The Role of Multinational Enterprises in the Shutdown of State-Owned Enterprises: Evidence from Central and Eastern Europe

Grzegorz Pac*

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Abstract

This paper examines the role of multinational enterprises (MNEs) in the shutdown of former state-owned enterprises (SOEs) in transitional economies of Central and Eastern Europe. An oligopoly model in an international setting predicts that MNEs can acquire SOEs and successfully operate in the local market. If productivity of SOEs is expected to increase only under MNEs ownership, then domestic private firms may acquire and shutdown SOEs to prevent MNEs entry into the market. Firm-level privatization data from Central and Eastern Europe reveals that MNEs' ownership of SOEs significantly reduces the probability of SOEs shutdown as compared to domestic ownership.

Keywords: Central and Eastern Europe, multinational enterprises, privatization, shutdown of state-owned enterprises

JEL classification: D21, F23, L22, P31

* Assistant Professor of Economics, College of Business, Alfred University, 1 Saxon Dr., Alfred, New York 14802. Email: pac@alfred.edu. I gratefully appreciate helpful comments from James Markusen, Scott Savage, Anna Rubinchik, Jennifer Lamping, and seminar participants at Midwest International Economics Meeting Fall 2008 and ETSG 2008 Warsaw.

1. Introduction

Despite many privatization programs over the last two decades, state-owned enterprises (SOEs) still constitute a substantial part of many transitional economies[1]. Governments implementing privatization have used the sale of SOEs 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 to avoid international trade costs associated with export. 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. The fear is that MNEs are acquiring SOEs with the intent to shut them down to eliminate potential competition. This fear is further substantiated through research documenting MNEs' role in the shutdown of local private firms in developed and developing countries, such as Bernard and Jensen, (2007); Görg and Strobl, (2003); Van Beveren, (2006); Bernard and Sjöholm, (2003). These studies have found that local firms owned by MNEs have a higher propensity to shutdown than do local firms owned by domestic investors. The case of transitional economies where MNEs acquire SOEs directly from the government has not been previously studied. This paper examines the relationship between MNEs and the shutdown of former SOEs to determine whether the fears and concerns of transitional governments have merit.

The arguments presented in the mentioned literature on MNEs and the shutdown of local firms propose that MNEs exit a market and shutdown their local owned firms quicker than domestic firms because they have fewer ties to the local economy and have multiple global locations. MNEs are more flexible than domestic firms as they have many locations allowing them to stay operational even if they exit one country. Shutdown of unhealthy firms is natural as it improves

the overall efficiency of the economy. However, the concern in transitional economies is that healthy SOEs are being acquired, mismanaged, and ultimately shutdown as an anti-competitive move by their acquiring MNEs. Many SOEs are local monopolies and by allowing foreign MNEs to acquire them, it is possible that governments are creating foreign-owned monopolies. Instead of investing in these former SOEs, MNEs simply shut them down and eliminate potential future competition. If SOEs were privatized to domestic investors, then the entering MNEs would have to compete for market share with the SOEs; however, by gaining control of healthy SOEs, MNEs can remove the threat of competition.

To determine whether MNEs or domestic investors shutdown more SOEs, a two country model of oligopoly in partial equilibrium is developed. It analyzes the various incentives MNEs and domestic firms have for acquiring and shutting down SOEs. The model incorporates productivity of SOEs and international trade costs faced by MNEs when exporting to the local market. Past literature (Megginson and Netter, 2001) has revealed that privatized SOEs' productivity increases after privatization. As a result, acquiring firms' rivals may intentionally acquire and shutdown SOEs to prevent stronger competition following privatization. Therefore, it is important to account for SOEs productivity when modeling the incentives for acquisition and shutdown.

The privatization process is modeled as a second-price auction and permits strategic interaction between MNEs and local private firms after the privatization. The model predicts that MNEs will not shutdown acquired SOEs when productivity of SOEs and international trade costs are high. MNEs want to produce locally with the SOEs in order to avoid international trade costs and to maximize profits by using productive SOEs. Furthermore, to avoid strong competition after privatization, domestic private firms can acquire SOEs to prevent easy entry for MNEs. SOEs

are then shutdown by the domestic firms if their costs of production are higher than domestic firms' existing local production.

The predictions of the model are tested using a novel firm-level privatization data from Central and Eastern Europe spanning years 1998 to 2006. The analysis reveals that MNEs have significantly lower probability of shutting down acquired SOEs as compared to domestic acquirers of SOEs. This result holds when controlling for productivity, size, and age of the former SOEs. Furthermore, productivity plays an important role in the decision to shutdown SOEs. SOEs acquired by foreign MNEs have significantly lower probability of being shutdown when their productivity is increasing; this result does not hold for SOEs acquired by domestic private firms. These findings support the theory that MNEs don't acquire SOEs for shutdown but actually want to operate locally with acquired SOEs. The results also represent potential evidence for the anti-competitive behavior of domestic private firms as productivity of SOEs does not influence domestic firms' decision to shutdown acquired SOEs.

Privatization continues to impact the economies of Central and Eastern Europe as well as other transitional economies. Privatization is a source of revenue for governments and represents a concrete way to improve the performance and efficiency of many industries. Because of the importance of privatization to the development of transitional economies, privatization has received much attention in economic literature. However, much of this literature fits into two primary categories; the first string of literature looks at pre- and post-privatization performance of SOEs as summarized in Meggision and Netter (2001). The second compares state-owned firms to private-owned firms as in Frydman et al (1999). The link between privatization and FDI has not received a great deal of attention in economic literature[4]. Examining this link can help privatizing governments understand the incentives of potential buyers and prevent the shutdown

of healthy firms. Furthermore, understanding the relationship between FDI and shutdown of acquired SOEs can strengthen positive image of FDI in transitional countries.

Section 2 presents the model and the equilibrium ownership of SOEs. Section 3 provides the data description and empirical specification. Section 4 presents summary statistics and estimation results. Section 5 concludes.

