Corporate Asset Purchases and Sales: Theory and Evidence

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Abstract

The purchase and sale of operating assets by firms created $162 billion for shareholders over the past 20 years. This paper characterizes the behavior of value-maximizing firms, which may invest in new capital, purchase existing assets or sell assets. This approach yields an endogenous selection model that links asset purchases and sales to fundamental properties of the firm. Empirical tests confirm the predictions of the model. In particular, return on assets and size strongly predict when firms purchase or sell assets, and the size of the transaction covaries with the marginal value of capital. These findings indicate that corporate asset purchases and sales are consistent with efficient investment decisions.

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Comments Welcome

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1 Introduction

Firms regularly trade product lines, operations in a specific locale, subsidiaries and other business units. Approximately \$100 billion worth of assets were transacted between firms in 2004. From 1985 onwards, these transactions, henceforth referred to as asset purchases and sales, lead to a net gain of \$162 billion for shareholders in buying and selling firms.[1] This suggests that asset sales improve the allocative efficiency of capital in the economy.

The paper presents and tests a model in which asset purchases and sales move capital from less productive to more productive firms. These transactions occur as part of the overall investment decisions of value-maximizing firms. The theoretical development produces an endogenous selection model that links asset purchases and sales to fundamentals of the firm. Specifically, the model implies the following: conditional on the firm's decision to either buy or sell assets, investment covaries with marginal Q; and both profitability and size determine whether the firm purchases or sells existing assets.

The empirical analysis builds on the theoretical results and employs logit regressions and selection models to test the predictions of the model. The logit regressions demonstrate that return on assets (RoA) and size strongly influence the choice of a firm to purchase or sell existing assets. Two-step estimation of the investment regressions for asset purchases and sales finds statistical significance for Tobin's Q. These findings indicate that efficient investment arguments have value for understanding asset purchases and sales.

The model builds on the Q-theoretic framework for investment.[2] Asset sales counteract allocative inefficiencies arising from heterogenous shocks to the productivity of firms. The key economic idea is that firms can disinvest by selling their assets to another firm, unlike standard models where firms can only disinvest by converting capital to the consumption good. This enables the model to capture asset purchases and sales between firms. Similar to Jovanovic and Rousseau (2002), the model presented in this paper argues that firms respond to external shocks by investing in new assets, purchasing assets from another firm, or selling assets to another firm. Asset purchases and sales create value by transferring assets from less profitable firms to more profitable firms.

The model economy consists of a large number of firms with heterogeneous profitability. Decreasing returns to scale lead managers to vary the size of the firm as profitability varies exogenously.

[1] In comparison, Moeller, Schlingemann, and Stulz (2005) reports that the total value creation to shareholders in mergers totaled \$55 billion from 1981 to 1998, and subsequently becomes negative.

[2] Lucas (1967), Hayashi (1982) and Abel (1983) develop the theoretical foundations of this class of models.

Asset purchases and sales occur at a discount to the price of new assets. Transaction costs keep firms from buying existing assets until profitability is sufficiently high. However, when a firm elects to purchase (sell) existing assets, the marginal value of capital inside the firm must equal the marginal cost (payoff) of the transaction. This yields a selection model where the quantity of assets traded depends on marginal Q, while the choice of purchasing or selling assets depends on firm characteristics.

The model identifies profitability and firm size as the key determinants of the choice of firms to buy and sell existing assets. Given size, optimal investment rises with profitability, and highly profitable firms will engage in asset purchases. Conversely, less profitable firms find it optimal to downsize and sell existing assets. Decreasing returns to scale increase the likelihood of an asset sale as size increases. Large firms also incorporate a given level of investment more easily due to a proportional adjustment costs of investment, and so engage in asset purchases more often than small firms.

Finally, the model also generates a selection effect on the realized stock returns of buyers and sellers of existing assets. While expected returns are constant, realized returns vary with the realized profitability shocks. As high profitability leads to a higher likelihood of an asset purchase, firms with high realized returns will purchase existing assets while firms with poor realized returns will sell assets.

The literature on mergers and diversification has identified potential inefficiencies in these transactions.[3] Asset purchases and sales lack the corporate control issues that often arise in mergers and acquisitions, and as a result are more likely to be driven purely by investment considerations. Comparing asset purchases and sales with mergers can help pinpoint the sources of inefficiencies often associated with mergers.

The empirical analysis employs a comprehensive set of asset purchases and sales obtained from the SDC Platinum mergers and acquisitions database.[4] This database contains information on asset purchases and sales by public firms, their subsidiaries and private firms. The data set provides extensive coverage on these transactions in the United States, recording more than 10000 completed

[3]Moeller, Schlingemann, and Stulz (2005), Berger and Ofek (1995), and Lamont and Polk (2002), among others, demonstrate value losses in these corporate transactions.

[4]Dong, Hirshleifer, Richardson, and Teoh (2005), Rhodes-Kropf, Robinson, and Viswanathan (2005) and Harford (2005) use this data to study mergers. Harford (2005) also demonstrates that asset purchases are high during merger waves. To the best of my knowledge, no other paper analyzes the asset purchase and sale component of the SDC data set in detail.

asset transactions involving public firms or their subsidiaries over the past 20 years. Prior studies on asset sales by Lang, Poulson, and Stulz (1995) and Bates (2005) analyze much smaller samples.

Logit regressions identify the primary determinants of the choice of firms to engage in asset purchases and sales. Consistent with the model, RoA strongly predicts the likelihood of a firm engaging in an asset purchase or sale. A unit standard deviation increase in RoA increases the probability of an asset purchase by 29% when compared to the mean firm. Similarly, a unit standard deviation decrease in RoA increases the probability of an asset sale by 35%. Also, as predicted by the model, large firms engage in asset purchases and sales much more than small firms. The selection models incorporate the information from the binary regressions and the first-order conditions for investment. Two-step estimation of the investment regressions yields a positive and statistically significant coefficient on Tobin's Q for both purchases and sales of existing assets.

An event study on the announcement of asset purchases and sales reveals that, on average, the stock price of both acquirers and sellers increases by 1% to 2% when a transaction is announced. The positive reaction supports an efficient investment argument and compares with a negative announcement effect for acquirers in mergers. Finally, portfolio analysis demonstrates that asset purchasers outperform the market in the three years prior to a transaction, while asset sellers underperform. A trading strategy consisting of buying firms that sell assets and holding them for three years yields a statistically insignificant annual excess return of 2% to 3%.

