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Survival of the Fittest: Corporate Control and the Cleansing Effect of Financial Crises*

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Abstract

How does the market for corporate control reallocate firm ownership in response to adverse aggregate financial shocks? To answer this question, we develop a tractable model of mergers and acquisitions (M&As) where firms facing different degrees of financial constraints acquire ownership of illiquid domestic firms. We show that acquisitions by financially constrained acquirers, on average, involve higher ownership stakes and post-acquisition survival rates when faced with adverse aggregate financial shocks, in comparison to acquisitions by unconstrained firms. This effect operates through two margins: An intensive margin (dominant for constrained acquirers) that works through a higher average productivity of acquirer-target matches, and an extensive margin (dominant for unconstrained acquirers) that operates thorough an increase in the proportion of fire-sale acquisitions in the economy. We provide evidence supportive of the predictions of the model in a large data set of M&As in emerging market economies. Our theoretical results provide insight into our novel empirical findings of a change in the degree of control acquired by and a convergence of survival rates between domestic and foreign acquisitions during financial crises, and point to the existence of a "cleansing effect" in the market for corporate assets.

Keywords: cleansing effect; financial crisis; financial shocks; cross-border mergers and acquisitions; capital reallocation.
JEL Codes: F21, G01, G34.

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1 Introduction

Since Joseph Schumpeter's classic work (Schumpeter, 1942) on competition, innovation and growth in modern economies, a large literature has evolved investigating the so-called cleansing effect of recessions. Described simply, the cleansing effect works by forcing the exit of the least productive firms and reallocating resources to the most productive ones, thereby raising the average productivity of the aggregate economy. In this paper we develop a simple analytical framework to explore a channel of reallocation of resources that has received less attention in the literature, that which is achieved by the process of mergers and acquisitions (M&A). In particular we ask if there is an analogous cleansing effect of aggregate negative *financial* shocks in the market for corporate control that raises the average productivity of matches that take place between acquiring and target firms.[1]

To answer this question, we build a simple partial equilibrium model of M&As where both acquiring and target firms face borrowing constraints. The borrowing constraints, which are tighter for smaller firms, make it harder for constrained firms to pay upfront fixed costs and make them more likely to exit. Other firms with more financial resources can step in and buy them and thus prevent inefficient liquidation. However these acquiring firms themselves have to raise funds to finance their acquisition if their internal resources are not sufficient for the purpose. Target firms that would not be viable by themselves are acquired if they are sufficiently productive, and exit otherwise. We label the former as "fire-sale" acquisitions since these are distressed assets whose value to a new owner capable of paying the fixed cost exceeds their valuation in the eyes of the current owners. "Technology-driven" acquisitions, on the other hand, involve those target firms that would be viable by themselves, but for which an acquisition brings productivity gains due to operational synergies. Fire-sale acquisitions are on average less productive than technology-driven ones because part of the surplus in these acquisitions is driven by the relaxing of borrowing constraints. Less productive acquirers also acquire smaller controlling stakes in target firms because of variable acquisition costs. In this setup, we analyze the consequences of a negative aggregate financial shock that tightens the borrowing constraints of all firm in the economy, including potential acquirers.

We first consider the simpler case of acquiring firms that are unconstrained under all circumstances. To fix ideas, we can think of these as foreign firms based in markets that have not faced the financial shock, and are active in the global market for corporate control. These could also be very large domestic firms that have enough internal funds of their own. The shock raises the share of fire-sale acquisitions (i.e., firms that would otherwise have gone bankrupt) in the total number of acquisitions they undertake, as a larger proportion of potential target firms find themselves unable to raise enough external debt financing to cover fixed expenses. Since fire-sale acquisitions correspond to lower values of productivity than technology-driven acquisitions, this lowers the average long-

[1] Our focus on financial shocks instead of technology shocks is motivated by recent work that demonstrates the importance of financial liquidity as a driver of M&A. Some recent papers are Almeida et al. (2011), Erel et al. (2014) and Alquist et al. (2015b). It would be straightforward to analyze the effects of aggregate technology shocks in our framework.

term productivity of the acquisitions made by unconstrained acquirers. We derive analytical results about this extensive margin, which refers to the change in the composition of acquisitions between fire-sale and technology-driven, and show that it unambiguously lowers the average productivity of the acquisitions completed by unconstrained acquirers during financial crisis episodes.[2]

While a negative financial shock can increase the mass of fire-sale acquisitions performed by constrained acquirers as well, thereby lowering the average productivity of their acquisitions, there are two additional forces in their case that tend to work in the opposite direction. These are driven by the joint borrowing constraint of the acquirer-target entity. First, the tightening of aggregate borrowing conditions reduces the ability of constrained acquirers to raise funding. This reduces their ability to complete acquisitions and tends to counteract the effect of an increase in the pool of distressed potential target firms. Thus the overall extensive margin in the case of constrained acquirers may move either way. Second, it makes fewer low-quality technology-driven acquisitions feasible: Since the joint borrowing constraint of the acquiring-target entity depends on the size and productivity of the acquirer, a credit crunch leaves only the most productive acquirers being able to raise enough resources to finance acquisitions. This is an intensive margin that raises the average productivity of acquisitions.

In order to quantitatively evaluate the net effect of these two margins, we calibrate the model to match three key features of the data – the average share acquired, the fraction of full acquisitions, and the observed size difference of domestic acquirers and their target – and then simulate a tightening of the borrowing constraint for all firms in the economy. We find that the intensive margin dominates in the case of constrained acquirers, so that the average productivity of acquisitions rises in the aftermath of an adverse aggregate financial shock. This is a central insight of our analysis: The average productivity of acquisitions completed by constrained acquirers improves during financial crises. If the financially constrained firms be interpreted as domestic firms in crisis-hit economies, then our analysis suggests that acquisitions completed by domestic firms during financial crisis are more productive on average, in contrast to unconstrained acquirers (foreign firms). This is, there is a "cleansing effect" in the market for corporate control, whereby aggregate financial shocks raises the average productivity of completed acquisitions among the group of domestic acquiring firms.

The model suggests that there are two observable implications of this cleansing effect. The first is that the share of equity acquired by domestic (constrained) acquirers should rise during financial crises, while the opposite should be true for foreign (unconstrained) acquirers. Second, to the extent that the rate of divestitures of acquisitions is weakly lower for foreign acquisitions during normal times (which, as we show later is a feature of the data), the higher average productivity

[2] This result is similar to Alquist et al. (2015a) who emphasize the industry composition of acquisitions. In their model matches between firms in the same industry are more productive and financial crises lead to more inter-industry acquisitions. Our approach in this paper is more general in that we do not assume any particular industry patterns in the gains from acquisitions. In addition, Alquist et al. (2015a) only model the decision of an unconstrained foreign acquiring firm since their focus is on foreign direct investment.

of domestic acquisitions during crisis should lead to a convergence in divestiture rates between foreign and domestic acquisitions for the crisis cohort. We test these predictions using data for about 30,000 foreign and domestic M&As for sixteen of the largest markets for corporate control in emerging economies between 1990 and 2007 from the Thompson-Reuters SDC database. We focus on emerging markets because we expect domestic firms there to conform more closely to the constrained firms of the model. Due to the structure of our hypotheses, which involve comparisons of two kinds of acquisitions (relatively financially constrained and unconstrained acquisitions, proxied by those made by domestic and foreign acquiring firms, respectively), across two macroeconomic regimes (normal and adverse financial shock, the latter proxied by country-specific banking crises), we employ a difference-in-difference approach. Using linear regressions and survival analysis techniques, we find evidence in favor of the main predictions of the model. In particular, we find that domestic acquisitions during crisis involve significantly higher stakes, in contrast to foreign acquisitions. The survival rates of foreign acquisitions during normal times is found to be higher than domestic ones. However, the survival rates of domestic acquisitions are significantly higher for the cohort of crisis-time acquisitions, which implies a convergence in the divestiture rates of foreign and domestic acquisitions.

Our paper is related to two broad strands of literature in macroeconomics and finance. The first concerns the cleansing effect of recessions and capital reallocation over the business cycle. This literature has explored several mechanisms in connection with the cleansing effect, related to labor markets (Caballero and Hammour, 1996), entrepreneurial credit constraints (Holtz-Eakin et al., 1994), and the contribution of new producers' productivity advantages and entry (Foster et al., 2008). Here, the closest paper to ours is Osotimehin and Pappadà (2015), who look at how credit constraints influence the cleansing effect of recessions in a theoretical model of firm dynamics. They find that the intensity of the cleansing effect is lower in the presence of credit frictions, especially when the recession is driven by a financial shock. The exit decision of firms in their model depends not only on their productivity but also their net worth, and hence some firms that are productive yet financially distressed exit the market while some low productivity firms do not. Eisfeldt and Rampini (2006) explore the procyclicality of capital reallocation among firms, and the apparent countercyclicality of the benefits from reallocation. Their analysis suggests that the cost of capital reallocation needs be strongly countercyclical to rationalize the observed joint cyclical properties of reallocation and productivity dispersion. In a similar vein, Cui (2014) develops a dynamic general equilibrium model where partial capital irreversibility generates delays in capital reallocation during periods when credit conditions are tighter and lowers aggregate productivity. Thus there is a large literature that puts forward various channels that either strengthen or weaken the basic mechanism of the aggregate cleansing effect. While our paper is silent about the cleansing effect for the overall economy, there are echoes of both arguments in our model. On the one hand, some less productive firms are saved from exit by being acquired, which might weaken the overall cleansing effect. On the other hand, the average productivity of the post-acquisition entities are higher after financial shocks compared to normal periods, which would work in favor of the aggregate cleansing effect.

Our paper is also related to a more recent literature on mergers and acquisitions. Almeida et al. (2011) present a model in which financially distressed firms merge with more liquid firms in their own industry. Their paper studies the optimal financial policies of firms when the primary motivation of mergers is to reallocate financial resources to firms that may otherwise be inefficiently terminated. In related work, Erel et al. (2014) provide evidence that both foreign and domestic acquisitions ease financial frictions in target firms in a large sample of European acquisitions. They find that the investment levels of the target firms increase significantly following an acquisition. These findings are consistent with our assumption that part of the gains from acquisitions arise out of acquirers relaxing the borrowing constraints of the targets. Other recent papers such as Chari et al. (2010) and Wang and Wang (2015) also document similar financial gains from acquisitions. The paper most similar to ours in this literature is Alquist et al. (2015a), who look at fire-sale foreign direct investment in a model where *all* target firms are credit constrained and *all* acquiring firms are unconstrained. In contrast to that paper, we develop here a more general yet tractable framework where constrained (domestic) and unconstrained (foreign) acquisitions can be analyzed simultaneously. We also distinguish between the long term productivity of firms, and temporary shocks to their productivity or liquidity, and analyze the interplay of these two factors.[3] In addition, our empirical analysis focusses on comparisons between domestic and foreign acquisitions across crisis and normal times. Our main results, an increase in the degree of control acquired by domestic firms and a convergence of survival rates between domestic and foreign acquisitions, are also novel.

The rest of the paper is organized as follows. Section 2 lays out a theoretical model of M&A, and derives some testable hypotheses that we take to the data in Section 3. Section 4 concludes.

2 Model

This section presents a simple model of the M&A process where both liquid and illiquid firms can become targets of acquisitions. They can also acquire other firms themselves if they have enough resources. The severity of a firm's financial constraint is allowed to vary in a continuum. The main comparative static we consider is an aggregate financial shock to the economy (a financial crisis), when ownership of assets gets reallocated to domestic firms that have financial resources beyond their own investment needs, or firms from a foreign market that remains unaffected by the financial shock.

[3]Earlier research (see Aguiar and Gopinath, 2005; Acharya et al., 2011) has focussed on the surge of foreign acquisitions and a concurrent decline in domestic acquisitions and portfolio investment during crisis episodes in emerging economies, as well the relationship between acquisition prices and firm liquidity.