2. 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: $U(Q,z)=u(Q)+z$; where z is the numeraire good and the u(Q) is quadratic[5]: $u(Q)=\alpha Q-((\beta Q^2)/2)$. The maximization problem yields the representative consumer's demand function which is then solved for the inverse demand function: $p=\alpha-\beta Q$.

Initially, firms M and D each have a single plant in their respective 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 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 by 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.

(Insert Figure 1)

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

$\max \pi_M = \max[(p(Q) - c_{Ml}^*)q_M]$

$\max \pi_D = \max[(p(Q) - c_{Dl}^*)q_D]$

Where the Cournot equilibrium outputs supplied by each firm are:

$q_M = ((\alpha - 2c_{Ml}^* + c_{Dl}^*)/(3\beta))$

$q_D = ((\alpha - 2c_{Dl}^* + c_{Ml}^*)/(3\beta))$

Equilibrium profits are:

$\pi_M(c_{Ml}^*, c_{Dl}^*) = \beta(q_M)^2$

$\pi_D(c_{Ml}^*, c_{Dl}^*) = \beta(q_D)^2$

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 be unsuccessful if the difference between marginal costs at the two plants plus productivity at its own plant is higher than productivity established by M at k, i.e. $(s-c_Mt)+ \theta > \rho_M$. It has been previously established in literature that FDI is carried out by firms with high productivity levels (Melitz, 2003). However, according to Proposition 1, high productivity of acquiring firm is not enough for successful FDI to take place. 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 existing 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 will 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, 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.

(Insert Figure 2)

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 than 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 $v_i=\pi_{ii}-\pi_{ij}$. As in Norbäck and Persson (2004), for a case with two firms the following lemma can be established:

Lemma 1: Assume firm i has the highest valuation. Asset k is then acquired by firm i at price equal to v_j, which is firm j's valuation of obtaining asset k.

Proof: See Appendix.

2a. 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 possible outcome of the game were solved. 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 $(((\rho_D)/(\rho_M)))^*$ 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 2: *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 $(((\rho_D)/(\rho_M))) < (((\rho_D)/(\rho_M)))^*$ firm M wins asset k at a price of v_D and produces with it; and for $(((\rho_D)/(\rho_M))) > (((\rho_D)/(\rho_M)))^*$ firm D acquires asset k at a price v_M and produces with it.

Proof: See the Appendix.

(Insert Figure 3)

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 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 in determining the equilibrium buyer. As trade costs between countries increase, firm M has greater incentives to acquire asset k. As trade costs increase from t=1to 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 assign greater valuation to asset k 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[6].

The equilibrium presents testable hypotheses regarding the shutdown of asset k. It shows that post-privatization productivity of asset k is a key factor in predicting whether or not asset k will be used for production. Low levels of asset k's productivity will lead to shutdown of asset k and high productivity levels will lead to production.

Trade costs also play a role in the shutdown of asset k. As trade costs rise between countries, foreign MNEs have greater incentives to keep local production and are therefore 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 fewer 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.

3. Data and Empirical Model

This theoretical model highlights the shutdown of SOEs caused by post-privatization ownership and productivity of SOEs. MNEs want to produce locally with the acquired SOEs as they provide a quick market entry method and encourage trade cost savings. Domestic firms do not need the acquired SOEs for production but are more 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.

3a. Data

Firm-level privatization data were obtained on ten Central and Eastern European countries from Zephyr and Orbis databases of the Bureau van Dijk Electronic Publishing[7]. The data include all SOEs which were privatized by direct sale to either foreign or domestic investor[8]. This method of privatization closely fits with the auction framework presented in the theoretical model where SOEs changed ownership only once directly from government to private. Zephyr is a merger and acquisition database that contains ownership information and financial information about the deals. Zephyr identified 419 privatization transactions between 1998 and 2006 that involved at least fifty percent of SOEs' assets sold directly to foreign or domestic investors. The new owners of SOEs became majority owners and controlled the future decision making of the SOEs. The 419 SOEs from Zepher were matched to the Orbis database. The Orbis database contains

historical balance sheets and income statements of firms. By combining the information from the two databases, a firms-level panel data with 3771 firm-year observations was created.

Identifying the operation status of each SOE after privatization has crucial for accurate analysis in this study. The data provided the status of each SOE as of 2006 in addition to pre- and post-privatization financial information. Out of 419 SOEs, 395 were listed as active and 24 were listed as either dissolved, in liquidation, or in bankruptcy. To determine the operation status of each SOE for years after 2006, a detailed search on all 419 former SOEs was conducted in February and March of 2008. The search was carried out using various country databases, news sources, and firm websites. The search identified 44 former SOEs that were shutdown as of March 2008. Out of the 24 SOEs listed either as dissolved, in liquidation, or in bankruptcy, 19 were shutdown after privatization. The other five either came out of bankruptcy or where joined in a merger with the buyer and remained operational.

From the search, the status of 55 SOEs remained uncertain so employment data was used to determine the operational status of these firms as in Mata and Portugal (1994), Mata, Portugal and Guimarães (1995) and Van Beveren (2006). These studies assumed that if employment fell to zero in a particular year, then the firm was considered shutdown. In this paper, this assumption was modified so that a SOE was deemed shutdown only if employment fell below ten employees in two consecutive years and if this reduction in employment constituted a 1000 percent decrease from previous employment levels. Using this method, an additional nine former SOEs were identified as being shutdown. In total, 53 former SOEs were shutdown within an average of 2.4 years after acquisition.

Table 1 summarizes shutdown statistics for the 419 former SOEs; out of the 419 privatized SOEs, 53 were shutdown and 366 remained operational. Out of 53 shutdown former SOEs, 40 were shutdown by domestic private acquirers and 13 were shutdown by foreign MNEs. Domestic private firms acquired 288 privatized SOEs and foreign MNEs acquired 131 SOEs. Calculating the ratio of shutdown SOEs to acquired SOEs for domestic private firms and MNEs, it is found that domestic private firms shutdown 14 percent of their acquired SOEs and foreign MNEs shutdown 10 percent of acquired SOEs. These statistics reveal that SOEs are shutdown more frequently by domestic investors. In the next section, an empirical model is outlined to formally analyze the probability of SOEs shutdown. Various controls are created to account for observable and unobservable firm and country characteristics.