The remainder of the paper is organized as follows. Section 2 presents a review of the related literature. Section 3 presents the model and derives testable implications. Section 4 discusses the data, and documents some initial findings. Section 5 presents the empirical evidence on the model predictions. Section 6 analyzes the stock returns of participants in asset transactions and compares this to mergers, and Section 7 concludes.

2 Literature Review

The literature on asset purchases and sales is relatively sparse and focuses mainly on empirical analysis. Some early work by Alexander, Bensen, and Kampmeyer (1984), Jain (1985) and Hite, Owers, and Rogers (1987) find a positive stock market response to corporate asset transactions. Slovin, Sushka, and Poloncheck (2005) study the announcement effects on asset purchases and find that payments by equity result in higher abnormal returns for buyers than cash payments. Lang, Poulson, and Stulz (1995) argue that asset sales occur when they are the cheapest method of raising funds and find that the stock market discounts proceeds retained by the firm. John and Ofek (1995) study asset sales and find that operating performance improves after the sale, with focusing firms demonstrating the strongest improvement. Bates (2005) studies the allocation of proceeds from asset sales, and finds evidence of a trade-off between investment efficiencies and agency costs. Ray and Warusawitharana (2006) study the cross-sectional variation in the market reaction to asset purchases and sales. They find that while larger transactions lead to higher abnormal returns to buyers and sellers, buyer returns drop sharply when agency problems are high. Schlingemann, Stulz, and Walkling (2002) find that the liquidity of the market for assets is an important determinant of which divisions a firm chooses to sell. This paper contributes to the literature by studying both the purchase and sale decision of firms, and provides evidence that value-maximizing investment choices drive these decisions.

The transactions studied in this paper involve the exchange of operating units. At a more disaggregated level, Maksimovic and Phillips (2001) study plant sales between firms and find that transactions improve the allocation of resources, and are consistent with profit-maximizing behavior. They also document that the productivity of the plants improves after the transaction. Using plant-level data Maksimovic and Phillips (2002) show that growth and investment of conglomerates and focused firms are consistent with optimal behavior. They model the choice of firms to invest in their primary or secondary operating segments. This paper models the choice of firms to grow internally or through acquisitions, and finds that optimal investment decisions explain transactions in business units. Schoar (2002) documents that while acquired plants increase in productivity after the transaction, existing plants of the acquirer suffer from a loss in productivity. An overlapping generations model underpins Eisfeldt and Rampini (2004), which studies the fraction of used assets employed by firms.

3 Investment Model

The model adapts the Q-theoretic framework to study asset transactions.[5] The partial equilibrium analysis focuses on the behavior of firms, and assumes exogenous wages and constant expected returns. Decreasing returns to scale lead firms to grow and shrink as their profitability changes. Firms disinvest by selling their operating units to other firms. In response to improved profitability,

[5] An alternate view explored by Berk, Green, and Naik (1999) and Gomes, Kogan, and Zhang (2003) model firms as consisting of projects.

firms have the option of growing internally through new investment or externally through asset purchases. Firms with low profitability can improve their productivity of capital via asset sales. This leads to asset purchases and sales between firms.

The model economy consists of a large number of firms. Each firm produces an identical good, which can be used for consumption or new investment. The market for this good is perfectly competitive and its price is normalized to 1. Firms fund projects with equity, and there are no external costs to raising funds or paying dividends. Managers maximize the discounted present value of dividends. Each manager optimally selects investment and dividends to maximize value. The investment can be in new assets or existing assets, which must be purchased from another firm. A unit of new capital costs 1, while a unit of existing capital trades at price $p(< 1)$. Purchases of existing assets incur a concave transaction cost. Firms disinvest by selling assets to other firms at the price p.[6] Hennessy and Whited (2005) assume a discount on the resale value of capital only in the event of a financial distress. Firms face convex adjustment costs of investment, and once installed, both types of assets are equally productive. In contrast to Eisfeldt and Rampini (2004), purchased capital does not require additional maintenance costs in the future.

The timeline of events is as follows. At the beginning of the period, each firm draws its random productivity shock from the conditional distribution. Firms produce and sell their output using their current capital stock. At the end of the period, each firm decides how much to invest. Firms grow through either new investments or purchases of existing assets, and shrink through asset sales. Each firm returns the cash remaining after investment activity to shareholders as a dividend.[7] A firm may also elect to sell all its assets to other firms and exit.

Value maximizing decisions drive both asset purchases and sales. Decreasing returns to scale result in a one-to-one relationship between profitability and the optimal size of the firm. Firms that grew rapidly when profitability was high may find themselves with too many assets when their profitability declines. These firms respond by shrinking their size towards the optimal through asset sales. The asset sale improves their average productivity of capital. The buyers benefit by obtaining assets at a relative discount. These transactions create value by reallocating assets from less profitable firms to more profitable firms. The participants split the surplus generated by the transaction.

[6] Pulvino (1998) studies a sample of used airplane sales and finds no discount in good times and a lower resale value in industry recessions. Ramey and Shapiro (2001) use auction data from the liquidation of plants to measure the discount on used capital, and demonstrate a sharp discount on various components.

[7] The models assumes that in the event of a shortfall, the equity holder will provide the necessary financing.

3.1 Output and Profits

Each firm uses capital and labor as inputs, with a decreasing returns to scale production function given by

$$f(K_t, L_t, x_{i,t}) = e^{x_{i,t}} K_t^{\alpha_K} L_t^{\alpha_L}, \tag{1}$$

where $x_{i,t}$ denotes an idiosyncratic shock that determines output and α_K, α_L represent the capital and labor elasticities of production. Decreasing returns to scale imply that $\alpha_K + \alpha_L < 1$. The gross profits of the firm can be written as

$$F(K_t, L_t, x_{i,t}) = e^{x_{i,t}} K_t^{\alpha_K} L_t^{\alpha_L} - wL_t - c,$$

where w denotes the wage rate and c represents a per period fixed cost of production. Assuming that wages are exogenous, the labor choice can be substituted out and the firm's profitability written solely in terms of its capital stock.[8] This yields the following expression for profits

$$F(K_t, z_{i,t}) = e^{z_{i,t}} K_t^{\alpha} - c, \tag{2}$$

where $\alpha = \frac{\alpha_K}{1-\alpha_L}$ represents a scale parameter of production and $z_{i,t}$ represents the idiosyncratic profitability of the i^{th} firm, which inherits the properties of $x_{i,t}$. The decreasing returns to scale assumption implies that $\alpha < 1$. The profitability shocks follow a truncated $AR(1)$ process:

$$\begin{aligned} z^*_{i,t+1} &= (1-\rho)\theta + \rho z_{i,t} + \varepsilon_{i,t+1} \\ z_{i,t+1} &= \max(\underline{z}, \min(z^*_{i,t+1}, \overline{z})), \end{aligned} \tag{3}$$

where $\varepsilon_{i,t+1}$ follows a truncated normal distribution with standard deviation σ_z.[9] The truncation of the distribution for profitability limits the optimal capital stock to an interval $[0, \overline{K}]$ and ensures compactness of the choice set. The parameters ρ and θ represent the autoregressive coefficient and mean of profitability. These parameters do not vary across firms. Thus, profitability shocks and endogenous differences in capital drive all heterogeneity across firms.