2.1 Model Setup

2.1.1 Potential Target Firms

The benchmark model has two periods and a continuum of firms. A firm has ϵA in profits at the end of the first period. ϵ, the profit margin, is a random variable with finite support and mean 1, and is i.i.d. across firms and time. Importantly, ϵ is independent of A and constitutes a temporary shock, whereas A can be thought of as baseline (long-term) productivity. Since a low (high) realization of ϵ means that the firm has fewer (more) internal resources in the first period, we also refer to it as "liquidity". To produce in period two, the firm has to pay an upfront cost bA. Expected output next period is A, with $b < 1$ such that the firm prefers production to non-production. Firms differ in terms of A. A also proxies for the size of the firm and the costs of production are assumed to be proportional to the size. Following an established literature on heterogeneous firms in international trade that demonstrates the correlation between productivity and firm size, we use the terms "size" and "productivity" interchangeably in what follows. With $E(\epsilon) = 1$, next period's expected profits net of costs are $A(1 - b)$.

To pay for the upfront cost bA, the firm is limited by a collateral constraint $bA \leq \tau(A)\epsilon A$, where $\tau(A)$ measures the degree of credit frictions that depends on the firm's size A. In an economy without credit frictions, $\tau = +\infty$, whereas $\tau = 1$ implies financial autarky and firms cannot borrow to pay for the upfront costs.[4] We refer to τ as a firm's maximum leverage ratio.[5] The form of the collateral constraint captures a common prediction from models of limited contract enforcement: The amount of credit is limit by the borrower's wealth (see Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Buera et al., 2011, for example). If profits are large enough or the line of financing generous enough, the firm pays for the upfront cost to produce in the next period. That is the case if $\epsilon \geq \frac{b}{\tau}$. Otherwise, it exits the market or is acquired by another firm. Market exit of this kind can be interpreted as inefficient liquidation of the firm since the firm would always prefer production to non-production in the second period. We allow τ to depend on a firm's size A with $\tau'(A) \geq 0$. If $\tau'(A) = 0$, a firm's size A does not enter the constraint. On the one hand, the value of larger firms is higher, thereby relaxing the constraint. On the other hand, larger firms require higher upfront costs. If $\tau'(A) = 0$, these two effects cancel out. If $\tau'(A) > 0$, smaller firms face tighter constraints, a common empirical finding.[6]

[4] For reasons that will be clear later, we will restrict τ to be in the range $(\frac{b}{\bar{\epsilon}}, \frac{b}{\underline{\epsilon}})$.

[5] The leverage ratio typically refers to total liabilities over total assets. We deviate from this definition by calling the ratio of total liabilities to total equity the leverage ratio. Also, in our two-period model, all liabilities are current.

[6] Gertler and Gilchrist (1994) choose firm size as a proxy for capital market access in their analysis of firm performance over the business cycle in the US. Smaller firms are more likely to seek finance through bank debt rather than by issuing commercial papers. Beck et al. (2005) analyze responses to the World Business Environment Survey from over 4,000 firms in 54 mostly developing countries. They find that smaller firms are the most financially constrained: Managers of smaller firms rank the severity of financial constraints by 0.7 higher than managers of larger firms (see table III), with the ranking ranging from 1 (no obstacle) to 4 (major obstacle). They further find evidence that the disadvantage of smaller firms is larger in countries with less developed financial markets, as measured by domestic bank credit to the private sector divided by GDP (see table VIII).

The total value of the stand-alone firm that is a potential target for an acquisition is

$$V_{tar} = \begin{cases} \epsilon A & \text{if} \quad \underline{\epsilon} \leq \epsilon < \frac{b}{\tau} \\ \epsilon A + E(\epsilon')A(1-b) = \epsilon A + A(1-b) & \text{if} \quad \frac{b}{\tau} \leq \epsilon \leq \overline{\epsilon}. \end{cases} \tag{2.1}$$

The first case is for a financially constrained firm that cannot pay or finance the upfront cost and hence cannot produce in the second period. These firms either exit the market after the first period, or become targets of acquisitions under certain conditions to be discussed shortly. If a firm's temporary productivity ϵ is high enough, it can produce in the second period, which raises its value. So there is a discrete jump in the firm's value at $\epsilon = \frac{b}{\tau}$.[7] These firms can stay in the market as stand-alone entities, or can be targets of acquisitions.

2.1.2 Financially Unconstrained Acquirers

The firm described above can be acquired by another firm. To build intuition we first analyze the case of an acquiring firm that is not financially constrained. An unconstrained acquirer faces $\tau = +\infty$.[8] We assume for now that target firms and potential acquirers of the same size A are randomly matched.[9] We relax this assumption when analyzing the problem of a financially constrained acquirer.[10] The acquirer and target can differ in their realization of ϵ.

When a firm acquires a target, the productivity of the target increases by a factor ϕ while the acquirer incurs a cost c. The precise form of ϕ and c, which depend of the degree of ownership acquired, are specified and discussed later. The value of an acquired target firm to an unconstrained acquirer is then

$$V_{acq} = (\epsilon - b + \phi)A - c. \tag{2.2}$$

The surplus of such an acquisition is the difference between the value of the acquired firm after and

[7]The discrete jump is due to the fixed cost. In a model with capital where period two investment costs are determined by productivity, V^d would be a continuous function of ϵ. We abstract from capital as an input for simplicity.

[8]We can think of an unconstrained firm as being from a market that is either much more financially developed, or not facing the same kind of financial shocks as the country where the target firm is located.

[9]Rhodes-Kropf and Robinson (2008) find evidence of assortative matching based on firm valuations among acquisitions in the US. Specifically, they find that on average, acquiring firms and their targets are less than a decile apart in market-to-book valuation. Thus, they characterize most transactions as "like buys like". This can be seen as close to the spirit of our model, where firm valuations are a function of both the temporary and permanent components of productivity. If firm valuations are mainly driven by long term productivity (A in our model), with small deviations due to temporary shocks (ϵ), our assumption of matches between firms of the same A would yield valuations consistent with the empirical evidence of these authors. As noted, we relax this assumption later.

[10]The size of the acquiring firm is irrelevant when $\tau = +\infty$. However, when $\tau'(A) > 0$ the size of the acquiring firm is important since very large firms are effectively unconstrained.

before the acquisition, i.e. $V_{acq} - V_{tar}$:[11]

$$S = \begin{cases} S^{cons} = (-b + \phi)A - c & \text{if } \ \underline{\epsilon} \leq \epsilon < \frac{b}{\tau} \\ S^{uncons} = (-1 + \phi)A - c & \text{if } \ \frac{b}{\tau} \leq \epsilon \leq \overline{\epsilon}. \end{cases} \tag{2.3}$$

The first case corresponds to the acquisition of a constrained *target* firm that would have otherwise exited the market. The second case corresponds to the acquisition of an unconstrained target firm that is viable on its own. An acquisition takes place if the surplus generated by such a match is positive.

Figure 1 shows the zero-surplus line $S = 0$ as a function of the permanent productivity A (of both acquirer and target since they are the same by assumption) and the target firm's temporary productivity ϵ. We denote the permanent productivity levels A that solve $S^{cons} = 0$ and $S^{uncons} = 0$ by A^{fire} and A^{tech}:

$$A^{fire} = \frac{c}{\phi - b} \tag{2.4}$$

$$A^{tech} = \frac{c}{\phi - 1}, \tag{2.5}$$

with $A^{tech} > A^{fire}$ because $b < 1$.[12] If two firms of size $A \geq A^{tech}$ are matched, an acquisition always takes place because the benefits from the resulting technological synergies always exceed the acquisition costs. This is true irrespective of the target firm's current productivity ϵ and the tightness of the collateral constraint. If two firms of size $A^{fire} \leq A < A^{tech}$ are matched, technological synergies are not sufficient to make an acquisition profitable. However, if the target firm is constrained (i.e. $\epsilon < \frac{b}{\tau}$), an acquisition generates benefits from both technological synergies and from relaxing the collateral constraint and is therefore profitable. If two firms with productivity $A < A^{fire}$ are matched, an acquisition never takes place. We refer to acquisitions of firms with productivity $A \geq A^{tech}$ as "technology-driven" acquisitions and acquisitions of firms with productivity $A^{fire} \leq A < A^{tech}$ as "fire-sale" acquisitions because the latter only take place if the target firm is borrowing constrained.[13] Figure 1 also shows the line describing the constraint, $\frac{b}{\tau(A)}$. Firms with A, ϵ combinations to the left of the constraint line cannot pay for the upfront cost and either have to exit the market or become targets of an acquisition. In the figure, we assume $\tau'(A) > 0$, that is larger firms face looser borrowing constraints, and the constraint line has a finite negative

[11] $S^{cons} = V_{acq} - V^d = (\epsilon - b + \phi)A - c - \epsilon A = (-b + \phi)A - c$, and $S^{uncons} = V_{acq} - V^d = (\epsilon - b + \phi)A - c - \epsilon A - A(1 - b) = (-1 + \phi)A - c$.

[12] As will be apparent later, these definitions of A^{fire} and A^{tech} are implicit definitions because ϕ is a function of the acquired share, which, in turn, is a function of A. See equation (2.7).

[13] The set of technology-driven acquisitions contains target firms that are constrained and would exit the market if they were not acquired. An alternative definition could assign those firms to the set of fire-sale acquisitions. Our current definition, however, turns out to be more convenient when conducting comparative statics for changes in the collateral constraint.

slope. For $\tau'(A) = 0$, the constraint line would be vertical.[14]

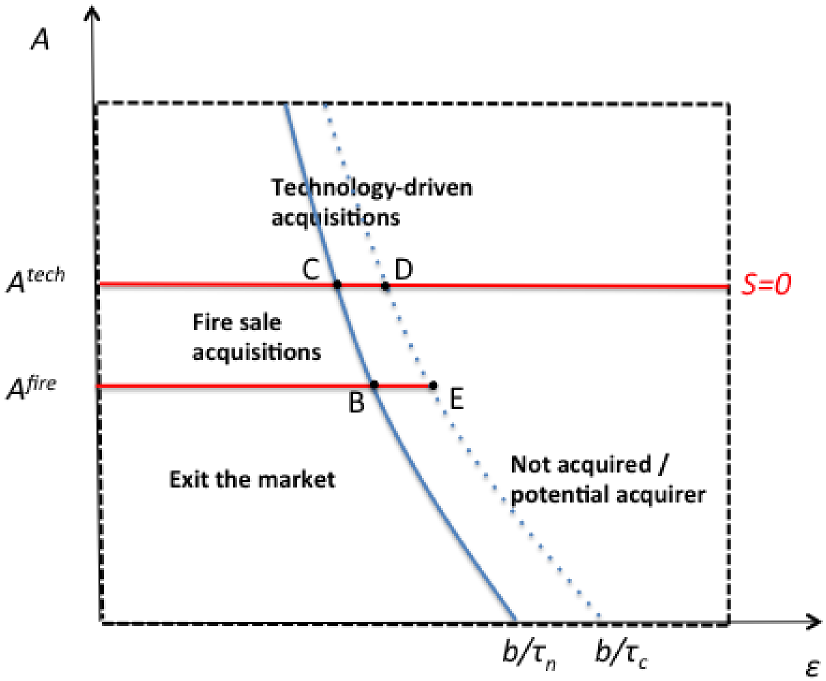

Figure 1: Acquisitions with Unconstrained Acquirers

Notes: Combinations of A (acquirer and target permanent productivity/size) and ϵ (target firm's temporary productivity/liquidity) for which $S^{tech} = 0$ and $S^{fire} = 0$, with A on vertical axis and ϵ on horizonal axis. Areas above the $S = 0$ lines show regions where each type of acquisition generates surplus. Also shows the maximum value for the target's current productivity, ϵ, that makes fire-sale acquisitions profitable during normal and crisis periods. The subscript on the τ indicates (n)ormal or (c)risis periods. See text for more details.