(Insert Table 1)

3b. Empirical Model

A probit model is used 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:

$\Pr(ShutDown_i=1|X_i,\gamma)=\Phi(X_i'\gamma)$

where the dependant variable is

$$ShutDown_i = \begin{cases} 1 \; if \; firm \; i \; was \; shutdown \\ 0 \; if \; firm \; i \; is \; operational \end{cases}$$

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:

$$Foreign\ Ownership_i = \begin{cases} 1 \ \ if\ SOE\ is\ owned\ by\ foreign\ MNE \\ 0\ if\ SOE\ is\ owned\ by\ domestic\ firm \end{cases}$$

where i denotes a former SOE acquired either by domestic or foreign buyer.

One limitation of most privatization studies is the potential presence of sample selection bias in the data. This bias can arise as a result of governments privatizing better-performing firms or from privatizing better-performing firms' first[9]. Better-performing firms should have lower probability of shutdown. Therefore, if this type of bias is present and better-performing firms were privatized first, then it can be argued that shutdown rates would be higher among all privatized SOEs. However, the incentives for acquisition and shutdown should not be affected by this bias and outcomes of this study should not change.

Another limitation of the data is its failure to provide information on unsuccessful bidders for the SOEs. This is potentially problematic as it is possible that ownership was assigned in a non-random fashion to the SOEs. This can cause a problem of endogeneity for the *Foreign Ownership* variable, where *Foreign Ownership* is also a choice variable as firms non-randomly 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 (Bernard and Jensen, 2007; Görg and Strobl, 2003; Van Beveren, 2006; Bernard and Sjöholm, 2003) has shown that various firm characteristics can influence the probability of shutdown. Without controlling for SOEs characteristics, the impact of ownership on shutdown probability would be inaccurate. To account for individual SOEs characteristics, control variables for age, size, and productivity were constructed.

Productivity is measured by Total Factor Productivity (TFP) and is obtained by estimating Cobb-Douglas production function using method developed by Levinsohn and Petrin's (2003), which is discussed in the Appendix. In estimating productivity functions, unobservable productivity shocks can be correlated with firm inputs to production. To solve this problem, Levinsohn and Petrin (2003) use intermediate inputs, such as material costs in this case, to proxy for unobservable productivity shocks. TFP is obtained for each SOE for years 1998 to 2006 and is then averaged for the probit specification. Because SOEs are shutdown only once, and because they switch ownership only once, the probit estimation does not use the panel dimension of the data and as a result, all of the control variables are averaged across the row.

Age variable is used to control for the possibility that older SOEs have lower probability of shutdown since they have more operational know-how. Age is constructed using the original date of incorporation that is provided in the data for each SOE. There is also the possibility that larger SOEs have a greater chance to remain operational. To control for this, a log of total employment is used to proxy the size of each SOE as is done in a study by Bernard and Jensen (2007). Furthermore, a full set of country dummies is used to control for unobservable country characteristics and industry fixed effects at single digit are used to control industry differences.

After the probit model is estimated using the entire data set, the data are split into two subgroups to estimate the effects of productivity on the shutdown of SOEs owned by domestic and foreign firms. The first group consists only of SOEs acquired by domestic firms and the second group consists only of SOEs acquired by foreign MNEs. The same probit model is estimated where now the main variable of interest is productivity. This will show the importance of SOEs productivity to each of the acquirers post-privatization.

4. Results

Before reporting the estimation results, various summary statistics are provided. First, the differences in all the variables between the shutdown SOEs and operational SOEs are presented in Table 2. Productivity of shutdown SOEs is lower than productivity of operational SOEs, however, the difference is not significant. Shutdown SOEs are significantly smaller and older than operational SOEs. The difference in size is not surprising as larger SOEs should have more resources which allow them to remain operational for longer period of time.

(Insert Table 2)

There is a possibility that MNEs are selecting better-performing SOEs in privatization and consequentially are shutting down fewer SOEs as is shown in Table 1. To unearth any evidence for MNEs' ability to select better SOEs than domestic firms, differences between SOEs acquired by MNEs and SOEs acquired by domestic private firms are reported in Table 3. The evidence in Table 3 completely refutes the possibility that MNEs are better at selecting SOEs. Productivity for SOEs acquired by domestic private firms is higher, albeit not significantly. The table also shows no significant difference between the sizes of the SOEs; only age is different where SOEs

acquired by domestic firm are older. The two groups of SOEs are very similar and therefore, the rate at which they are shutdown should also be very similar.

(Insert Table 3)

The statistics in Table 2 and Table 3 report averages for each control variable using information from 1998 to 2006. However, the theory presented earlier focuses more on productivity of SOEs after privatization. To align the theory closer to the empirical work and as a robustness check, averages of the same control variables were created using only information after privatization. Summary statistics and estimation is redone using these new post-privatization control variables. Table 4 and Table 5 report the same statistics as in Table 2 and Table 3 except that the averages are only over post-privatization information. Using SOEs post-privatization information does not reveal new significant differences between operational SOEs and shutdown SOEs. Additionally, there are no new differences between SOEs acquired by foreign MNEs and SOEs acquired by domestic firms.