3.2 Firm Growth

Firms may invest in new or existing capital. Though implicit, changes in capital lead to changes in the labor inputs of the firm. An asset purchase entails a change in both the capital stock

[8]The optimal labor choice is given by $L_t = \left[\frac{e^{x_{i,t}} \alpha_L K_t^{\alpha_K}}{w}\right]^{1/(1-\alpha_L)}$.

[9]The truncation implies that $z_{i,t+1} \in [\underline{z}, \overline{z}]$.

and the labor employed by the buyer and the seller. This corresponds to the data, as most asset purchases involve the transfer of both capital and labor from one firm to another. Once acquired, both new and acquired capital are equally productive, with their profitability level determined by $z_{i,t}$. Denote the quantity of new investment and existing capital traded by N and M, respectively. The current capital stock depreciates linearly at the rate δ. The law of motion for capital can be written as

$$K_{t+1} = K_t(1-\delta) + M_t + N_t. \tag{4}$$

The relative price of existing capital p is assumed to be a constant. This assumption can be justified by thinking of p as being determined by market clearing conditions on aggregate demand and supply of existing assets.[10] The model differentiates new and existing capital through their transaction costs as well as their relative prices. Acquirers of existing capital pay a transaction cost of $\Psi(M) = aM^{\theta}$. The transaction cost function displays economies of scale ($\theta < 1$); the unit transaction cost declines with the size of the purchase. In addition, constant returns to scale adjustment costs apply to total investment. Dropping the time subscripts for simplicity, the following equation gives the total cash outlay of investing in M and N of existing and new capital:

$$\begin{aligned} C(M,N,K) &= pM + N + \Phi(I,K) + \Psi(M)\cdot \mathbf{1}_{(M>0)} \qquad (5) \\ I &= M + N \\ N &\geq 0, \end{aligned}$$

where I and K denote total investment and the current capital stock, and M represents asset purchases or sales. $\Phi(I,K)$ denotes the convex adjustment cost of investment. In the model, all disinvestment occurs at the unit price p. Therefore, any disinvestment would be reflected in a negative value for M, and a non-negativity constraint affects new investment. The adjustment costs restrain small firms with large positive shocks from growing explosively; this follows Lucas (1967). The adjustment cost enters the model as a current period loss in output. This can be thought of as disruptions to production caused by the installation of the new capital.

A key assumption is that there are concave transaction costs of purchasing capital from other firms. A firm that seeks to expand through an asset purchase would need to spend considerable resources and time looking for a suitable target. There could also be legal and administrative costs of buying assets as well as possible restructuring costs associated with adapting the purchased

[10] Allowing p to vary over time does not materially impact the results and complicates the firm problem considerably.

units with the firm. $\Psi(M)$ captures these costs and allows for larger transactions to have a lower average cost than smaller transactions. An alternative model with fixed and variable transaction cost components would imply similar investment behavior. The transaction costs involved in an asset purchase lead to lumpy investment in the existing assets market, with firms seeking to buy existing capital only when their total investment exceeds a threshold.

3.3 Value of the Firm

The firm pays out the cash remaining after investment as a dividend:

$$D(M, N, K, z) = F(K, z) - C(M, N, K). \tag{6}$$

The discounted present value of future dividends yields the value of the firm:

$$V(K, z) = \max_{\{D,K\},T} \sum_{t=0}^{T} \beta^t D_t + \beta^T p(1-\delta) K_T,$$

where $T(\geq 1)$ represents a stopping time at which the firm will exit by selling its stock of capital. Alternatively, the value of the firm can be written as the solution to a dynamic programming problem. The cum-dividend value of the firm solves the following Bellman equation:

$$\begin{aligned} V(K, z) &= \max_{K',M,N} F(K, z) - C(M, N, K) + \beta E\left[V(K', z')|z\right] \\ K' &= K(1-\delta) + M + N \\ \text{s.t. } N &\geq 0. \end{aligned} \tag{7}$$

The analysis can be simplified by separating the problem into a dynamic and static component. Conditional on a desired level of total investment, the allocation decision between new and existing capital can be solved as a static problem. Given the optimal allocation decision, the dynamic programming problem can be solved in terms of total investment:

$$\begin{aligned} V(K, z) &= \max_{K',I} F(K, z) - C^*(I, K) + \beta E\left[V(K', z')|z\right] \\ K' &= K(1-\delta) + I, \end{aligned} \tag{8}$$

where $C^*(I, K)$ represents the minimum cash outlay for a given level of investment. This is obtained as the solution to the following static problem:

$$\begin{aligned} C^*(I, K) &= \min_{M,N} C(M, N, K) \\ \text{s.t. } M + N &= I \\ N &\geq 0. \end{aligned} \tag{9}$$

The following proposition presents the solution to the allocation decision given a desired level of total investment.

Proposition 1 *There exists a threshold* $\tilde{I} = \left[\frac{a}{1-p}\right]^{1/(1-\theta)}$ *below which all investment consists of new investment and above which all investment consists of purchased existing capital*

$$\begin{aligned} I &= N \ \textit{if} \qquad 0 \leq I \leq \tilde{I} \\ &= M \ \textit{if} \qquad I < 0 \ \textit{or} \ I > \tilde{I}. \end{aligned}$$

Corollary *The investment cost function* $C^*(I, K)$ *obtained by substitution of the above allocation choice is continuous.*

Proof. Appendix A. ■

The concave transaction cost of purchasing existing capital and the relative price of existing assets impact the optimal allocation choice. For low levels of investment, all investment consists of new capital. Beyond the threshold $\tilde{I}$, the cost saving from purchasing existing assets exceeds the transaction cost Ψ. Therefore, firms that grow more than $\tilde{I}$ will do so by purchasing existing assets from another firm. Substitution of the optimal allocation choices to the total cost of investment $C(M, N, K)$ yields the minimum cash outflow for that level of investment $C^*(I, K)$. The Bellman equation can be written solely in terms of total investment and future capital by using the solution to the allocation problem between new and existing capital given a level of total investment. This formulation reduces the dimensionality of the problem, and simplifies the analysis. The following proposition establishes the uniqueness and monotonicity of the solution to the dynamic programming problem (8).