Let G denote the distribution associated with the target firms' temporary productivity ϵ. Under our assumption of equal A for targets and acquirers, the random variable A describes both the size of the target firm and the acquirer and its distribution is F^*. The * superscript indicates that we consider unconstrained acquirers. Lower and upper bars on random variables indicate their lower and upper bounds. Then the mass of fire-sale and technology-driven acquisitions are respectively $n^{fire*} \equiv \int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{\frac{b}{\tau}} dGdF^*$ and $n^{tech*} \equiv \int_{A^{tech}}^{\bar{A}} dF^*$. They correspond to the relevant areas in Figure 1, where the bounds $\underline{A}$, $\bar{A}$, $\underline{\epsilon}$, and $\bar{\epsilon}$ have been left out to avoid cluttering the diagram.

An aggregate financial shock to the economy is modeled as a decrease in τ from τ_n to τ_c, and a concurrent increase in the level of ϵ needed to be able to pay the upfront cost from $\frac{b}{\tau_n}$ to $\frac{b}{\tau_c}$. The

[14]The constraint in the (A, ϵ) plane is negatively sloped ($\frac{dA}{d\epsilon} = -\frac{\tau(A)^2}{b\tau'(A)} < 0$) when $\tau'(A) > 0$ and vertical when $\tau'(A) = 0$.

shock increases the share of fire-sale acquisitions as a larger proportion of potential target firms find themselves unable to raise enough external debt financing to cover the upfront cost of operating in the second period, and thus face liquidation. In Figure 1 this increase is the region $\overline{BCDE}$ in the centre bounded by A^{tech} to A^{fire} on the vertical axis, and $\frac{b}{\tau_n(A)}$ to $\frac{b}{\tau_c(A)}$ on the horizontal axis. In terms of the masses of fire-sale and technology-driven acquisitions defined above, note that n^{fire^*} goes up because of the increase in the upper limit of the integral from $\frac{b}{\tau_n}$ to $\frac{b}{\tau_c}$, while the n^{tech^*} remains unchanged since all targets above A^{tech} can still be acquired by unconstrained acquirers.

2.1.3 Financially Constrained Acquirers

We now analyze the case of acquirers that are similar to target firms in that they face borrowing constraints, which reduces their ability to perform acquisitions. We depart from the equal size assumption imposed in the previous section and let $A_{acq} = kA$, with $k \geq 1$. This gives us the flexibility to capture the empirical feature that acquirers are invariably much larger than their targets.[15] The case of $k > 1$ is also of interest because borrowing constraints depend on firm size in our model, and thus the size difference between acquirers and their target could be crucial. For example, if $k >> 1$, then the borrowing constraint of the acquiring firm may be non-binding and it would effectively behave as if it were unconstrained. The proportional-size assumption simplifies our exposition considerably. We later calibrate k to the actually observed size difference between domestic acquirers and targets.

In contrast to the proportional-size assumption, we allow acquirers and targets to freely differ in their first-period profits. Since the acquirer as well as the target are now financially constrained, we need to keep track of both their collateral constraints. Let ϵ_{acq} denote the temporary productivity of a constrained acquirer. Then, such an acquisition takes place if the following three conditions are met: i) it generates positive surplus, i.e., $A \geq A^{tech}$ for technology-driven domestic acquisitions and $A^{fire} \leq A < A^{tech}$ for fire-sale acquisitions; ii) the acquiring firm has sufficient collateral so as not to be constrained, i.e., $\epsilon_{acq} > \frac{b}{\tau}$; and iii) both firms together have enough current resources to pay for their upfront costs. The post-acquisition entity's (i.e., the two firms' combined) collateral constraint states that total upfront costs for the target and acquiring firm, $bA + bA_{acq} = b(1+k)A$, cannot exceed a fraction τ of the total current assets of the two firms: $\epsilon A + \epsilon_{acq} A_{acq} = (\epsilon + \epsilon_{acq} k)A$.[16] This condition can be solved for the target firm's temporary productivity:

$$\begin{aligned} b(1+k)A &\leq \tau(\epsilon + \epsilon_{acq}k)A \\ \epsilon &\geq \frac{b(1+k)}{\tau} - \epsilon_{acq}k \equiv \epsilon^l(\epsilon_{acq}, \tau) \end{aligned} \tag{2.6}$$

[15]More specifically, a simple linear regression of the size of an acquirer on the size of its target, both measured by the logarithm of their assets, gives the following slope and intercept estimates, both significant at 1%: log(acquirer assets)= 3.65 + 0.68 log(target assets).

[16]For simplicity, we assume that acquisition costs c are not included in debt. This facilitates the exposition, but changing this assumption would leave our main results unaffected.

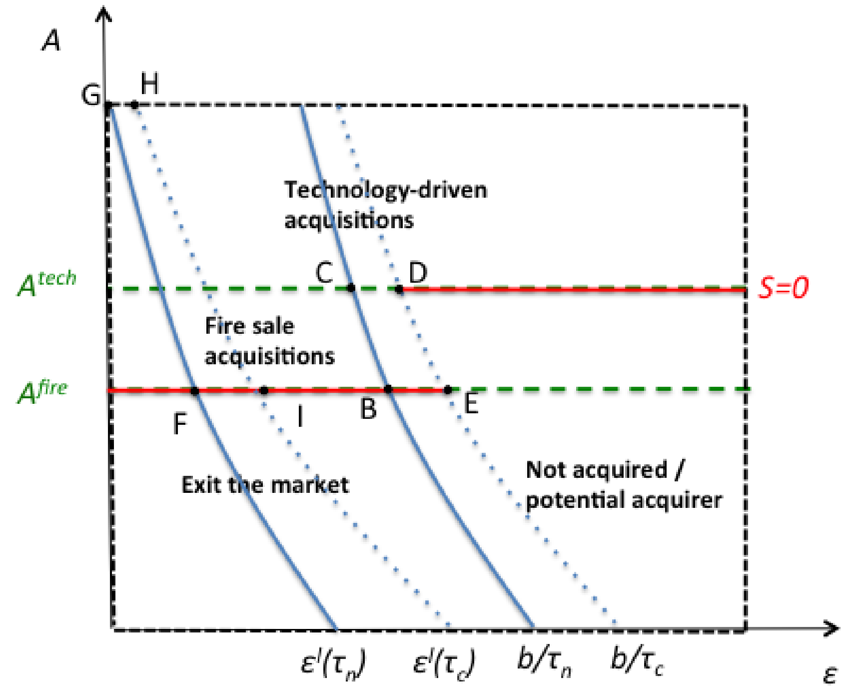

Figure 2: Acquisitions with Financially Constrained Acquirers

Notes: Shows the range of values for the target's current productivity, ϵ, that define fire-sale and technology-driven acquisitions for domestic acquisitions during normal and crisis periods. These ranges are $\epsilon^l \leq \epsilon \leq \frac{b}{\tau}$ for fire-sale and $\epsilon \geq \epsilon^l$ for technology-driven acquisitions, with the subscript on the τ indicating (n)ormal or (c)risis periods. See text and notes for Figure 1 for more details.

The impact of the modified borrowing constraint on acquisitions is illustrated in Figure 2. As in the case of unconstrained acquirers, it shows the combinations of size A and a target's liquidity ϵ for which constrained acquisitions can take place. The downward-sloping line denoted $\frac{b}{\tau}$ shows, as before, the regions of ϵ for which the stand-alone target firm is constrained. Again, we assume that τ is increasing in A. However, in contrast to acquirers who do not have financial constraints, the present acquirers face a borrowing constraint which is a downward sloping line with an ϵ intercept of $\epsilon^l \equiv \frac{b(1+k)}{\tau(\underline{A})} - \epsilon_{acq}k$. For a given constrained acquirer's current productivity ϵ_{acq}, only acquisitions to the right of that line can potentially take place. Note that since $\epsilon_{acq} > \frac{b}{\tau}$, the joint borrowing constraint line is always to the left of the constraint for the target firm alone. This means that there will always be some fire-sale acquisitions as long as τ is not too high. Higher internal funds available to the acquirer (higher ϵ_{acq}) lowers the cut-off value of the target firm's liquidity ϵ for which it can be acquired by an acquirer that is itself constrained.

Let G and F denote the distributions associated with the temporary productivity and permanent productivity, respectively, of the acquiring as well as target firms. As in the case of unconstrained acquirers let n^{fire} and n^{fire} denote the mass of fire-sale and technology-driven acquisitions. Then,

$$n^{fire} = \int_{kA^{fire}}^{kA^{tech}} \int_{A^{fire}}^{A^{tech}} \int_{\frac{b}{\tau}} \int_{\epsilon^l}^{\frac{b}{\tau}} dGdGdFdF$$

$$n^{tech} = \int_{kA^{tech}}^{\bar{A}} \int_{A^{tech}}^{\frac{\bar{A}}{k}} \int_{\frac{b}{\tau}} \int_{\epsilon^l} dGdGdFdF.$$

Starting from the innermost integral and moving outward, the limits of integration refer to the relevant ranges of the temporary productivity of the target firm, the temporary productivity of the acquiring firm, the permanent productivity of the target firm, and the permanent productivity of the acquiring firm, respectively. Note that there are two additional integrals in these definitions for constrained acquirers than for unconstrained ones, where we did not need to keep track of the available financial resources of the acquirer in the first period.

A negative financial shock shifts the $\frac{b}{\tau}$ line to the right. This results in firms with medium values for ϵ facing borrowing constraints, making them targets for fire-sale acquisitions. When the acquirers were financially unconstrained, this had the effect of increasing the mass of fire-sale acquisitions while leaving the mass of technology-driven acquisitions unchanged. Since fire-sale acquisitions correspond to lower A values than technology-driven acquisitions, as a corollary, this also lowered the average long-term productivity of the matches taking place. While a negative financial shock also has the effect of increasing the mass of fire-sale acquisitions in the case of constrained acquirers, there are two additional forces at work that are driven by the joint borrowing constraint line ϵ^l shifting to the right. First, relative to the case when acquirers are unconstrained, it reduces the number of fire-sale acquisitions. Second, it makes fewer low-quality (low A) technology-driven acquisitions feasible since the joint borrowing constraint of the acquiring-target entity depends on the value of A. Intuitively, a reduction in τ leaves only the constrained acquirers with the highest values of A to be able to raise enough resources to finance acquisitions. These two forces combined may counteract the effect of the increase in fire-sale acquisitions. This is a central insight of our analysis: The "quality" of acquisitions completed by constrained acquirers improves during financial crises because more of the matches taking place are between firms with higher values of A, the technology-related fundamental. If the financially constrained firms be interpreted as domestic firms, then acquisitions completed by domestic firms during financial crisis should be based more on fundamentals, in contrast to unconstrained acquirers (foreign firms). This is, there is a "cleansing effect" in the market for corporate control, whereby large aggregate financial shocks lead to a higher average quality of completed acquisitions among the group of domestic acquiring firms.

2.2 Acquired Share and Aggregate Financial Shocks

When a firm acquires a target, the productivity of the target increases by a factor ϕ, which is both increasing and strictly concave in the acquired share α.[17] But the frictions associated with the acquisition process necessitate a cost $c(\alpha)$ with $c' > 0$ and $c'' \geq 0$.[18] The precise form of the marginal cost curve of acquiring additional ownership is not critical for our results. The acquirer continues to operate its own firm, whether it acquires another firm or not.

For simplicity, we assume that the two parties set up a contract that aligns their interests. As a result, the acquired share is chosen by the acquiring firm to maximize total surplus:[19]

$$\phi'(\alpha)A = c'(\alpha). \tag{2.7}$$

This condition simply states that the marginal benefit of an increase in α, $\phi'(\alpha)A$, has to equal the marginal cost of an increase in α, $c'(\alpha)$. We can think of the optimal α defined by this first order condition as a function $\alpha(A)$. Under our assumptions about the derivatives of ϕ and c, it is easy to show that $\alpha' > 0$.[20] Ceteris paribus, smaller stakes are associated with lower productivity. In this sense, there is a relationship between the fraction of a target firm acquired and the "quality" of targets acquired, measured by the productivity of the target firm. In the next section, we show that financially unconstrained firms (which we identify as foreign firms when we take the model to the emerging markets acquisitions data) acquire on average smaller shares during liquidity crises. We then show that – under certain conditions that we will specify – financially constrained firms (domestic EME firms in our data) acquire on average larger shares during liquidity crises. We interpret this through the lens of our model as meaning that the quality of domestic and foreign acquisitions during liquidity crises move in opposite directions.