(Insert Table 4)

(Insert Table 5)

The main probit results are reported in Table 6, where the control variables are averaged over years 1998 to 2006 for each SOE. The dependent variable is the *Shutdown* dummy in each of the four columns and the main independent variable is the *Foreign Ownership* dummy. Table 6 provides marginal effects for the coefficients. Each column includes industry and country fixed effects and robust standard errors that were clustered at the firm level. Column I only includes the main independent variable of *Foreign Ownership* and each consecutive column adds one of the control variables for the SOEs. In all cases, the coefficient on the *Foreign Ownership* is

negative and significant. This result implies that foreign ownership reduces the probability of SOEs' shutdown by 7.3 to 15.4 percent whereas domestic ownership increases the probability of SOEs' shutdown by the same amount. In column I, where control variables are not included, SOEs' owned by MNEs have a 9.6 percent lower probability of shutdown compared to domestic ownership. Column II includes the coefficient on the productivity variable (which is not significant) yielding no change in the *Foreign Ownership* coefficient. In column III, *Size* coefficient is reported in addition to productivity. Adding *Size* does not change the sign and significance of *Foreign Ownership* but the coefficient on *Productivity* is now significant at 10 percent and negative. Results in column III imply that larger and more productive SOEs have a lower probability of shutdown. Finally, column IV reports the results where *Age* variable is included in estimation. Adding the *Age* variable does not change the sign and significance of *Foreign Ownership* or the other two control variables. The coefficient on *Age* is positive and significant which means that older SOEs have a higher probability to shutdown.

(Insert Table 6)

In Table 7, the same probit estimations are reported except the control variables are only averaged over the information after privatization. The coefficient on *Foreign Ownership* remains negative and significant at five percent in columns II to IV. The coefficients on *Size* and *Age* also retain the same sign and similar significance, whereas coefficients on *Productivity* lose their significance.

(Insert Table 7)

To further test the implications of Proposition 2 and the impact that SOEs productivity has on shutdown decision by both MNEs and domestic investors, the sample data are split into two sub-

samples. The first sub-sample includes SOEs acquired only by foreign MNEs and the second sub-sample includes SOEs acquired by domestic private firms. The same probit model is regressed on both sub-samples to show whether productivity of SOEs post-privatization differently affects the shutdown decision. The results are reported in Table 8 where again marginal effects are provided. For the group of SOEs acquired by MNEs, the coefficient on *Productivity* is negative and significant which means that increasing productivity reduces the probability of SOEs' shutdown. The significance on *Productivity* disappears when observing SOEs acquired by domestic private firms. These results show that productivity of SOEs impacts the probability of shutdown only for SOEs acquired by MNEs and not for SOEs acquired by domestic firms. Therefore, domestically acquired SOEs are shutdown for alternative reasons than productivity. This is potential evidence for the anti-competitive behavior of domestic private firms in privatization.

(Insert Table 8)

5. Conclusion

This paper investigates the integral role played by MNEs and domestic investors in the shutdown of SOEs. A model centering on the interaction between MNEs, domestic investors, and SOEs in transitional economies is developed and empirically tested. The partial-equilibrium model in oligopoly setting shows that MNEs can operate profitably with acquired SOEs. This profitability has a positive impact on the local economy as MNEs will help to increase the performance of the SOEs and will improve their long-term development. In this model, productivity of SOEs post-privatization is important for the assignment of ownership in the auction framework used to model the sale of SOEs. When productivity of SOEs under MNEs' ownership is expected to

increase, domestic acquisition can take place in the effort to prevent MNEs from entering the market with productive SOEs. This type of acquisition can lead to the shutdown of SOEs as SOEs are not acquired for their productive assets.

The predictions of the model are tested using novel firm-level privatization data from Central and Eastern Europe. The data show that foreign MNEs' acquisition of SOEs significantly reduces the probability of SOEs shutdown as compared to domestic acquisition. It also shows that although productivity of SOEs is important in reducing the probability of foreign acquired SOEs' shutdown, it is not important for domestically acquired SOEs. These general findings from the data closely align with the predictions of the model.

Governments entering the process of privatization should carefully examine incentives of potential acquirers before selling SOEs in the effort to prevent the shutdown of healthy SOEs. Acquiring firms not only consider productivity of SOEs and market share, but also the competition that ensues post-privatization. Knowing that domestic acquirers have anti-competitive motives and higher probability of shutting down SOEs should encourage governments to consider potential foreign acquisitions.

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

$(([\alpha+c_D-2c_Dt+2\theta-\lambda]^2)/(9\beta))>(([\alpha+c_D-2s-\lambda+2\rho_M]^2)/(9\beta))$

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

$(s-c_Mt)+\theta> \rho_M$.

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

$(([\alpha-2c_D+c_Mt-\theta+2\lambda]^2)/(9\beta))>(([\alpha-2s+c_Mt-\theta+2\rho_D]^2)/(9\beta))$

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

$(s-c_D)+\lambda>\rho_D$. ■

Proof of Lemma 1:

Without loss of generality, assume that $v_i>v_j$. Consider the possible equilibrium where firm i acquires asset k. Consider the equilibrium bid b^*, where $b_i^*>b_j^*$, $j\neq i$. If firm i wins asset k, then $b_i^*>v_i^*$ is a weakly dominated strategy, since no firm will post a bid over its maximum valuation of obtaining asset k. If $b_i^*<v_j^*$, then firm j benefits from deviating to $b_j^{**}=b_i^*+\varepsilon$, since it then obtains asset k and pays a price for asset k lower than its valuation for it. Finally, consider bid $b_i^*=v_j^*$, $b_j^*=v_j-\varepsilon$. Then, no firm has an incentive to deviate.

Furthermore, it can be shown that this is the only NE. Let firm j acquire 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 equilibrium.

Finally, if there is no reservation price at the auction, either firm i or firm j must acquire asset k.

■

Proof of Proposition 2:

Outcome 1. 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 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:

$$v_M=\pi_M(c_{Mo}^{*},c_{Do}^{*})-\pi_M(c_{Mo}^{*},c_{Do}^{*})= (([\alpha+c_D-2c_M t+2\theta-\lambda]^2)/(9\beta))-(([\alpha+c_D-2c_M t+2\theta-\lambda]^2)/(9\beta))= 0$$

$$v_D=\pi_D(c_{Mo}^{*},c_{Do}^{*})-\pi_D(c_{Mo}^{*},c_{Do}^{*})= (([\alpha-2c_D+c_M t-\theta+2\lambda]^2)/(9\beta))-(([\alpha-2c_D+c_M t-\theta+2\lambda]^2)/(9\beta))=0$$

Again, by Lemma 1, 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

$$v_M-v_D=0$$

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.