Proposition 2 *There exists a unique function* $V(K, z)$ *that solves for the current value of the firm.* $V(K, z)$ *is continuous and strictly increasing in its components.*

Proof. Appendix A. ■

The derivation of the comparative statics of the model requires the solution $V(K, z)$ to be differentiable. As the investment cost function $C^*(I, K)$ contains kinks at $I = 0$ and $I = \tilde{I}$, the value function may not be differentiable everywhere. The following proposition establishes differentiability for points in the interior of the regions where the firm purchases existing assets, invests in new assets or sells assets.

Proposition 3 *For values of K and z that are in the interior of the regions where the firm buys existing assets, invests in new capital or sells assets, the value function $V(K,z)$ is concave and differentiable with respect to K, with the derivative given by*

$$V_K(K,z) = \alpha e^z K^{\alpha-1} - \frac{\partial C^*(I,K)}{\partial K} + \frac{\partial C^*(I,K)}{\partial I}(1-\delta).$$

Proof. Appendix A. ■

3.4 Asset Purchases and Sales

This section establishes some characteristics of firms that engage in asset purchases and sales, and derives testable implications for the subsequent empirical analysis. The optimal total investment varies with the current size K and profitability z of the firm. The following first-order condition solves for the optimal I except when $I = 0$ or $I = \tilde{I}$:

$$\frac{\partial C^*(I,K)}{\partial I} = \frac{\partial}{\partial K'}\left(\beta E\left[V(K',z')|z\right]\right). \tag{10}$$

Given a level of total investment, the solution to the allocation problem given in proposition 1 determines whether the firm acquires existing assets, invests in new capital or sells assets. Firms will buy existing assets when desired investment $I(K,z) > \tilde{I}$, invest in new capital when $0 < I(K,z) \leq \tilde{I}$, and sell assets when $I(K,z) < 0$.

The first-order conditions for investment can be simplified by adding more structure to the adjustment cost of investment. Assume a standard quadratic adjustment cost function for $\Phi(I,K) = \lambda\frac{I^2}{2K}$. Denote the marginal value of capital inside the firm by $q = \frac{\partial}{\partial K'}\left(\beta E\left[V(K',z')|z\right]\right)$. Simplification of (10) implies that for firms that purchase existing assets,

$$p + a\theta I^{\theta-1} + \lambda\frac{I}{K} = q. \tag{11}$$

As the above condition holds when $I(K,z) > \tilde{I}$, this system can be estimated using the two-stage estimator proposed by Heckman (1974). A similar selection model holds for firms that sell assets. When $I(K,z) < 0$, the first-order conditions for asset sales yield

$$p + \lambda\frac{I}{K} = q. \tag{12}$$

A firm elects to engage in an asset purchase or sale depending on the state variables K and z. The following proposition links profitability to asset purchase and sale activity.

Proposition 4 *For a fixed size K, there exists a profitability threshold $z_a(K)$ above which the firm purchases assets from another, and a profitability threshold $z_s(K)$ below which the firm sells assets.*

Proof. Appendix A. ■

The persistence in profitability z and decreasing marginal productivity of capital results in a monotone relationship between the optimal size of the firm and z. An increase in profitability leads to an increase in the optimal size of the firm. For a firm of given size K, investment increases (decreases) as z increases (decreases). As firms acquire existing assets when $I > \tilde{I}$, the most profitable firms will engage in asset purchases. Similar reasoning implies that the least profitable firms will downsize through an asset sale.

Figure 1 plots the optimal investment of a firm with fixed size K as a function of profitability z. The figure demonstrates the monotonic increase of investment with profitability. The minimum cost function for investment $C^*(I, K)$ contains a kink at $\tilde{I}$. This kink influences investment activity by introducing a discontinuity in the first-order condition (10). The jump in the marginal investment cost function at $\tilde{I}$ leads to a jump in the policy function. Therefore, firms that engage in asset purchases grow much more than firms that do not. The wedge between the purchase cost of new assets and the resale value of capital leads to an inactivity region for investment as demonstrated by Abel and Eberly (1994).

Size, in addition to profitability, determines the likelihood of a firm engaging in an asset purchase or sale. The following proposition demonstrates that larger firms are more likely to sell assets.

Proposition 5 *For a given level of profitability z, there exists a size threshold $K_s(z)$ above which the firm sells assets.*

Proof. Appendix A. ■

As the optimal size of the firm decreases when profitability decreases, some firms that suffer a negative profitability shock will find themselves with more assets than optimal. These firms will sell assets to reach the optimal size. The asset sale improves the marginal productivity of the remaining assets of the firm. Large firms will be more likely to find themselves with too many assets than optimal, and therefore will be more likely to engage in asset sales.

For most parameter values, the probability of an asset purchase will increase with firm size.[11] For a given level of investment I, the constant returns to scale adjustment cost of investment lowers the investment cost as the size of the firm increases. This captures the intuition that larger firms

[11] The result will fail for values of $\tilde{I}$ close to 0, as almost all growth will then occur through asset purchases.

integrate new assets more easily than smaller firms. As size decreases, the cost of investing more than $\tilde{I}$ increases, thereby lowering the likelihood of an asset purchase.

The model also provides intuition linking prior stock returns to asset purchase and sale activity. The value of the firm's equity increases with profitability z. Though expected returns do not vary across firms, realized returns will vary with the realized values of idiosyncratic profitability. Positive shocks to profitability result in high realized returns, and negative shocks result in low realized returns. As highly profitable firms will be most likely to acquire assets, these firms will generally have had strong realized returns in the periods prior to the acquisition. Similarly, firms that sell assets will tend to do so after a period of poor returns. The next section numerically solves the model and generates a simulated panel data set of firms. The analysis of the simulated data highlights the theoretical predictions of the model.

3.5 Calibration and Simulation

The study of simulated data sets follows a burgeoning literature.[12] This approach is particularly beneficial when issues such as endogeneity, multi-collinearity and measurement errors cause problems for statistical analysis. The simulation method also helps demonstrate links between stock returns and corporate policies. The simulation demonstrates that on average, firms with high realized returns will purchase assets from firms with low realized returns.