We first show that in our model, unconstrained firms acquire smaller ownership stakes during liquidity crises than in normal times. This result is similar to Alquist et al. (2015a) and is presented first to build intuition, because the problem of the unconstrained firm is simpler since it does not

[17]The first part of the assumption is meant to capture the gains arising from technological synergies between the two firms. Thus there are no value-destroying acquisitions (see Moeller et al., 2005) in our setup. The second part of the assumption is meant to capture the role of ownership in mitigating hold-up problems arising from incomplete contracts or transaction costs. Higher ownership by the acquiring firm is also more likely to incentivize the introduction of better management practices and enable closer monitoring of existing processes.

[18]This is meant to capture the idea that acquiring higher stakes might involve a greater degree of pre-acquisition screening and higher administrative or legal costs. The assumption $c'' \geq 0$ can be relaxed if ϕ is sufficiently concave (see footnote 20).

[19]This is done to simplify the algebra. Alternatives, such as the acquirer maximizing her share of surplus αS, would add complexity without adding insight into the main effect the model is meant to highlight. See Alquist et al. (2015b) for a more complete analysis of the contracting problem in an acquisition.

[20] This condition holds as long as $\frac{c''(\alpha)}{c'(\alpha)} > \frac{\phi''(\alpha)}{\phi'(\alpha)}$, which is satisfied if c is strictly convex and a is strictly concave. One can read the inequality condition as saying that c has to be 'less concave' / 'more convex' than ϕ for all possible α.

face credit constraints.[21] We then show that the opposite holds for constrained acquirers: These firms acquire larger ownership stakes during liquidity crises. These two contrasting results highlight the role of the firm level liquidity constraint, which in our model is the only difference between firms, in determining which financially constrained firms remain active in the market for corporate control. It should be noted that this is done to demonstrate the effect we are after, which is the difference in the behavior of foreign and domestic firms when the latter are faced by financial shocks, most cleanly. Thus we will mostly focus on the comparative static results of a financial shock rather than the initial level differences in the variables of interest, which could be due to differences in technology between constrained (domestic) and unconstrained (foreign) firms that are not part of the model. For the purpose of proving the two propositions, we make two functional form assumptions:

Assumption 1 *Temporary productivity ϵ is uniformly distributed with support* $[0, 2]$.

Assumption 2 *The borrowing constraint parameter τ takes on the form $\tau = \bar{\tau} A^{\eta}$, with $\eta > 0$.*

The first assumption simplifies the exposition of the proof, but our propositions do not hinge on this special functional form. We later show in simulations that our propositions are robust to a variety of common distributions for ϵ. The second assumption is a parsimonious way to model the notion that smaller firms (low A) face tighter borrowing constraints (low τ). Liquidity crises are modeled through a decrease in $\bar{\tau}$ that affects firms of all sizes symmetrically. The parameter η is the elasticity of the collateral constraint with respect to firm size.

2.2.1 Average Share Acquired by Unconstrained Acquirers

Using Bayes' formula, we can write the average acquired share as the expected acquired share conditional on the share being positive:

$$\bar{\alpha}^* = \frac{\int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{\frac{b}{\tau}} \alpha(A) dG dF^* + \int_{A^{tech}}^{\bar{A}} \alpha(A) dF^*}{\int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{\frac{b}{\tau}} dG dF^* + \int_{A^{tech}}^{\bar{A}} dF^*}.$$

Here, $n^{fire^*} \equiv \int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{\frac{b}{\tau}} dG dF^*$ and $n^{tech^*} \equiv \int_{A^{tech}}^{\bar{A}} dF^*$ denote the mass of fire-sale and technology-driven acquisitions, as defined earlier. Similarly, we define $\alpha^{fire^*} \equiv \int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{\frac{b}{\tau}} \alpha(A) dG dF^*$ and $\alpha^{tech^*} \equiv \int_{A^{tech}}^{\bar{A}} \alpha(A) dF^*$ as the sum of acquired shares in fire-sale and technology-driven acquisitions. Then, the average share acquired in each type of acquisitions, $\bar{\alpha}^{fire^*}$ and $\bar{\alpha}^{tech^*}$, can be

[21] Alquist et al. (2015a) emphasize the role of within-industry synergies in driving a similar result for foreign acquisitions. They do not consider the decision problem of a domestic acquiring firm.

written as:

$$\bar{\alpha}^{fire^*} = \frac{\alpha^{fire^*}}{n^{fire^*}} \qquad \bar{\alpha}^{tech^*} = \frac{\alpha^{tech^*}}{n^{tech^*}}.$$

The Lemma below characterizes the relative size of these two averages.

Lemma 1 *The average acquired share for fire-sale acquisitions is lower than the average acquired share for technology-driven acquisitions: $\bar{\alpha}^{fire^*} < \bar{\alpha}^{tech^*}$.*

Proof: This Lemma is the direct result of: i) the positive dependence of the acquired share on the firm's permanent level of productivity, $\alpha'(A) > 0$ and ii) the lower productivity range for fire-sale acquisitions $A^{fire} \leq A < A^{tech}$ compared to technology-driven acquisitions $A \geq A^{tech}$. ■

Using the quantities defined above, the average acquired share in unconstrained acquisitions overall, $\bar{\alpha}^*$, can be conveniently expressed as the weighted sum of these average shares acquired $\bar{\alpha}^{fire^*}$ and $\bar{\alpha}^{tech^*}$, with the weights being the share of these two types of acquisitions in total unconstrained acquisitions:[22]

$$\bar{\alpha}^* = \omega^* \bar{\alpha}^{fire^*} + (1 - \omega^*) \bar{\alpha}^{tech^*},$$

where $\omega^* = \frac{n^{fire^*}}{n^{fire^*} + n^{tech^*}}$. Changes in $\bar{\tau}$ affect $\bar{\alpha}^*$ through both changes in ω^* and changes in the average acquired shares $\bar{\alpha}^{fire^*}$ and $\bar{\alpha}^{tech^*}$.

Proposition 1 *Under Assumptions (1) and (2) unconstrained firms acquire on average smaller shares during liquidity crises, i.e., if $\bar{\tau}_c < \bar{\tau}_n$ then $\bar{\alpha}^*_c < \bar{\alpha}^*_n$.*

Proof: To prove the proposition we show that the partial derivative of $\bar{\alpha}^*$ with respect to $\bar{\tau}$ is positive. The partial derivative is

$$\frac{\partial \bar{\alpha}^*}{\partial \bar{\tau}} = \frac{\partial \omega^*}{\partial \bar{\tau}} \left(\bar{\alpha}^{fire^*} - \bar{\alpha}^{tech^*} \right) + \omega^* \frac{\partial \bar{\alpha}^{fire^*}}{\partial \bar{\tau}} + (1 - \omega^*) \frac{\partial \bar{\alpha}^{tech^*}}{\partial \bar{\tau}}$$

We simplify this expression step by step. The first partial derivative is:

$$\begin{aligned}
\frac{\partial \omega^*}{\partial \bar{\tau}} &= n^{*-2} \left(\frac{\partial n^{fire^*}}{\partial \bar{\tau}} n^{tech^*} - \frac{\partial n^{tech^*}}{\partial \bar{\tau}} n^{fire^*} \right) \\
&= n^{*-2} \left(- \int_{A^{fire}}^{\bar{A}} \frac{b}{\tau^2} \frac{\partial \tau}{\partial \bar{\tau}} g\left(\frac{b}{\tau}\right) dF^* n^{tech^*} - \int_{A^{tech}}^{\bar{A}} \frac{b}{\tau^2} \frac{\partial \tau}{\partial \bar{\tau}} g\left(\frac{b}{\tau}\right) dF^* n^{fire^*} \right) < 0.
\end{aligned}$$

[22]To see this, note that $\bar{\alpha}^* = \frac{\alpha^{fire^*} + \alpha^{tech^*}}{n^{fire^*} + n^{tech^*}} = \frac{n^{fire^*} \frac{\alpha^{fire^*}}{n^{fire^*}} + n^{tech^*} \frac{\alpha^{tech^*}}{n^{tech^*}}}{n^{fire^*} + n^{tech^*}} = \frac{n^{fire^*} \bar{\alpha}^{fire^*} + n^{tech^*} \bar{\alpha}^{tech^*}}{n^{fire^*} + n^{tech^*}}$.

This result together with Lemma 1 shows that the term $\frac{\partial \omega^*}{\partial \bar{\tau}} \left(\bar{\alpha}^{fire^*} - \bar{\alpha}^{tech^*} \right)$ is positive.

For the terms $\frac{\partial \bar{\alpha}^{fire^*}}{\partial \bar{\tau}}$ and $\frac{\partial \bar{\alpha}^{tech^*}}{\partial \bar{\tau}}$, we first simplify $\bar{\alpha}^{fire^*}$ and $\bar{\alpha}^{tech^*}$ using Assumptions (1) and (2):

$$\bar{\alpha}^{fire^*} = \frac{\int_{A^{fire^*}}^{A^{tech^*}} G\left(\frac{b}{\tau}\right) \alpha dF^*}{\int_{A^{fire^*}}^{A^{tech^*}} G\left(\frac{b}{\tau}\right) dF^*} = \frac{\int_{A^{fire^*}}^{A^{tech^*}} A^{-\eta} \alpha dF^*}{\int_{A^{fire^*}}^{A^{tech^*}} A^{-\eta} dF^*}$$

$$\bar{\alpha}^{tech^*} = \frac{\int_{A^{tech^*}}^{\bar{A}} \alpha dF^*}{\int_{A^{tech^*}}^{\bar{A}} dF^*}$$

Thus, both $\bar{\alpha}^{fire^*}$ and $\bar{\alpha}^{tech^*}$ are independent of $\bar{\tau}$. As a result, the acquired share is increasing in τ and therefore low during liquidity crises when τ is low. ■

That unconstrained firms acquire on average smaller shares when faced with large aggregate financial shocks is due to an increase in the proportion of fire-sale acquisitions, which are smaller than technology-driven ones by Lemma 1, in the pool of unconstrained acquisitions. In our empirical tests we proxy for unconstrained firms using foreign firms from a large group of developed economies.