Outcome 2. 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:

$v_M=\pi_M(c_{Mo}^*,c_{Do}^*)-\pi_M(c_{Mo}^*,c_{Dk}^*)= (([\alpha+c_D-2c_Mt+2\theta-\lambda]^2)/(9\beta))-(([\alpha+s-2c_Mt+2\theta-\rho_D]^2)/(9\beta))= -(1/(9\beta))(s+\lambda-\rho_D-c_D)(s+4\theta+2\alpha-\lambda-\rho_D+c_D-4c_Mt).$

$v_D=\pi_D(c_{Mo}^*,c_{Dk}^*)-\pi_D(c_{Mo}^*,c_{Do}^*)= (([\alpha-2s+c_Mt-\theta+2\rho_D]^2)/(9\beta))-(([\alpha-2c_D+c_Mt-\theta+2\lambda]^2)/(9\beta)) = -(4/(9\beta))(s+\lambda-\rho_D-c_D)(\alpha-\theta-s+\lambda+\rho_D-c_D+c_Mt)$.

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

$v_M-v_D=(1/(9\beta))(s+\lambda-\rho_D-c_D)(2\alpha-8\theta-5s+5\lambda+5\rho_D-5c_D+8c_Mt)$

The first term in the equality is $(1/(9\beta))>0$. 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 $(2\alpha-8\theta-5s+5\lambda+5\rho_D-5c_D+8c_Mt)$. Defining the value of ρ_D^* as the level of productivity of firm D that will make $2\alpha-8\theta-5s+5\lambda-5c_D+8c_Mt+5\rho_D^*=0$, and simplifying

$\rho_D^*=((8\theta+5s+5c_D-5\lambda-8c_Mt-2\alpha)/5)$

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 $(2\alpha-8\theta-5s+5\lambda+5\rho_D-5c_D+8c_Mt)>0$ 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 $(2\alpha-8\theta-5s+5\lambda+5\rho_D-5c_D+8c_Mt)<0$ and $v_M-v_D>0$. Firm M wins the auction and pays acquisition price v_D.

Outcome 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:

$v_M=\pi_M(c_{Md}^*,c_{Do}^*)-\pi_M(c_{Mo}^*,c_{Do}^*)=$ $(([\alpha+c_D-2s-\lambda+2\rho_M]^2)/(9\beta))-(([\alpha+c_D-2c_Mt+2\theta-\lambda]^2)/(9\beta))=$ $-(4/(9\beta))(s+\theta-\rho_M-c_Mt)(\theta-s+\alpha-\lambda+\rho_M+c_D-c_Mt)$.

$v_D=\pi_D(c_{Mo}^*,c_{Do}^*)-\pi_D(c_{Mk}^*,c_{Do}^*)=$ $(([\alpha-2c_D+c_Mt-\theta+2\lambda]^2)/(9\beta))-(([\alpha-2c_D+s+2\lambda-\rho_M]^2)/(9\beta))=$ $-(1/(9\beta))(s+\theta-\rho_M-c_Mt)(s-\theta+2\alpha+4\lambda-\rho_M-4c_D+c_Mt)$.

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.

$v_M-v_D=$ $-(1/(9\beta))(s+\theta-\rho_M-c_Mt)(5\theta-5s+2\alpha-8\lambda+5\rho_M+8c_D-5c_Mt)$

The first term is $-(1/(9\beta))<0$. The second term $(s+\theta-\rho_M-c_Mt)<0$ 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 $(5\theta-5s+2\alpha-8\lambda+5\rho_M+8c_D-5c_Mt)$. Defining ρ_M^* as the value of firm M′s productivity that makes $5\theta-5s+2\alpha-8\lambda+8c_D-5c_Mt+5\rho_M^*=0$, and simplifying

$\rho_M^*=((5c_Mt+5s+8\lambda-8c_D-5\theta-2\alpha)/5)$

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

Outcome 4. If $(s-c_Mt)+\theta<\rho_M$ 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:

$v_M=\pi_M(c_{Mk}^*,c_{Do}^*)-\pi_M(c_{Mo}^*,c_{Dk}^*)=$ $(([\alpha+c_D-2s-\lambda+2\rho_M]^2)/(9\beta))-(([\alpha+s-2c_Mt+2\theta-\rho_D]^2)/(9\beta))=$ $-(1/(9\beta))(\rho_D-2\theta-\lambda-3s+2\rho_M+c_D+2c_Mt)(s-2\theta-2\alpha+\lambda+\rho_D-2\rho_M-c_D+2c_Mt)$.

$v_D=\pi_D(c_{Mo}^*,c_{Dk}^*)-\pi_D(c_{Mk}^*,c_{Do}^*)=$ $(([\alpha-2s+c_Mt-\theta+2\rho_D]^2)/(9\beta))-(([\alpha-2c_D+s+2\lambda-\rho_M]^2)/(9\beta))$ $= -(1/(9\beta))(2\rho_D-\theta-2\lambda-3s+\rho_M+2c_D+c_Mt)(s+\theta-2\alpha-2\lambda-2\rho_D+\rho_M+2c_D-c_Mt)$.

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.

$v_M-v_D=$ $-(1/(9\beta))(8s\theta-8s\lambda-10s\rho_D+10s\rho_M+5\theta^2-5\lambda^2+5\rho_D^2-5\rho_M^2 +5c_M^2t^2+8sc_D-5c_D^2+2\theta\alpha-2\alpha\lambda-8\theta\rho_D+2\alpha\rho_D-2\alpha\rho_M +8\lambda\rho_M+2\alpha c_D+10\lambda c_D-8\rho_Mc_D-8sc_Mt-10\theta c_Mt-2\alpha c_Mt+8\rho_Dc_M t)$.