The calibration exercise fits the model parameters to their empirical counterparts at an annual frequency. The calibration focuses on generating a plausible panel of firm characteristics. The discount factor in the simulated economy $\beta = 0.95$. The decreasing returns to scale parameter $\alpha = .9$ follows Gomes (2001) and maps to capital and labor elasticities in the economy of 2/3 and 30% respectively. The depreciation rate of 12% corresponds to the rate of new investment in the economy. The study parametrizes the adjustment costs as $\Phi(I, K) = \frac{\lambda I^2}{2K}$. Whited (1992) estimates structural investment models and obtains values for the adjustment cost parameter λ of .5 to 2. Hall (2004) uses industry level data and obtains an estimate for λ close to 0. The study uses a value of $\lambda = 1$. The parameters on the transition equation determine the cross-sectional and time series properties of profitability. The calibrated parameters imply an autocorrelation coefficient of .85 and unconditional standard deviation of 15% for RoA.

The calibration of the fixed transaction cost of asset purchases selects a value to match the

[12] Strebulaev (2005), Gomes and Livdan (2004), and Colak and Whited (2005), among others, use simulated data sets to study firm behavior.

observed frequency of asset purchases and sales in the sample. The chosen values of $a = 0.02$ and $\theta = 0$ represent approximately 8% of the annual profits of the median firm. The relative price of purchased capital p is set such that total aggregate asset purchases equal aggregate asset sales. This corresponds to the price that clears the market for corporate assets in the stationary state of the economy. The calibrated value of p equals 0.98. Empirically, this measures the discount at which firms transact operating units. Pulvino (1998) provides the closest empirical counterpart to this value. He studies the discount on used airplane sales, and finds no discount in good times, and a mean discount of 14% in bad times. While the calibrated discount may appear low, note that asset purchases involve the purchase of whole operating units, unlike used assets, which may require costly modifications before they can be productively used in the firm. A modification of the calibration such that a takes a higher value would lead to a lower value for p and fewer transactions. A lower value of p does not significantly impact the results of the logit regression and the pattern of returns for buyers and sellers.

Appendix B provides details on the numerical solution of the value function and the characterization of the optimal investment policies. Figure 2 plots the regions in which the firm buys and sells assets. As the model predicts, highly profitable firms engage in asset purchases, and firms with low profitability sell assets. The profitability level below which the firm sells assets increases with size. As firms become larger, the likelihood that their size is greater than the optimal for a given profitability level increases, leading to an increased likelihood of an asset sale. The adjustment costs deter small firms from asset purchases, as the cost of investing more than $\tilde{I}$ increases as K decreases. The next section discusses the sample employed to analyze the empirical predictions of the model.

4 Data

The data on asset purchases and sales is obtained from the SDC Platinum mergers and acquisitions database. Thomson Financial Services Ltd. maintains the data set, which contains detailed information on purchases and sales of operating units by firms. The data categorizes each transaction as a merger, an acquisition, an asset acquisition or an acquisition of certain assets. The sample of asset purchases and sales in the study consists of transactions listed in the last two categories. The value of the transaction is available for about half of the sample. The selected sample consists of all buyers and sellers from 1985 to the 3$^{\text{rd}}$ quarter of 2005, who are either publicly listed or subsidiaries of listed companies.[13] The sample includes transactions where one of the counterparties is a private firm. The selection scheme yields a comprehensive list of firms who have elected to grow or shrink via asset purchases and sales.

The Compustat annual files and the CRSP monthly stock files provide information on the operating performance and market valuation of firms. These are linked to the SDC sample via the CUSIP numbers of the participants, or for transactions by subsidiaries, the CUSIP numbers of their ultimate parents. The sample excludes all financial firms and regulated utilities, as their characteristics differ systematically from those of other firms. This yields a panel of firms that can be used to study the determinants of firms' decisions to buy or sell business units. The median transaction size in the sample is $16 million. The study constructs the following independent variables at the end of each fiscal year: Return on assets equals EBIDTA scaled by book assets at the beginning of the period; size is the log of the book value of assets; Tobin's Q is the ratio of market value of assets[14] to the book value of assets; leverage is the book value of debt divided by book value of debt plus equity; sales growth measures the growth in net sales over the previous year; PPE growth measures the change in net plant, property and equipment over the previous fiscal year; stock return measures the return over the fiscal year; and cash is the value of cash and short-term instruments scaled by book assets. Sales growth and PPE growth are adjusted for inflation using the deflator for gross private investment.

Asset purchases and sales reflect choices made by management on the boundary of the firm. They provide a window to study the growth decisions of managers, and differentiate between competing hypotheses on investment. The empirical analysis focuses on testing the first-order conditions given in (11) and (12), conditional on the selection criteria identified in propositions 4 and 5. Logit regressions on the choice of firms to buy and sell assets identify the primary determinants of these decisions. The selection models study the relationship between (dis)investment and Tobin's Q, conditional on a firm engaging in an asset purchase or sale. In addition, analysis of the stock returns of firms that buy or sell assets, and logit regressions on merger participants enable the comparison of asset transactions and mergers. The next section compares the characteristics of buyers and sellers with the characteristics of other firms.

[13] Discussions with an SDC employee verified that the data set provides comprehensive coverage on such transactions from 1985 onwards.

[14] Market value of assets is defined as market value of equity + book assets - book equity - deferred taxation.

4.1 Summary Statistics

Table 1 reports sample statistics for all firms listed on Compustat from 1984 to 2004, and for the subsample of buyers and sellers of existing assets. On average, 10% of all listed firms will buy assets from another firm, and 6% of firms will sell. As the model predicts, buyers tend to have a higher return on assets than other firms. This suggests that managers of firms with high profitability elect to grow through an asset purchase. Sellers have a higher mean and lower median return on assets than other firms. Both buyers and sellers are larger than the average firm. Large firms will be more likely to have exhausted their internal growth opportunities and may seek to expand through an acquisition. A large firm will also find it easier to integrate an acquired unit. On the other hand, a troubled large firm can improve profitability by selling an underperforming unit to another firm.

The market values buyers more and sellers less than average firms when market-to-book ratios and Tobin's Q values are used as metrics. Acquiring firms may exercise their growth options through the purchase of relatively inefficient units of other firms. Acquiring firms have been growing rapidly in the year prior to the transaction. They exhibit significantly higher sales, and net plant, property and equipment growth than the average firm. Sellers, on the other hand, demonstrate anemic growth prior to the transaction.