2.2.2 Acquisitions by Constrained Acquirers

To calculate the average acquired share for financially constrained acquirers, we integrate the relevant distribution functions over three sets of conditions which were discussed earlier and summarized as: i) for the permanent productivity of the acquirer or target, $A \geq A^{tech}$ (for technology-driven acquisitions) and $A^{tech} > A \geq A^{fire}$ (for fire-sale acquisitions); ii) for the temporary productivity of the acquirer, $\epsilon_{acq} > \frac{b}{\tau}$; and iii) for the target's temporary productivity, $\epsilon \geq \epsilon^l$. As before, the average acquired share can be written as the weighted sum of the average acquired shares for fire-sale acquisitions and technology-driven acquisitions:

$$\begin{aligned} \bar{\alpha} &= \frac{\int_{kA^{fire}}^{kA^{tech}} \int_{A^{fire}}^{A^{tech}} \int_{\frac{b}{\tau}} \int_{\epsilon^l}^{\frac{b}{\tau}} \alpha(A) dGdGdFdF + \int_{kA^{tech}}^{\bar{A}} \int_{A^{tech}}^{\frac{\bar{A}}{k}} \int_{\frac{b}{\tau}} \int_{\epsilon^l} \alpha(A) dGdGdFdF}{\int_{kA^{fire}}^{kA^{tech}} \int_{A^{fire}}^{A^{tech}} \int_{A^{fire}}^{\bar{A}} \int_{\frac{b}{\tau}} \int_{\epsilon^l}^{\frac{b}{\tau}} dGdGdFdF + \int_{kA^{tech}}^{\bar{A}} \int_{A^{tech}}^{\frac{\bar{A}}{k}} \int_{\frac{b}{\tau}} \int_{\epsilon^l} dGdGdFdF} \\ &= \omega \bar{\alpha}^{fire} + (1-\omega) \bar{\alpha}^{tech} \end{aligned}$$

where $\bar{\alpha}^{fire}$ and $\bar{\alpha}^{tech}$ denote the average acquired share for fire-sale and technology-driven acquisitions:

$$\bar{\alpha}^{fire} = \frac{\alpha^{fire}}{n^{fire}} = \frac{\int_{kA^{fire}}^{kA^{tech}} \int_{A^{fire}}^{A^{tech}} \int_{\frac{b}{\tau}} \int_{\epsilon^l}^{\frac{b}{\tau}} \alpha(A) dGdGdFdF}{\int_{kA^{fire}}^{kA^{tech}} \int_{A^{fire}}^{A^{tech}} \int_{\frac{b}{\tau}} \int_{\epsilon^l}^{\frac{b}{\tau}} dGdGdFdF}$$

$$\bar{\alpha}^{tech} = \frac{\alpha^{tech}}{n^{tech}} = \frac{\int_{kA^{tech}}^{\bar{A}} \int_{A^{tech}}^{\frac{\bar{A}}{k}} \int_{\frac{b}{\tau}} \int_{\epsilon^l} \alpha(A) dGdGdFdF}{\int_{kA^{tech}}^{\bar{A}} \int_{A^{tech}}^{\frac{\bar{A}}{k}} \int_{\frac{b}{\tau}} \int_{\epsilon^l} dGdGdFdF}$$

As before, this expression states that the average acquired share is a weighted sum of the average share of fire-sale acquisitions and technology-driven acquisitions. This expression is useful for analyzing the effect of changes in τ, and hence the effect of domestic financial shocks, on $\bar{\alpha}$. Its partial derivative with respect to τ is

$$\frac{\partial \bar{\alpha}}{\partial \bar{\tau}} = \frac{\partial \omega}{\partial \bar{\tau}} \left(\bar{\alpha}^{fire} - \bar{\alpha}^{tech} \right) + \omega \frac{\partial \bar{\alpha}^{fire}}{\partial \bar{\tau}} + (1 - \omega) \frac{\partial \bar{\alpha}^{tech}}{\partial \bar{\tau}} \tag{2.8}$$

To evaluate this expression, note that Lemma 1 is applicable without modification. Thus, $\bar{\alpha}^{fire} < \bar{\alpha}^{tech}$, so that an increase in ω lowers the overall average share. For unconstrained acquirers we showed that this increase in the proportion of fire-sale acquisitions as a consequence of a decrease in $\bar{\tau}$ was the main force in lowering the overall average share of acquisition during financial crises. The average shares of the two types of acquisitions were independent of $\bar{\tau}$ due to our simplifying assumptions, so that the last two terms were absent.

However, as our earlier discussion of Figure 2 suggested, this result might be overturned in the case of constrained acquisitions due to two forces that work together to counteract the effect of an increase in the fire-sale target pool. First, the proportion of fire-sale acquisitions ω might decrease overall as constrained acquirers find themselves unable to raise sufficient funds for the acquisition due to tighter borrowing constraints. Second, relatively few low-quality (i.e., low A) technology-driven acquisitions are now feasible since the joint borrowing constraint of the acquiring-target entity only allows the high-A acquirers to be able to raise enough resources to finance acquisitions. These two channels would tend to raise the average A associated with the constrained acquisitions.

From our earlier discussion about the mapping from the permanent productivity A to the degree of control acquired, one observable implication of a higher average level of permanent productivity of the constrained acquisitions is a higher average share bought by these firms. Recall that fire-sale acquisitions involve lower ownership, and high-A acquirers acquire higher stakes. Thus each of the two channels described before have the effect of increasing the average share acquired by constrained acquirers and, in combination, may counteract the decline in average shares caused by the increase in the fire-sale target pool. Whether that happens is a quantitative question that we settle by numerical simulations. In the simulations that we present below, we find that under certain plausible conditions, the second set of effects dominates the effect of an increase in the fire-sale target pool, and as a result, the average share acquired by constrained acquiring firms goes up in the aftermath of an aggregate financial shock.

2.2.3 Calibrating and Simulating the Model

We simulate the model to analyze the reaction of the average acquired share to a tightening of the collateral constraint. We first have to choose functional forms and parameters. Some of these parameters are chosen to match certain features of the data on emerging market acquisitions from the years 1990-2007, which are described later in the empirical section. For the purpose of the calibration, unconstrained and constrained acquiring firms are identified with foreign and domestic acquirers respectively. This seems a reasonable assumption because the majority of foreign acquiring firms in our sample were from countries with more well-developed financial markets, not other EMEs.[23] Thus in this section, we refer to unconstrained and constrained acquirers interchangeably as foreign and domestic acquirers. Obviously, this does not imply that we believe that all foreign acquirers are unconstrained whereas all domestic acquirers are constrained, only that this is true on average. Also recall that our setup allows for domestic acquirers to be larger than domestic targets, and in particular, large enough to overcome borrowing constraints.

For the size parameter A we choose a Pareto distribution with probability density function $f(A) = \lambda A^{-\lambda-1}$ for $A \geq 1$. In accordance with the literature on firm size distributions, we select a value of the shape parameter close, but above 1: 1.01.[24] There is less guidance for the distribution of the temporary shock ϵ. We have experimented with uniform, normal and beta distributions and different standard deviations. Our qualitative results are robust to these distributions and reasonable standard distributions. Our results presented in this section assume a symmetric beta distribution with $\alpha = \beta = 3$ and a finite support of ϵ from 0.5 to 1.5.[25]

The cost function and spillover function jointly determine the distribution of the acquired share. We assume their forms to be:

$$c = \gamma_0 + \alpha$$
$$\phi = 1 + \alpha^{\psi}$$

The cost of an acquisition consists of a fixed cost γ_0 and a variable cost that is linearly increasing in the acquired share α. The value of the fixed cost strongly affects the average acquired share. As the fixed cost increases, small acquisitions become unprofitable and the average share increases.

[23] This is documented in Alquist et al. (2015b) using indices of financial development such as private credit/GDP and bond market capitalization/GDP ratios.

[24] See e.g. Di Giovanni et al. (2011) for estimates of λ across countries.

[25] The virtue of the beta distribution is that it can be parameterized to have a bell shape similar to a normal distribution, but a finite support like a uniform distribution.

Table 1: Acquired Share

	$< 50\%$	$50-60\%$	$60-70\%$	$70-80\%$	$80-90\%$	$90-100\%$	100%	$\bar{\alpha}$
Data	28.7%	8.8%	5.9%	2.5%	3.7%	2.7%	47.8%	70.1%
Model	25.6%	10.6%	7.6%	6.0%	4.7%	3.8%	41.7%	75.1%

Notes: The table reports average acquired shares for the total of domestic and foreign acquisitions in the data and the model. Model parameters are explained in the text. For this table, we set $\bar{\tau} = 1.17$.

The form for the spillover function ensures that productivity spillovers are non-negative and are increasing in α. As the elasticity ψ increases, spillover more strongly increase in α, making larger acquisitions more profitable. Since we have to restrict α to be between 0 and 1, an increase in ψ raises the share of full acquisitions. We choose γ_0 and ψ to match both the average acquired share and the fraction of full acquisitions that we observe in the data. Table 1 compares acquired shares in the data and the model. We cannot perfectly match the two moments: In the data, the fraction of full acquisitions is somewhat larger than in the model. At the same time, the average acquired share is smaller. The reason for the discrepancy is that the model does not feature any small scale acquisitions with shares of less than 30%, which can be observed in the data. However, the fit is fairly good for our very parsimonious model. In both the data and the model a bit more than 70% of all acquisitions lead to shares with 50% or more.

The collateral constraint is $\tau = \bar{\tau} A^{\eta}$. There is little empirical evidence to guide our calibration of η, the elasticity of a firm's maximum leverage ratio with respect to its size A. Several studies suggest that smaller firms have less access to finance (see Beck et al., 2005), which indicates a positive η. We choose $\eta = 0.05$ implying that the maximum liability to equity ratio increases by 5% if a firm doubles in size. As a robustness check, we have also tried smaller values for η and our results remain qualitatively robust up to $\eta = 0.02$. For $\eta = 0$, when small and large firms enjoy the same access to finance, the acquired share increases in τ for domestic acquirers, as it does for foreign acquirers. So the presence of a sufficiently positive η is crucial for our results.

We calibrate the parameter k to the observed size difference of domestic acquirers and their target. We measure a firm's size as the book value of their total assets. Our dataset contains 1,518 domestic acquisitions for which total assets of both the acquirer and the target are available. The resulting ratio of the average acquirer's total assets to the average target's total assets is 3.2 across all years and countries. We therefore set $k = 3.2$.

Finally, we choose the fixed cost parameter to be $b = 0.9$. This implies that expected profits are 10% of a firm's size.

We now analyze a tightening of the collateral constraint from $\bar{\tau} = 1.33$ to $\bar{\tau} = 1$, translating into a 25% drop of a firm's maximum leverage ratio. In our simulation, this reduces a typical firm's

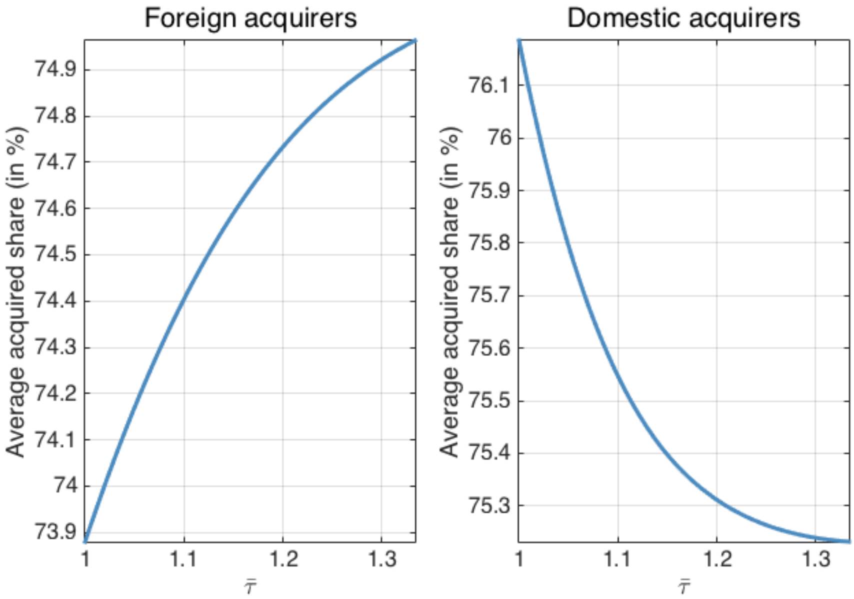

Figure 3: Average Acquired Share For Foreign and Domestic Acquirers
Notes: Simulated average acquired share as a function of $\bar{\tau}$ (collateral constraint parameter) for foreign acquirers (left panel) and domestic acquirers (right panel). A financial crisis is modeled as a decrease of $\bar{\tau}$. See text for more details on the calibration.

leverage ratio from 1.38 to 1.04.[26] The smallest firms lose complete access to financial markets, so that they can only pay for the fixed cost b if their current productivity is high enough, i.e. $\epsilon \geq b$. Figure 3 shows how the average acquired share of both foreign and domestic acquirers adjusts to a steady decline in $\bar{\tau}$ from 1.33 to 1. At $\bar{\tau} = 1.33$ the share of both foreign and domestic acquirers is fairly close to each other at 75 percent. As credit constraints tighten, the average share declines for foreign acquisitions by almost one percentage point, whereas it increases by a similar amount for domestic acquisitions.

