	(0.0006)	(0.0005)
Size	0.0049	-0.0057
	(0.0046)	(0.0039)
Age	-0.0002	-0.0031***
	(0.0002)	(0.0006)
Acquisition Cost	-0.0031*	-0.0002
	(0.0010)	(0.0009)

Note: The coefficients provide marginal effects. Each column also includes year, country and industry fixed effects. Acquisition Costs are measured in 10 million Euros. * significant at 10%, **significant at 5%, *** significant at 1%. Standard Errors are given in parenthesis and are robust.