Selling firms demonstrate some evidence of financial distress. Both buyers and sellers have less cash than average firms, but this is more pronounced for sellers. Some selling firms may face liquidity problems, and sell units to raise cash. This would be consistent with the arguments of Lang, Poulson, and Stulz (1995). Sellers also have higher leverage than average firms, increasing the potential costs of obtaining new funds in the bond market. The next section employs this data set to test the predictions of the theoretical model.

5 Evidence on Asset Purchases and Sales

This section tests the predictions of the investment model on asset purchases and sales. The empirical implementation first analyzes the determinants of the choice of a firm to engage in an asset purchase or sale, and then tests the selection model for investment. Discrete choice models provide a natural method for understanding the characteristics of buyers and sellers. The model predicts a monotone ordering between profitability and the choice of a firm to sell assets, invest in new capital or buy existing assets. The next section tests this prediction using an ordered logit model.

5.1 Ordered Logit Regressions

Define $y_{i,t+1}$ as a variable that takes values of -1, 0 or 1 depending on whether the i^{th} firm sells existing assets, neither buys nor sells assets or buys existing assets from another firm during the $t+1$ fiscal year. The ordered logit model estimates the following equation:

$$\begin{aligned} y_{i,t+1} &= 1 \quad \text{if} \quad I(K_{i,t}, z_{i,t}) > \tilde{I} \\ y_{i,t+1} &= 0 \quad \text{if} \quad 0 \leq I(K_{i,t}, z_{i,t}) \leq \tilde{I} \\ y_{i,t+1} &= -1 \quad \text{if} \quad I(K_{i,t}, z_{i,t}) < 0 \\ I(K, z) &= \beta_0 + \beta_1 z + \beta_2 K + \epsilon, \end{aligned}$$

where ϵ denotes an approximation error. The logit regression imposes the additional distributional assumption that the cumulative distribution function of the error term $\epsilon_{i,t+1}$ follows a logistic distribution:

$$F(\epsilon_{i,t+1}) = \frac{\exp(\epsilon_{i,t+1})}{1 + \exp(\epsilon_{i,t+1})}.$$

The empirical tests employ RoA as a proxy for profitability, the log of book assets as a measure of size, and use leverage, cash, stock return, sales growth and PPE growth as control variables.

Table 2 reports the results from estimation of the above ordered logit model. Standard errors are reported in parentheses. The analysis includes year and industry dummies and the standard error computation clusters by firms to adjust for within-firm serial correlation. The table also reports the odds ratios corresponding to the given parameter estimates. The odds ratios represent the relative increase in the odds in favor of an asset purchase relative to not purchasing assets for a unit standard deviation increase in the independent variable. The latter half of the table reports the results from the same model where the dependent variable takes values of -1 and 1 only when SDC reports a deal value for the asset sale or purchase. This focuses the analysis on larger and presumably more important transactions.

The regression coefficients of all covariates except cash do not vary much across either of the two specifications for the dependent variable. RoA strongly predicts the decision of the firm to buy or sell assets. A unit standard deviation increase in RoA increases the odds in favor of an asset purchase, and decreases the odds in favor of a sale by 25%. This agrees with the prediction of the model that high z firms would buy existing assets and low z firms would sell assets. While RoA has the strongest impact on the relative odds of a transaction, the control variables also influence the decision to engage in an asset purchase or sale. The positive and significant coefficient on realized stock return confirms the selection argument that firms with strong returns will buy assets from firms with poor returns. Similarly, the coefficients on sales growth and PPE growth demonstrate that buyers have had strong growth while sellers have had weak growth.

The significant coefficients on cash and leverage demonstrate that the model does not capture all the determinants of the choice of a firm to engage in an asset purchase or sale. Purchasers have lower leverage and sellers higher leverage than other firms, indicating that high leverage can deter purchases through reduced managerial flexibility. The positive coefficient on the stock of liquid assets demonstrates that financing considerations influence asset purchase or sale decisions. The ordered logit regressions implicitly assume that the independent variables have the same impact on the asset purchase and sale decisions. The next section reports the results of multinomial regressions on the same data set. This specification allows the covariates to have a different impact on the purchase and sale decisions, and helps clarify the avenues through which the covariates affect the purchase and sale decisions.

5.2 Multinomial Logit Regressions

The multinomial regressions model the choice of a firm purchasing existing assets versus investing in new capital conditional on not selling assets as following a standard logit model. The probability model specifies that

$$\text{Prob}(y_{i,t+1} = 1 | y_{i,t+1} \geq 0) = \frac{\exp(\beta_1 x_{i,t})}{1 + \exp(\beta_1 x_{i,t})}.$$

Where $x_{i,t}$ denotes a vector of predetermined covariates. A similar probabilistic model yields the conditional probability of a firm selling assets given that it does not buy assets. The empirical implementation includes the predetermined covariates in the ordered logit regression.

Table 3 reports the results from estimation of the above multinomial logit model for asset purchases and sales. Standard errors are reported in parentheses. The analysis includes year and industry dummies, and the clustered standard errors adjust for within-firm serial correlation. The table also reports the odds ratios corresponding to the given parameter estimates. The first half of the table reports the coefficients for asset purchases, while the latter half reports the results for asset sales. The simultaneous estimation of the two conditional probability models for asset purchases and sales yields both sets of coefficients.

The results for the purchase decision support the predictions of the model. RoA and size positively predict the likelihood of a firm engaging in an asset purchase, and they have a much larger impact on the decision than the control variables. A unit standard deviation increase in RoA increases the odds in favor of a purchase by 29%. As in the ordered regressions, buyers display strong returns and robust growth prior to the transaction. This accords with the intuition of the selection argument. The significant and negative coefficient on leverage indicates that highly levered firms buy existing assets less frequently than firms with low leverage. The negative and insignificant coefficient on cash rejects the empire-building hypothesis that firms with surplus cash grow by asset purchases. These results demonstrate that the efficient investment model captures the bulk of the asset purchases in the sample.