We decompose this overall change in the average acquired share into three components (where a prime $'$ denotes the value after the change)

$$\Delta\bar{\alpha} = \underbrace{\left(\bar{\alpha}^{fire} - \bar{\alpha}^{tech}\right)\Delta\omega}_{Ext} + \underbrace{\omega'\Delta\bar{\alpha}^{fire}}_{Int^{fire}} + \underbrace{(1-\omega')\Delta\bar{\alpha}^{tech}}_{Int^{tech}} \tag{2.9}$$

The extensive margin captures the composition effect of a change in the share of fire-sale and technology-driven acquisitions. The two intensive margins refer to changes in the average share of the two types of acquisitions. Figure 4 shows the result of this decomposition for a change in $\bar{\tau}$ from 1.33 to 1, for both foreign and domestic acquisitions. As discussed before, the fall in

[26] A typical firm's size is $A = 2$, so that their leverage ratio is $\bar{\tau}2^{0.05} = 1.04\bar{\tau}$.

the average acquired share for foreign acquisitions is almost completely driven by a composition change.[27] For domestic acquisitions, this composition effect is weaker and is dominated by an increase in the average acquired share for technology-driven acquisitions. This result supports our intuition that during financial crises only the best domestic acquiring firms – those with higher productivity and liquidity – remain in the market for corporate control. The increase in the share of fire-sale acquisitions is less pronounced for domestic acquirers because the acquirers themselves face tighter borrowing constraints. Low-quality matches therefore become less profitable and the average acquired share increases.

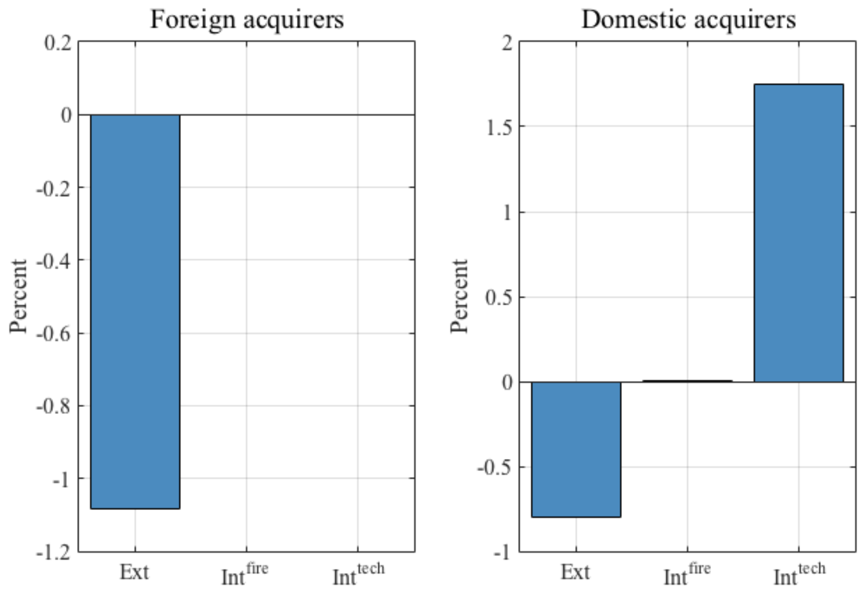

Figure 4: Decomposition of a Change in the Average Acquired Share

Notes: Decomposition of a change in the average acquired share caused by a reduction in $\bar{\tau}$ from 1.33 to 1. The change is decomposed into a composition change, the extensive margin, and a change in the average acquired share of both fire-sale acquisitions and technology acquisitions (see Equation (2.9)).

2.3 Possible Resale of Acquisitions

To allow for possible resales after acquisitions, we extend the model by an additional period, period 3. Period 3 is a normal period with $\bar{\tau}$ returning to its initial value. In period 2, after revenues for that period have been realized, the acquirer receives an all-or-nothing offer V^o for her entire share α of the firm.

We make a number of assumptions to simplify the analysis. The assumptions are that: (i)

[27] The term Int^{fire} is not equal to zero, but very small. Our simulations suggest that the predominance of the extensive margin in explaining changes in $\bar{\alpha}^*$ seems very robust to different assumptions on the distribution of A.

the new acquirer making the buy-back offer is not liquidity constrained; (ii) the new acquirer has access to the same technology as the original owner of the firm and there are no monitoring costs (i.e. $\phi = 1$ and $c = 0$); (iii) acquirer and seller engage in Nash bargaining over any surplus of an acquisition, with η denoting the fraction of the surplus that the acquirer obtains; and (iv) temporary productivity ϵ of the target firm equals 1 in period 2 and 3. This last assumption implies that the target firm is never liquidity constrained in period 2 because profits, A, exceed the upfront cost, bA, for producing next period.

The value of a potential target firm that is not acquired in the first period is

$$V^d = \begin{cases} A\epsilon + 0 + A(-b+1) & \text{if} \quad \underline{\epsilon} \leq \epsilon < b/\tau \\ A\epsilon + A(-b+1) + A(-b+1) & \text{if} \quad b/\tau \leq \epsilon \leq \bar{\epsilon}. \end{cases}$$

The value of the firm is the sum of all three periods' profits. First-period (gross) profits are $A\epsilon$. In periods 2 and 3, profits net of fixed costs are $A(-b+1)$. In the first case, the owner of the firm is constrained at the end of the first period and cannot pay for the upfront fixed cost. He therefore does not receive any profits in the second period. In the second period, the owner of the firm can pay for the fixed cost himself, or he can sell the firm and the new owner pays for the fixed cost. Either way, the firm produces in the third period generating additional profit $A(-b+1)$. In the second case, the owner is not constrained at the end of the first period and the firm produces in all three periods.

The value of a firm acquired in the first period is

$$V^{acq} = \begin{cases} A\epsilon + A(-b+\phi) - c + A(-b+1) & \text{if} \quad V^o > (\epsilon - b + \phi)A - c \\ A\epsilon + A(-b+\phi) - c + A(-b+\phi) - c & \text{if} \quad V^o \leq (\epsilon - b + \phi)A - c, \end{cases}$$

where, as before, ϕ and c denote function values with optimally chosen share α. The optimal chosen α satisfies $\phi'(\alpha)A = c'(\alpha)$ and is constant across periods. The first two terms, $A\epsilon$ and $A(-b+\phi) - c$, are the profit from producing in both the first and second period. In the second period, the acquirer can either resell the firm or hold on to it. If he sells the firm, profits in the third period are $A(-b+1)$. If he holds onto it, profits are $A(-b+\phi) - c$, as in the second period.

It is optimal for the initial acquirer to resell the firm whenever the outside offer V^o exceeds the value of holding onto the firm $A(-b+\phi) - c$. The outside offer is the sum of the value of holding onto the firm plus a share of the surplus from the transaction. We assume that the initial acquirer and the new acquirer engage in Nash bargaining, so that they share any surplus from the transaction, with share $1 - \psi$ going to the initial acquirer. The surplus from selling is the value if the firm is sold, $A(-b+1)$, minus the value if it is not sold, $-A(-b+\phi) + c$. The outside offer is therefore

$$V^o = (-b+\phi)A - c + (1-\psi)\left[(-b+1)A - (-b+\phi)A + c\right]$$

Then, the acquirer sells back the firm if $V^o > A(-b+\phi) - c$, which is equivalent to $A > \frac{c}{1-\phi}$. This condition holds for small enough values of A.[28] The threshold below which flipping occurs corresponds to A^{tech}, as defined in the previous section. Therefore, all acquired firms with $A < A^{tech}$ are flipped in the second period. This formalizes the intuition that acquisitions characterized by lower values of A are more likely to be resold.

Now that we have solved the flipping problem in the second period, we can look at the initial acquisition problem in the first period: A target firm is acquired if an acquisition generates positive surplus. The surplus, $V^{acq} - V^d$, is

$$S = \begin{cases} A(\epsilon - b + \phi) - c + A(-b+1) - \epsilon A - A(-b+1) & \text{if } \underline{\epsilon} \leq \epsilon < b/\tau \quad \& \quad A < A^{tech} \\ A(\epsilon - b + \phi) - c + A(-b+1) - \epsilon A - 2A(-b+1) & \text{if } b/\tau \leq \epsilon < \bar{\epsilon} \quad \& \quad A < A^{tech} \\ A(\epsilon - b + \phi) - c + A(-b+\phi) - c - \epsilon A - A(-b+1) & \text{if } \underline{\epsilon} \leq \epsilon < b/\tau \quad \& \quad A \geq A^{tech} \\ A(\epsilon - b + \phi) - c + A(-b+\phi) - c - \epsilon A - 2A(-b+1) & \text{if } b/\tau \leq \epsilon < \bar{\epsilon} \quad \& \quad A \geq A^{tech}. \end{cases}$$

Simplifying these expressions gives

$$S = \begin{cases} (\phi - b)A - c < 0 & \text{if } \underline{\epsilon} \leq \epsilon < b/\tau \quad \& \quad A < A^{fire} \\ (\phi - b)A - c \geq 0 & \text{if } \underline{\epsilon} \leq \epsilon < b/\tau \quad \& \quad A^{fire} \leq A < A^{tech} \\ (\phi - 1)A - c < 0 & \text{if } b/\tau \leq \epsilon < \bar{\epsilon} \quad \& \quad A < A^{tech} \\ (\phi - b)A - c + (\phi - 1)A - c > 0 & \text{if } \underline{\epsilon} \leq \epsilon < b/\tau \quad \& \quad A \geq A^{tech} \\ 2\left((\phi - 1)A - c\right) \geq 0 & \text{if } b/\tau \leq \epsilon < \bar{\epsilon} \quad \& \quad A \geq A^{tech}. \end{cases}$$

where the inequality signs follow from the restriction on A.

Cases 4 and 5 above comprise combinations of A and ϵ, where initial acquisitions take place and acquirers hold on to the firm in the second period. These correspond to technology-driven acquisitions as defined in the previous section. In case 3, acquisitions do not take place: The target firm's productivity A is too low and its temporary productivity too high, so that it is unconstrained. Therefore, it is not profitable to acquire it. If the firm is constrained, but it is productive enough so that $A \geq A^{fire}$, it is acquired in the first period (case 2). This is a fire-sale acquisition. Fire-sale acquisitions will be flipped in the second period, when credit conditions improve. Finally, if $A < A^{fire}$ (case 1), the constrained firm goes bankrupt without attracting a buyer. The two following propositions

Proposition 2 *Unconstrained acquisitions made during an aggregate adverse financial shock have higher flipping rates, i.e., if $\tau_c < \tau_n$ then $\frac{n_c^{flip^*}}{n_c} > \frac{n_n^{flip^*}}{n_n}$.*

[28] To see this, note that this inequality can be rewritten as $A > \phi A - c$. The RHS is increasing in A faster than the LHS: $\frac{d\phi A - c}{dA} = \frac{\partial \phi A - c}{\partial A} + \frac{\partial \phi A - c}{\partial \alpha} \frac{\partial \alpha}{A} = \frac{\partial \phi A - c}{\partial A} = \phi > 1$, where the second term drops because α is chosen optimally.