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

$(((\rho_D)/(\rho_M)))^*=(((+5\rho_M-8\lambda+2\alpha+8c_D-10s))/((5\rho_D-8\theta+2\alpha+8c_Mt-10s))) +(((8s\lambda-8s\theta-5\theta^2+5\lambda^2-5c_M^2t^2-8sc_D+5c_D^2-2\theta\alpha))/(\rho_M(5\rho_D-8\theta+2\alpha+8c_Mt-10s))) +(((2\alpha\lambda-2\alpha c_D-10\lambda c_D+8sc_Mt+10\theta c_Mt+2\alpha c_Mt))/(\rho_M(5\rho_D-8\theta+2\alpha+8c_Mt-10s)))$

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

Estimating TFP using Levinsohn and Petrin (2003):

Panel dimension of the data is used to estimate the following Cobb-Douglas production function:

$$Y_{it} = A_{it}L_{it}^{\beta_l}K_{it}^{\beta_k}M_{it}^{\beta_m}$$

Taking logs, the production function becomes:

$$y_{it} = \beta_o + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it}$$

where y_{it} denotes revenue of each SOE at time *t*, l_{it} is labor, k_{it} is capital, and m_{it} is material costs. Total employment in each year is used as the measure of labor, and total assets are used as capital measure. 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. Productivity for each SOE is obtained by estimating coefficients on labor, capital, and materials and solving:

$$\varpi_{it} = y_{it} - \hat{\beta}_l \, l_{it} - \hat{\beta}_k \, k_{it} - \hat{\beta}_m \, m_{it}$$

For further details on this methodology see Levinsohn and Petrin (2003).

Notes

1. According to Galenson (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).
4. For one known exception see Norbäck and Persson (2004).

5. 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.
6. 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.
7. Countries include: Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Poland, Romania, Slovakia, Slovenia, and Ukraine.
8. There are other forms of privatization that governments used to dispose SOEs including sale to managers, employees, and voucher privatization.
9. For further discussion on sample selection bias in privatization studies see Megginson and Netter (2001), and Frydman et al. (1999).

References

Anderson, J., & van Wincoop, E. (2004). Trade Costs. *Journal of Economic Literature*, 42(3), 691-751.

Bernard, A. B., & Jensen, J. B. (2007). Firm Structure, Multinationals, and Manufacturing Plant Deaths. *The Review of Economics and Statistics*, 89(2), 193-204.

Bernard, A. B., & Sjöholm, F. (2003). Foreign Owners and Plant Survival. NBER Working Paper #10039.

Frydman, R., Gray, C., Hessel, M., & Rapaczynski, A. (1999). When does privatization work? The impact of private ownership on corporate performance in the transition economies. *The Quarterly Journal of Economics*, 114(4), 1153-1191.

Galenson, A. Economies in Transition: An OED Evaluation of World Bank Assistance. The International Bank for Reconstruction and Development/ The World Bank. Washington D.C. (2004).

Görg, H., & Strobl, E. (2003). *Footloose Multinationals?* The Manchester School, 71(1), 1-19.

Levinsohn, J., & Petrin, A. (2003a). Estimating Production Functions Using Inputs to Control for Unobservables. *Review of Economic Studies*, 70(2), 317-342.

Markusen, J.R. (1995). The boundaries of multinational enterprises and the theory of international trade. *Journal of Economic Perspective*, 9(2), 169-189.

Mata, J., & Portugal, P. (1994). Life duration of new firms. *The Journal of Industrial Economics*, 42(3), 227-245.

Mata, J., Portugal, P., & Guimarães, P. (1995). The survival of new plants: Start-up conditions and post-entry evolution. *International Journal of Industrial Organization* 13(4), 459-481.

Megginson, W. L., & Netter, J. M. (2001). From state to market: a survey of empirical studies on privatization. *Journal of Economic Literature*, 39(2), 321-389.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6), 1695-1725.

Norbäck, P-J., & Persson, L. (2004). Privatization and Foreign Competition. *Journal of International Economics*, 62(2), 409-416.

World Investment Report 2005: Transnational Corporations and the Internationalization of R&D. New York and Geneva: United Nations, United Nations.

Van Beveren, I. (2007). Footloose Multinationals in Belgium? Review of World Economics, 143(3), 483-507.

Tables

Table 1: Shutdown Statistics of SOEs by Ownership

	Domestic SOEs	Foreign SOEs	Total
Shutdown SOEs	40	13	**53 (13%)**
Operational SOEs	248	118	**366 (87%)**
Total	**288 (69%)**	**131 (31%)**	**419 (100%)**

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

Table 2: Comparison of Shutdown and Operational SOEs

	Shutdown SOEs	Operational SOEs	t-test
Productivity	0.8010	1.3393	1.19
Size	5.4296	5.9030	1.85*
Age	27.15	25.61	-0.20

Note: Mean of all values is give, where Productivity is tfp and Size is log of total employment. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 3: Comparison of Foreign acquired SOEs to Domestic acquired SOEs

	Foreign owned SOEs	Domestic owned SOEs	t-test
Productivity	0.7977	1.4838	1.17
Size	5.9030	5.8160	-0.42
Age	21.79	27.71	1.97**

Note: Mean of all values is give, where Productivity is tfp and Size is log of total employment. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 4: Comparison of Shutdown and Operational SOEs with post privatization means

	Shutdown SOEs	Operational SOEs	t-test
Productivity	0.5609	0.7931	1.46
Size	5.3484	5.7276	1.21
Age	29.63	27.67	-0.25

Note: Mean of all values is give, where Productivity is tfp and Size is log of total employment. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 5: Comparison of Foreign acquired SOEs to Domestic acquired SOEs with post privatization means

	Foreign owned SOEs	Domestic owned SOEs	t-test
Productivity	0.6610	0.8154	1.08
Size	5.7578	5.6458	-0.49
Age	23.61	29.84	1.95*

Note: Mean of all values is give, where Productivity is tfp and Size is log of total employment. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 6: Probit Estimation