The results for the sale of existing assets also confirm the predictions of the model. RoA enters the predictive equation with a significant and negative coefficient indicating that low profitability induces firms to sell assets. A unit standard deviation increase in profitability decreases the odds in favor of an asset sale by 35%. Size also has a strong impact on the choice of a firm to sell assets, with large firms selling assets more frequently than small firms. In contrast to buyers, firms that sell assets demonstrate low realized returns, and poor sales and PPE growth prior to the asset sale. The level of liquid assets strongly impacts the choice of a firm to sell assets. A unit standard deviation increase in cash stocks decreases the odds in favor of an asset sale by 31%. This confirms the findings of Lang, Poulson, and Stulz (1995) that firms in financial distress sell assets to raise funds. Evidence of financial distress does not imply that agency considerations lead to asset sales, as financing difficulties may coexist with efficient investment. The positive coefficient on leverage provides further evidence in support of financial difficulties leading to asset sales.

Unreported results focusing only on the sample for which SDC reports deal values generate similar coefficients. However, the coefficient on cash for asset purchases changes to a positive and statistically significant value. This suggests that agency considerations influence large transactions more than small transactions. The odds ratios of RoA and size still dwarf that of cash, indicating that the efficient investment model captures the bulk of the observed variation in asset purchase and sale activity.

The logit regressions identify the primary determinant of the choice of a firm to buy or sell existing assets. Given an asset purchase or sale, the model also links the level of investment to the marginal value of capital inside the firm. The next section employs selection models to test this prediction.

5.3 Selection Models

Conditional on a firm engaging in an asset purchase, the first-order conditions given in (11) link investment to the marginal Q of the firm. The empirical implementation proxies for marginal Q with average Q. Assuming that the transaction cost of asset purchases is approximately linear in the relevant region, the first order condition for asset purchases can be written as

$$\begin{aligned} \frac{I}{K} &= -\frac{p + a\theta}{\lambda} + \frac{1}{\lambda}Q + \epsilon \\ \text{if} \quad I(K, z) &\geq \tilde{I}. \end{aligned}$$

Linearization of the selection equation provides a selection model, which can be estimated using the two-step estimator developed in Heckman (1974). The two-step approach first estimates the selection equation and then estimates the investment equation with the inverse Mill's ratio from the selection model as an additional covariate. The empirical implementation of the selection model focuses only on the transactions for which SDC reports a deal value. The value of the transaction proxies for I in the investment equation. A similar model applies to the investment decisions of firms that sell assets.

Table 4 reports the results from estimation of the investment models for the purchase and sale of existing assets.[15] Standard errors are reported in parentheses. The specification for the selection and investment equations include industry and year dummies. Following the investment literature, column (2) reports the results using RoA as another predictive variable. The coefficients for the selection equations are available from the author, and once adjusted for a scaling factor to account for the use of a probit model, closely match the results of the multinomial regressions.

The positive and significant coefficient on Tobin's Q for both asset purchases and sales supports the main prediction of the model: the transaction size covaries with firm Q. This indicates that firms engage in asset transactions in response to changes in the value of capital inside the firm. Tobin's Q has a bigger economic impact on asset purchases than on asset sales. This may be related to the influence of financial distress on asset sales. Typical of investment regressions, cash flow as measured by RoA has a positive and statistically significant coefficient. Following Fazzari, Hubbard, and Petersen (1988), this has been interpreted as evidence of financial constraints of firms. However, recent work by Erickson and Whited (2000) and Hennessy, Levy, and Whited (2005) have argued that this is driven by measurement error and model misspecification. Cooper and Ejarque (2003) demonstrate that when firms have market power, investment regressions will

[15] Hovakimian and Titman (2003) study the relationship between asset sales and cash flow regressions.

lead to significant and positive coefficients on cash flow. In the context of asset purchases, a financial constraints explanation would be less plausible, as firms that buy assets tend to have had strong profitability and growth.

The inverse of the coefficients on Q provides an estimate for the marginal adjustment cost parameter λ. The results indicate implausibly high adjustment cost coefficients. The comparison on the coefficients for asset purchases and sales indicates that the costs of selling assets may be greater than that of buying assets. This supports the assumptions of asymmetric adjustment costs employed by Zhang (2005) and others. A richer model that explicitly accounts for leverage, costly external finance, and employs a better estimate of the marginal value of capital may be required to obtain a better estimate of the resale value of assets. The next section presents the results of some robustness checks on the empirical tests of the model.

5.4 Robustness

The panel nature of the sample provides some challenges to the statistical analysis. A fixed-effects logit regression estimates a binary logit model for asset purchases only on the subsample of firms that either purchased or sold assets in at least one year. This allows for a firm-level fixed effect in the estimation. The estimates of fixed-effects logit models for asset purchases and sales generate similar results for RoA and size to those reported in the multinomial regressions. As demonstrated by Petersen (2005), the correlation pattern in the error terms may significantly influence the estimated standard errors. The study reports standard errors obtained by clustering the data at the firm level. This allows for a constant serial correlation term for the observations of the same firm across different years. An alternative approach using the procedure suggested in Fama and MacBeth (1973) yields similar results for the ordered and multinomial logit regressions. Such an approach would generate standard errors robust to cross correlation across firms in a given year. The study reports clustered estimates, as firm-level factors would be more likely to influence asset purchase and sale decisions than macro variables.

The significant and positive coefficient on RoA can be interpreted in favor of an agency hypothesis. The agency hypothesis argues that managers derive benefits from increased size, and use free cash flow to grow via asset purchases. High return on assets indicates increased cash flow to the firm, and managers with misaligned incentives use the excess cash to grow the firm and increase their private benefits. Proposition 4 demonstrates that value-maximizing managers respond to increased profitability by engaging in asset purchases. The replication of the above logit regressions with an additional free cash flow measure helps separate the agency and efficiency interpretations. The free cash flow variable measures net operating cash flow minus cash flow for investing activities, divided by book assets at the beginning of the fiscal year.[16] The difference between earnings and cash flow is greater for growth firms and firms in the service industry. The inclusion of the free cash flow measure does not change the coefficient on RoA, and the coefficient on free cash flow itself is negative and statistically significant. This provides evidence that the relationship between RoA and asset purchases is not driven by agency considerations.

6 Comparison of Asset Transactions and Mergers

The results in the previous section demonstrate that efficiency considerations drive asset purchases and sales. Many authors have argued that valuation and agency considerations influence merger activity.[17] Comparison of the evidence on mergers and asset transactions may help identify the source of potential inefficiencies in merger. Mergers and asset transactions both involve the exchange of corporate assets from one firm to another. Despite this fundamental similarity, important differences remain between these transactions. Asset purchases and sales do not typically substantially change the assets under the control of managers. On the other hand, mergers will substantially influence the tasks of senior management, with target managers losing their jobs in some cases. Therefore, corporate control issues may have a greater impact on potential mergers than on asset transactions. The next section compares the aggregate movement in mergers and asset purchases and sales.