Proof: The proportion of flipped acquisitions by unconstrained acquirers is

$$\frac{n^{flip^*}}{n^*} = \frac{n^{fire^*}}{n^{fire^*} + n^{tech^*}} = \frac{\int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{b/\tau} dGdF^*}{\int_{A^{fire}}^{A^{tech}} \int_{\underline{\epsilon}}^{b/\tau} dGdF^* + \int_{A^{tech}}^{\bar{A}} dF^*}$$

Taking the derivative with respect to $\bar{\tau}$ gives

$$\frac{\partial \frac{n^{flip^*}}{n}}{\partial \bar{\tau}} = \frac{\frac{\partial n^{fire^*}}{\partial \bar{\tau}} n^{tech^*}}{(n^*)^2},$$

which is negative because

$$\frac{\partial n^{fire^*}}{\partial \bar{\tau}} = -\int_{A^{fire}}^{A^{tech}} g\left(\frac{b}{\tau}\right) \frac{b}{\tau^2} \frac{\partial \tau}{\partial \bar{\tau}} dF^* < 0.$$

As a result, the share of flipped acquisitions is higher for unconstrained acquisitions undertaken in the periods of an aggregate financial shock. ■

The proportion of flipped unconstrained acquisitions is simply equal to the share of fire-sale acquisitions in total acquisitions. As shown earlier, this share increases when there is an adverse aggregate financial shock. For constrained acquirers, the proportion of flipped acquisitions is

$$\frac{n^{flip}}{n} = \frac{n^{fire}}{n^{fire} + n^{tech}}$$

and the derivative is

$$\frac{\partial \frac{n^{flip}}{n}}{\partial \bar{\tau}} = \frac{\frac{\partial n^{fire}}{\partial \bar{\tau}} n^{tech} - \frac{\partial n^{tech}}{\partial \bar{\tau}} n^{fire}}{(n^*)^2}.$$

As the simulations in the previous section suggest, the share of fire-sale acquisitions increases during a crisis for constrained (domestic) acquirers (see Figure 4, extensive margin), but by less than for unconstrained (foreign) acquirers. Figure 5 confirms this: Flipping rates increase for both foreign and domestic acquirers, from 0.3 to 2.8 for foreign acquirers and from 0.3 to 2.1 for domestic acquirers. We later take this hypothesis to the data, that flipping rates for domestic acquirers increase by less than flipping rates for foreign acquirers during periods of adverse aggregate financial shocks.

The reader might be puzzled that the result for domestic acquirers seems to suggest a decline

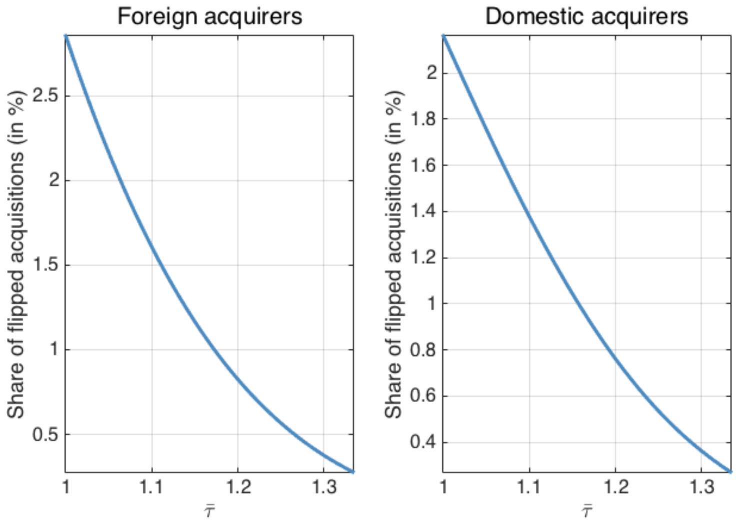

Figure 5: Share of flipped acquisitions for domestic and foreign acquisitions.
Notes: Simulated share of flipped acquisitions as a function of $\bar{\tau}$ for foreign acquirers (left panel) and domestic acquirers (right panel). For more details, see notes of Figure 3.

in the average productivity of domestic acquisitions undertaken during a crisis, and goes in the opposite direction as the result for the size of domestic acquisitions. The reason for this apparent discrepancy is as follows. Our results on flipping are driven entirely by the extensive margin, and recall from Figure 4 that the extensive margin does lower the average size of acquisitions (by increasing the proportion of fire-sale acquisitions), whereas the increase in size is driven by the intensive margin. To foreshadow our empirical findings, the absence of an intensive margin effect for flipping is a simplification which leads to one counterfactual prediction. However, note from Figure 5 that the model predicts that if the normal-period cohort of domestic acquisitions had weakly higher divestiture rates than foreign acquisitions, then there should be a convergence of these divestiture rates for the cohort of crisis acquisitions. We find evidence in favor of this convergence effect.

3 Testing the Implications of the Model

The theory gives us two sets of testable implications regarding the size and flipping rates of domestic and foreign acquisitions in times of financial distress, in comparison to normal times. To test these, we need transaction level data for mergers and acquisitions. Our source for this is the Thompson-Reuters Securities Data Company Platinum database, which contains information on the universe of such deals in a large set of EMEs.[29] For each transaction, we mainly utilize a few key variables – the

[29] See Alquist et al. (2015a) for a detailed description of the SDC data.

share of a firm acquired, the names of the firms involved, their primary SIC industry classifications, the country of origin of the acquirer, and the date on which the transaction was completed – for sixteen of the largest markets for corporate control in EMEs between 1990 and 2007.[30]

Due to the structure of the hypotheses, which are essentially comparisons of two kinds of acquisitions (relatively financially constrained and unconstrained acquisitions, proxied by those made by domestic and foreign acquiring firms, respectively), across two macroeconomic regimes (normal and adverse financial shock), we employ a difference-in-difference approach. To test whether there is convergence in the size of acquisitions between foreign and domestic acquisitions during an adverse financial shock, we estimate the following linear model:

$$fracacq_{kjct} = \beta_{jc}\boldsymbol{\delta}_{jc} + \beta_C D_C^{ct} + \beta_F D_F^{kjct} + \beta_{C,F} D_{C,F}^{kjct} + \boldsymbol{controls}'_{c,t-4}\beta_{mc} + \epsilon_{kjct}. \tag{3.1}$$

Here k, j, c, and t stand for transaction, single-digit SIC industry of the target firm, country, and time, respectively. The dependent variable is the fraction of the target firm acquired in transaction k. The two main independent variables are D_{ct}^C, that indicates whether an acquisition took place during a period when there was an aggregate adverse financial shock, and D_F^{kjct}, which indicates whether the acquirer involved in a particular transaction is a foreign firm. We also include a vector of fixed effects $\boldsymbol{\delta}_{jc}$ and a set of lagged country-level macroeconomic controls $\boldsymbol{controls}_{c,t-4}$. The standard errors are clustered two-way along the cross-sectional (country×target-industry) and time (month) dimensions.[31] Since $fracacq_{kjct} \in [0,1]$, a linear model might potentially lead to predicted values outside this range. Hence we also estimate β_C , β_F and $\beta_{C,F}$ in a Generalized Linear Model (GLM) framework using maximum likelihood. This takes into account the bounded nature of our dependent variable (see Papke and Wooldridge, 1996).

In terms of the variables used we follow Alquist et al. (2015a) closely. D_{ct}^C, which serves as our proxy for an aggregate adverse financial shock, is defined using the (annual) systemic banking crises dates from Laeven and Valencia (2010).[32] The lagged macroeconomic variables are used to control for the business cycle determinants of M&A activity.[33]Alquist et al. (2015a) find regional differences (especially, Asia and Latin America) in their empirical analysis of acquisitions in emerging economies. Hence, we report results for our full sample, for Asia, and for all other countries.

[30]The countries are Argentina, Brazil, Chile, China, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Singapore, South Africa, South Korea, Taiwan, Thailand, and Vietnam. Our data contains both private and listed firms.

[31]This procedure adjusts for the possible correlation of the error terms within the same country×target-industry, as well as among firms within the same month. Petersen (2009) shows that failing to cluster along multiple dimensions can lead to deflated standard errors in firm level studies and provides code to implement inference in Stata.

[32]See Alquist et al. (2015a) for a detailed discussion on the arguments in favor of using the banking crisis dates as a proxy for financial shocks, as opposed to currency or twin crises.

[33]Specifically, they are the change in the nominal exchange rate (quarterly), the use of IMF credit and loans as a percentage of a country's quota (quarterly), real GDP per capita (annual), and real GDP growth (annual). The data sources are the Penn World Tables, the IMF's *International Financial Statistics*, Taiwan's National Statistical Office, and the Central Bank of the Republic of China. More details and descriptions of the macroeconomic controls are provided in Alquist et al. (2015a).

As noted before, we identify the effects predicted by the models empirically using the assumption that domestic acquirers are constrained, while foreign acquirers are not, and that the banking crisis dates proxy an adverse financial shock for all firms in a country. Based on the theory, we frame two key empirical hypotheses regarding the coefficients β_C and $\beta_{C,F}$ in Regression 3.1.[34] Note below that we do not frame hypotheses involving β_F, which measures the difference in acquired shares during normal times between foreign and domestic acquisitions. We want to focus on the comparative static results of a financial shock rather than the initial or final level differences in acquired shares, which could be due to differences in technology between constrained (domestic) and unconstrained (foreign) firms that are not part of the model. Accordingly, we remain agnostic about the sign of β_F and interpret its estimates in the context of the literature.

(i) β_C: Domestic acquisitions involve larger stakes during a banking crisis, i.e., $\beta_C > 0$.

(ii) $\beta_C + \beta_{C,F}$: We expect crisis-time foreign acquisitions to involve smaller stakes, i.e., $\beta_C + \beta_{C,F} < 0$.

The results are shown in Tables 2 and 3 for the OLS and GLM estimations, respectively. We find strong empirical support for our two key hypotheses in the full sample of acquisitions, with some regional differences that are discussed below. First, domestic acquisitions involve significantly higher stakes during crises. The point estimate for the full sample and the unconditional mean fraction acquired in the sample (about 63%) for domestic acquisitions indicates a 6.3% increase in the size of domestic acquisitions during crises. The model also does well on the second prediction. By the OLS estimates, crisis-time foreign acquisitions are found to be smaller, though not significantly so, in the full and non-Asian sample, while they are significantly smaller in the Asian samples. The GLM estimates suggest that they are significantly smaller in the full sample as well.

The sign and significance of β_F and $\beta_F + \beta_{C,F}$ can be interpreted using the model. The estimates of β_F suggest that foreign and domestic acquisitions do not differ significantly during normal times in the full sample, but this result masks large regional differences. In particular, the GLM results show that foreign stakes are significantly larger than domestic ones during normal times in the Asian samples, while the opposite is true for the non-Asian sample (mostly Latin America). These two cancel out in the full sample to yield an insignificant coefficient on the foreign acquisition dummy. Through the lens of our model, this finding is consistent with foreign-owned firms being engaged in acquisitions that lead to long-term synergies in Asia, and being more productive than domestic firms. There is ample evidence in the literature in favor of the latter point (see Yasar and Morrison Paul, 2007; Blalock and Gertler, 2008; Arnold and Javorcik, 2009). Next, note that $\beta_F + \beta_{C,F} < 0$, i.e., foreign stakes acquired during crises are significantly smaller than domestic stakes acquired during crises, in all the samples using both OLS and GLM estimates. These two results together point to a "convergence" in the size of stakes acquired in foreign and domestic acquisitions during financial crisis episodes. Recall that this convergence is

[34] The baseline group in the regression is ($\beta_C = 0, \beta_F = 0$), i.e., domestic acquisitions during normal times.

Table 2: Average Size of Ownership Stakes: OLS

	Full	Asia	Post-1997 Asia	Non-Asia
$\hat{\beta}_C$	0.04^a	0.04^a	0.03^b	0.02
	(0.01)	(0.01)	(0.01)	(0.03)
$\hat{\beta}_F$	0.00	0.02	0.03	-0.04^a
	(0.01)	(0.02)	(0.02)	(0.01)
$\hat{\beta}_{C,F}$	-0.07^a	-0.09^a	-0.09^a	-0.03
	(0.02)	(0.02)	(0.03)	(0.04)
No. obs.	29,728	20,410	17,524	9,318
R^2	0.0914	0.078	0.0856	0.0535
Macroeconomic Controls	Yes	Yes	Yes	Yes
Country×Target-Industry Fixed Effects	Yes	Yes	Yes	Yes
	Linear Combination Tests			
	Foreign Crisis Versus Foreign Non-Crisis			
$H_0 : \beta_C + \beta_{C,F} = 0$	-0.03	-0.05^b	-0.06^b	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
	Foreign Crisis Versus Domestic Crisis			
$H_0 : \beta_F + \beta_{C,F} = 0$	-0.07^a	-0.07^a	-0.06^a	-0.07^c
	(0.02)	(0.02)	(0.02)	(0.04)

Notes: The table reports the point estimate of the coefficient associated with the banking crisis dummy β_C, foreign acquisition dummy β_F and their interaction term $\beta_{C,F}$ obtained from a linear model. The regression is Equation 3.1 in the text. The dependent variable is the fraction of a firm acquired. It is based on the full sample of acquisitions by domestic and foreign acquirers. The dates for the domestic banking crises are from Laeven and Valencia (2010). a, b and c indicate statistical significance at the 1%, 5% and 10% levels, respectively. Standard errors, clustered two-way at the level of country×target-industry and month, are reported in parentheses. The coefficient estimates for the country×target-industry fixed effects and the macroeconomic controls lagged four quarters are omitted from the table to conserve space.

one observable implication of the change in the relative average productivity of constrained and unconstrained acquisitions in a crisis. It is a distinctive prediction of our model and suggests the existence of "cleansing effect", whereby only the most productive domestic acquiring firms in a country hit by a negative financial shock are able to compete in the market for corporate control.