	$ShutDown_i$			
	I	**II**	**III**	**IV**
Foreign Ownership	-0.0964***	-0.0943***	-0.0732***	-0.1543**
	(0.02954)	(0.0294)	(0.0251)	(0.0496)
Productivity		-0.0069	-0.01759*	-0.0318*
		(0.0088)	(0.0091)	(0.0192)
Size			-0.0271***	-0.0680***
			(0.0088)	(0.0189)
Age				0.0012*
				(0.0007)
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Pseudo R2	0.29	0.28	0.32	0.31
Observations	353	351	351	200

Note: Probit estimation in all four columns where coefficients provide marginal effects. Productivity is measured as tfp and Size is log of total employment. Standard errors in parenthesis are clustered at the firm level and are robust. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 7: Probit Estimation where control variables are post privatization averages

	ShutDown$_i$			
	I	**II**	**III**	**IV**
Foreign	-0.0964***	-0.0772**	-0.0649**	-0.1577**
Ownership	(0.02954)	(0.0311)	(0.0279)	(0.0623)
Productivity		-0.0126	-0.0264	0.0366
		(0.0130)	(0.0200)	(0.0333)
Size			-0.0250***	-0.0545**
			(0.0101)	(0.0215)
Age				0.0014**
				(0.0007)
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Pseudo R2	0.29	0.25	0.28	0.27
Observations	353	271	271	157

Note: Probit estimation in all four columns where coefficients provide marginal effects. Productivity is measured as tfp and Size is log of total employment. Standard errors in parenthesis are clustered at the firm level and are robust. *Significant at 10%, **Significant at 5%, Significant at 1%

Table 8: Probit Estimation for Foreign Owned SOEs and Domestic Owned SOEs

	Sub-Sample of Foreign Owned SOEs: ShutDown$_i$			*Sub-Sample of Domestic Owned SOEs: ShutDown*$_i$		
	I	**II**	**III**	**IV**	**V**	**VI**
Productivity	-0.1011***	-0.1156***	-0.0689*	-0.0057	-0.0139	-0.0452
	(0.0408)	(0.0410)	(0.0369)	(0.0100)	(0.0091)	(0.0344)
Size		-0.0262**	-0.0207**		-0.0216***	-0.0621*
		(0.0125)	(0.0154)		(0.0113)	(0.0378)
Age			0.0021**			0.0014
			(0.0017)			(0.0010)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.14	0.20	0.32	0.43	0.45	0.53
Observations	86	86	67	240	240	106

Note: Probit estimation in all four columns where coefficients provide marginal effects. Productivity is measured as tfp and Size is log of total employment. Standard errors in parenthesis are clustered at the firm level and are robust. *Significant at 10%, **Significant at 5%, Significant at 1%