To test whether there is convergence in the flipping rate of acquisitions between foreign and domestic acquisitions during crisis times, we estimate a Cox proportional hazards model of the following form:

$$\ln[h_{jc}(\tau|\mathbf{X})] = \ln[h_{jc}(\tau)] + \beta_C D_C^{ct} + \beta_F D_F^{kjct} + \beta_{C,F} D_{C,F}^{kjct} + \boldsymbol{controls}'_{c,t-4}\beta_{mc} + \epsilon_{kjct} \tag{3.2}$$

where $\mathbf{X}$ is a vector of independent variables as defined before. The only new object is the estimated hazard function $h_{jc}(\tau)$, which is the probability density that an average firm experiences an

Table 3: Average Size of Ownership Stakes: GLM

	Full	Asia	Post-1997 Asia	Non-Asia
$\hat{\beta}_C$	0.21^a	0.20^a	0.16^a	0.08
	(0.04)	(0.05)	(0.05)	(0.08)
$\hat{\beta}_F$	-0.00	0.08^a	0.13^a	-0.21^a
	(0.02)	(0.03)	(0.03)	(0.04)
$\hat{\beta}_{C,F}$	-0.33^a	-0.40^a	-0.39^a	-0.13
	(0.06)	(0.07)	(0.08)	(0.10)
No. obs.	29,728	20,410	17,524	9,318
Log L	-15,905.4	-11,232.5	-9,590.8	-4,655.0
Macroeconomic Controls	Yes	Yes	Yes	Yes
Country×Target-Industry Fixed Effects	Yes	Yes	Yes	Yes
	Linear Combination Tests			
	Foreign Crisis Versus Foreign Non-Crisis			
$H_0 : \beta_C + \beta_{C,F} = 0$	-0.12^b	-0.20^a	-0.24^a	-0.05
	(0.05)	(0.06)	(0.07)	(0.07)
	Foreign Crisis Versus Domestic Crisis			
$H_0 : \beta_F + \beta_{C,F} = 0$	-0.33^a	-0.32^a	-0.26^a	-0.34^a
	(0.05)	(0.07)	(0.07)	(0.09)

Notes: The table reports the point estimate of the coefficient associated with the banking crisis dummy β_C, foreign acquisition dummy β_F and their interaction term $\beta_{C,F}$ obtained from the Generalized Linear Model. The dependent variable is the fraction of a firm acquired. It is based on the full sample of acquisitions by domestic and foreign acquirers. The dates for the domestic banking crises are from Laeven and Valencia (2010). a, b and c indicate statistical significance at the 1%, 5% and 10% levels, respectively. Robust standard errors are reported in parentheses. The coefficient estimates for the country×target-industry fixed effects and the macroeconomic controls lagged four quarters are omitted from the table to conserve space.

acquisition event in a small interval of time $\Delta\tau$, conditional on it not having been the target of an acquisition for τ units of time since the last acquisition event.[35]

We frame two empirical hypotheses regarding the coefficients β_C and $\beta_{C,F}$ in Regression 3.2. For the reasons outlined before we do not frame hypotheses involving β_F and instead interpret the

[35]The duration τ of an acquisition is measured as follows. We first identify firms that appear at least twice in our data as a target firm, which implies: (a) either that the first acquirer sold off her stake in the second acquisition if the initial acquisition involved 100% of the firm; (b) a different prior owner sold a stake in the firm. Since we are interested only in resales by acquirers, we limit ourselves to 50% or 100% acquisitions (we report results for the former) because we are more confident in those cases that the initial buyer was flipping her acquisition. Under this assumption, the initial transaction identifies the beginning of the relationship. The second sale is thus assumed to mark the end of the immediately preceding ownership relationship, and so on for subsequent appearances by the same target in the dataset. The duration of an acquisition is thus the distance in time between each transaction involving the same target. A detailed discussion about the merits and drawbacks of this method can be found in Alquist et al. (2015a).

Table 4: Divestiture Rates

	Only Majority Acquisitions			
	Full	Asia	Post-1997 Asia	Non-Asia
$\hat{\beta}_C$	-0.27^b	-0.46^a	-0.68^a	0.31^c
	(0.13)	(0.15)	(0.15)	(0.17)
$\hat{\beta}_F$	-0.18^b	-0.35^a	-0.29^b	0.10
	(0.08)	(0.11)	(0.13)	(0.09)
$\hat{\beta}_{C,F}$	0.12	0.35^b	0.27	-0.43^c
	(0.16)	(0.17)	(0.19)	(0.26)
No. Obs.	21,216	13,830	12,085	7,386
Log L	-8,685.0	-5,932.1	-4,640.8	-2,735.2
Macroeconomic Controls	Yes	Yes	Yes	Yes
Country×Target-Industry Stratification	Yes	Yes	Yes	Yes
	Linear Combination Tests			
	Foreign Crisis Versus Foreign Non-Crisis			
$H_0 : \beta_C + \beta_{C,F} = 0$	-0.15	-0.10	-0.41^b	-0.12
	(0.13)	(0.18)	(0.19)	(0.17)
	Foreign Crisis Versus Domestic Crisis			
$H_0 : \beta_F + \beta_{C,F} = 0$	-0.07	0.01	-0.01	-0.33
	(0.15)	(0.15)	(0.16)	(0.25)

Notes: The table reports the point estimates of the coefficients associated with the banking crisis dummy β_C, foreign acquisition dummy β_F, their interaction term $\beta_{C,F}$ and the fraction owned after the acquisition $\beta_{fracownaft}$ obtained from the Cox regression model. The regression is Equation 3.2 in the text. The dependent variable is the hazard rate of an acquisition. It is based on the full sample of acquisitions by domestic and foreign acquirers in which post-acquisition stake is at least 50%. The dates for the domestic banking crises are from Laeven and Valencia (2010). Standard errors are reported in parentheses. a, b and c indicate statistical significance at the 1%, 5% and 10% levels, respectively. The coefficient estimates for the macroeconomic controls lagged four quarters are omitted from the table to conserve space.

estimates through the lens of the model. Note that a positive coefficient in the Cox model indicates a higher hazard, i.e., a higher risk of flipping.

(i) β_C: Domestic acquisitions undertaken during a banking crisis (compared to domestic acquisitions during normal times) have higher subsequent hazard rates, i.e., $\beta_C > 0$.

(ii) $\beta_C + \beta_{C,F}$: Foreign acquisitions undertaken during a banking crisis (compared to foreign acquisitions during normal times) have higher subsequent hazard rates, $\beta_C + \beta_{C,F} > 0$.

The results of the Cox regression estimation are shown in Table 4. Our first prediction is soundly rejected. The coefficient β_C is negative and statistically significant in all the samples. Recall that the prediction of $\beta_C > 0$ comes from a model of flipping that has no role for the intensive margin, but instead relies only on the extensive margin. But this empirical result fits well with our results for the size of domestic acquisitions, which show an increase in the size of domestic acquisitions. The absence of an intensive margin effect for flipping, which yields this counterfactual prediction, is the consequence of a theoretical simplification we consider acceptable because it preserves the key insight that flipping rates should converge. This point is explained shortly. The second prediction too is weakly rejected by the data. The point estimates in all the samples are negative, though they are insignificant in three out of the four samples (it is significant at 5% in the post-1997 Asia sample).

However, the model offers a nice interpretation of the two other empirical results. From the second row of coefficients in Table 4, $\beta_F < 0$ and significantly so in three out of the four samples. This indicates that foreign acquisitions in normal times have lower divestiture rates than domestic ones. Through the lens of our model, this suggests that foreign acquirers in Asia, on average, completed acquisitions that had higher technological synergies than domestic acquirers, a finding that is consistent with our earlier result that foreign acquisitions in Asia also resulted in larger stakes. Next, we find that $\beta_F + \beta_{C,F}$ is not significantly different from zero, which says that foreign and domestic acquisitions of the crisis cohort do not have different divestiture rates. These two findings together point to a convergence in divestiture rates between foreign and domestic acquisitions after an adverse financial shock: While the divestiture rates of foreign acquisition are significantly lower than domestic ones for the normal-time cohort, the two are statistically indistinguishable for the crisis cohort.

To summarize, we find strong empirical support for all our predictions regarding the fraction of a firm acquired. Our evidence on divestiture rates is mixed, but overall favors the mechanism highlighted by the model. In particular, we find evidence for convergence during financial crises of both the fraction acquired and divestiture rates between domestic and foreign acquisitions.[36]

4 Conclusion

This paper provides a simple analytical framework for assessing the effects of adverse aggregate financial shocks on the market for corporate control. It also provides evidence in favor of the implications of the model on the fraction of a firm acquired and post-acquisition divestiture rates. In particular, we document a novel"convergence" in the size and divestiture rates of foreign and domestic acquisitions in the aftermath of adverse aggregate financial shocks.

We model two kinds of acquiring firms: Those operating under financial constraints similar to target firms, and those that are financially unconstrained. Two main insights emerge from our

[36] A specification that controls for the fraction of the firm that is acquired or the fraction that is owned after a transaction yields very similar results. We prefer not to control for the fraction acquired in our baseline specification because our theory suggests that the size, like the duration, is a reflection of the underlying quality of the match between the acquiring and target firms. Thus using it as a control would introduce endogeneity. The estimate of the coefficient on the fraction acquired is negative and significant (i.e., larger stakes reduce the hazard of a divestiture), which is in line with the theory.

theoretical model. First, we show that adverse financial shocks have an aggregate "cleansing effect" in the market for corporate control, whereby only the most productive financially constrained firms perform acquisitions. Intuitively, larger and more productive firms are less subject to credit constraints and find it easier to raise financial resources to complete acquisitions. Second, we identify two margins along which this effect operates – an intensive margin (dominant for constrained acquirers) that works through a higher average productivity of acquirer-target matches, and an extensive margin (dominant for unconstrained acquirers) that operates thorough an increase in the proportion of fire-sale acquisitions in the economy. Interpreting constrained and unconstrained acquiring firms as domestic and foreign acquirers in a large dataset of emerging market acquisitions spanning the years 1990-2007, we provide evidence for the most distinctive prediction of the model: The convergence, in periods of aggregate financial distress, between constrained (domestic) and unconstrained (foreign) firms with regard to the fraction of a firm acquired and divestiture rates.

The paper has a rich set of firm level predictions regarding the joint distribution of productivity and financial liquidity for acquirers and targets that we do not test. Using firm level balance-sheet data from select EMEs to explore these predictions is a fruitful direction for future work. Also, while applied to the data in the context of EMEs, the model in this paper is equally applicable to acquisitions in developed markets, for which better quality and more extensive firm-level data exist, and where financial liquidity has also been shown to be important for the M&A process (see Almeida et al., 2011; Erel et al., 2014). The model can thus help guide future empirical work on the role of productivity and financial constraints in the market for corporate control in these countries. These and other investigations are left for future work.

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