Figures

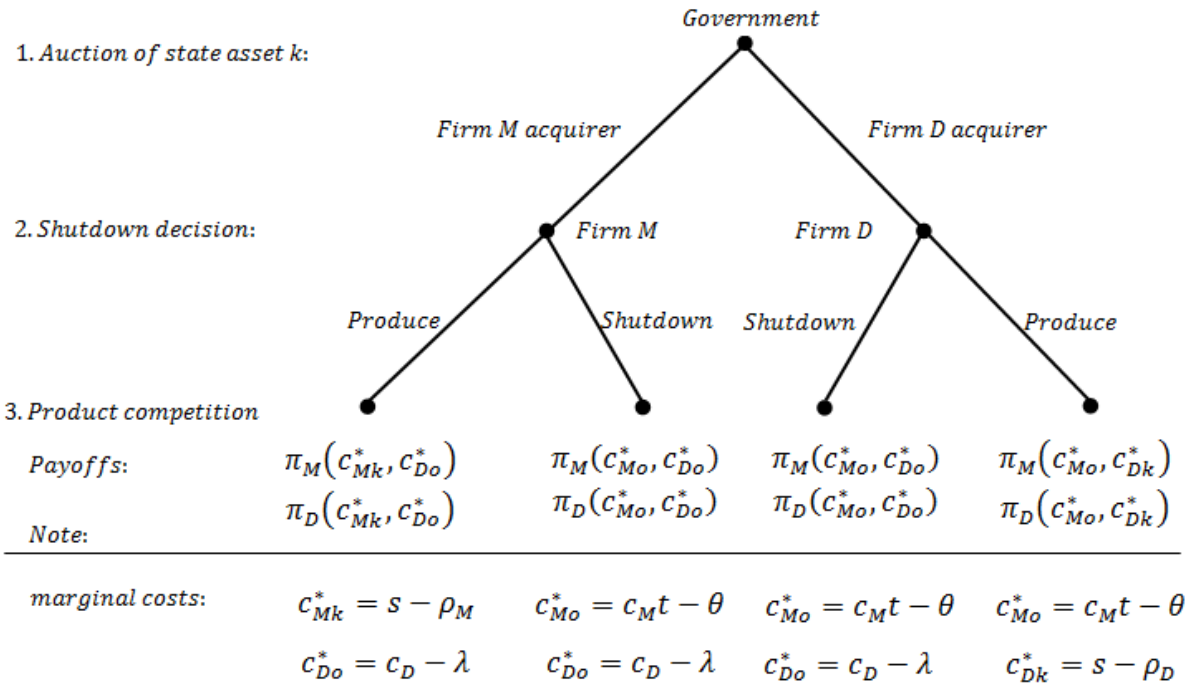

Figure 1: Three stage game

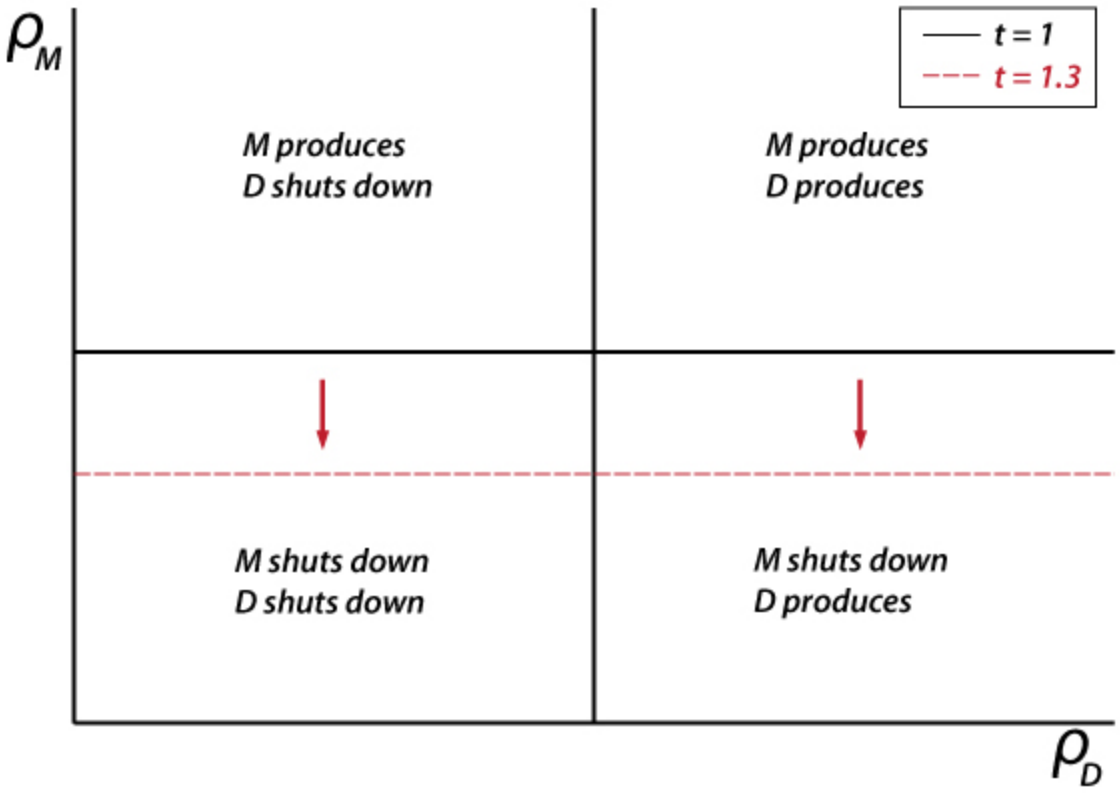

Figure 2: The decision to shutdown for each firm displayed in the productivity space ρ_M and ρ_D of asset k. Other parameters are set as follows: $\alpha=\beta=1$, $c_D=c_M=0.2$, $\theta=\lambda=0.3$, $t=1$, and $s=0.2$.

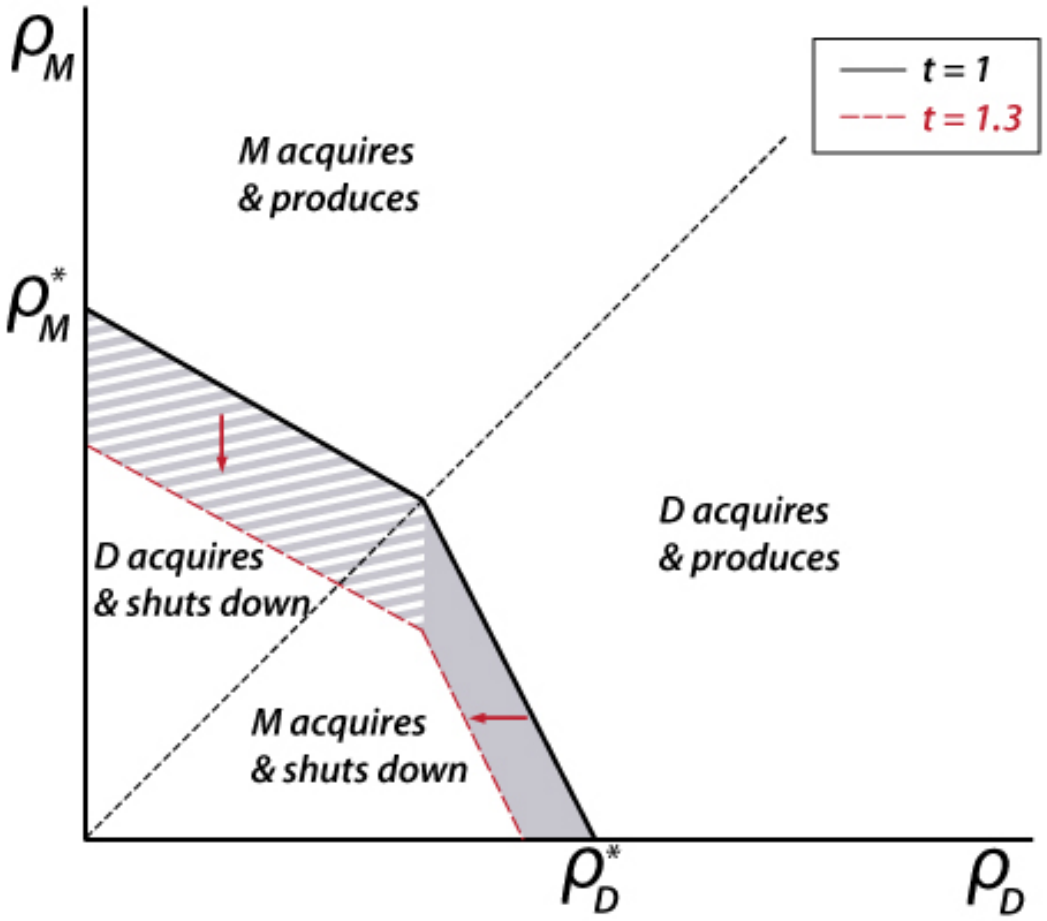

Figure 3: The equilibrium acquirer of asset k and the shutdown decision displayed in the productivity space ρ_M and ρ_D of asset k. Other parameters are set as follows: $\alpha=\beta=1$, $c_D=c_M=0.2$, $\theta=\lambda=0.3$, $t=1$, and $s=0.2$.