6.1 Aggregate Deal Values

Mergers activity tends to cluster across time and industry.[18] Eisfeldt and Rampini (2005) study the aggregate reallocation of capital between firms and demonstrate a link between capital market

[16] Net operating cash flow and net investing cash flow are given by Compustat variables 308 and 311, respectively. Free cash flow = data308 + data311. Free cash flow measures the cash generated from operations net of investment activity. These variables are available from 1987 onwards.

[17] Jensen (1986) and Roll (1986) argue that agency considerations drive mergers. Moeller, Schlingemann, and Stulz (2005) show that mergers may lead to substantial value losses for acquirers. Shleifer and Vishny (2003) and Rhodes-Kropf, Robinson, and Viswanathan (2005) provide theoretical and empirical evidence linking market valuations to mergers.

[18] Harford (2005), Mitchell and Mulherin (1996), and Rhodes-Kropf, Robinson, and Viswanathan (2005) present evidence on the clustering of mergers.

liquidity and reallocation of assets. Asset purchases and sales may act as complements to mergers if they are both driven by related economic forces, or they may act as substitutes if firms switch from one to the other depending on market conditions. Figure 3 demonstrates that aggregate merger and asset purchase activity move together. The correlation coefficient between changes to the annual deal value of mergers and asset purchases is 0.59. This suggests that firms view mergers and asset purchases as complementary means of growth. The level of activity displays an upward trend over the sample. Improvements in the quality of information about firms and reduced transaction costs can lead to an upward trend in activity. Similar to merger activity, the dollar value and the number of asset transactions increase in good times and decrease in recessions. This observation accords with the intuition provided by Shleifer and Vishny (1992): in bad times firms find it difficult to sell assets, as the pool of prospective buyers decline. The next section uses the announcement date information in the SDC Platinum database to perform an event study on asset purchases and sales.

6.2 Announcement Effects of Asset Purchases and Sales

The market reaction to the announcement of a corporate action provides evidence on whether the market considers that action to have a positive or negative impact on the firm. The merger literature has observed big positive abnormal returns for targets and negative abnormal returns for sellers. Table 5 presents the results of an event study for buyers and sellers in asset transactions. The table reports the mean abnormal return over a three-day window around the announcement date. A three-day window captures the effects of information leakages prior to the announcement and accounts for announcements made after the close of trade. Inaccuracies in the announcement date add noise to the observed results, thereby reducing the power of statistical tests. The results reported in the study replicate those of Hite, Owers, and Rogers (1987) using a more recent and larger sample. The table reports abnormal returns using the CAPM as a benchmark.[19] The test statistics are generated by standardizing the abnormal return of each security by its own standard deviation, and computing means of standardized abnormal returns across firms in the sample. This method follows Brown and Warner (1985) and is widely used in the literature.

The market responds positively to the announcement of asset purchases and sales. In contrast to mergers, both buyers and sellers demonstrate positive and statistically significant abnormal returns around the dates of the announcement. The positive announcement effect for buyers suggests that

[19] Other benchmarks yield similar results.

the market treats asset purchases as value-creating transactions. The effect is slightly greater for selling firms and indicates that the market perceives the announced sale as positive for the future of the company. As the model assumes full information and rational expectations, it does not make any predictions about announcement effects. The positive abnormal returns provide *prima facie* evidence that the market does not view these transactions as inefficient and value-destroying. The analysis of stock returns prior to and following an asset purchase or sale can provide evidence on the selection argument for stock returns, and evaluate the long-term impact of asset transactions.

6.3 Comparison of Stock Returns

Table 6 presents the summary statistics of the returns of portfolios of firms that engaged in asset purchases or sales. In a given month, each portfolio includes a firm if the firm participated in an asset purchase or sale within three years of that month. For example, the portfolio of buyers prior to a transaction includes three years of monthly returns prior to the transaction for each buyer. The monthly portfolio return is constructed using equal weights across firms.[20]

Panel A reports the excess returns on the portfolio of buyers before and after a transaction, and the portfolio of sellers before and after a transaction. Before an asset purchase, the portfolio of buyers generates an excess return of 11%, and the portfolio of sellers generates an excess return of -14%. The results indicate that acquirers have had a period of sustained strong performance, and that sellers have gone through a period of poor performance.[21] This provides evidence in favor of the selection argument that on average buyers will have had strong returns and sellers have had weak returns. Following a transaction, the portfolio of buyers generates an excess return of 1% and the portfolio of sellers returns 5%. These results demonstrate a turnaround from prior to the asset purchase, when acquirers outperformed and sellers underperformed. The performance of sellers after a transaction indicates that these firms have improved their cash flows or growth prospects following the asset sale.

The performance of sellers subsequent to an asset sale displays some similarities to the performance of firms that reduce the number of operating segments. The diversification literature documents that firms which engage in spin-offs improve investment efficiency and increase valuation ratios.[22] The above results indicate that both diversified and undiversified firms may benefit from

[20]Value weights result in qualitatively similar but less extreme excess returns.

[21]These results do not change qualitatively when the portfolio returns are regressed on a set of factor returns.

[22]Burch and Nanda (2003), Ahn and Denis (2004) and Gertner, Powers, and Scharfstein (2002) provide evidence of improved valuations and investment efficiencies of firms after a spin-off. Colak and Whited (2005) dispute this

an asset sale.

Panel B reports the comparable results from the simulated sample. The returns of portfolios of buyers and sellers match the patterns observed in the data. Before a transaction, the portfolio of buyers generates an excess return of 14% and a portfolio of sellers generates an excess return of -13%. The pattern of excess returns prior to a transaction is robust to the calibrated parameters in the model economy and displays the selection effect on stock returns. After the transaction, both buyers and sellers generate returns comparable to the market return.

Panel C reports the results for acquirers and targets in mergers prior to a transaction, and for acquirers after a transaction. As with asset purchasers, the portfolio of acquirers outperforms the market prior to the acquisition. However, the portfolio of merger targets does not demonstrate poor performance prior to a transaction, indicating that targets have not had negative operating shocks prior to the merger. This suggests that an efficient investment model such as the one presented above would have less success in explaining mergers than asset sales.

The pattern of returns for firms that engage in asset purchases and sales broadly matches the results obtained by simulation of the model. However, the model does not explain the excess return of firms after they sell assets. Consider a trading strategy that buys firms that sells assets and holds them for a period of three years after the sale. In each month, the portfolio allocation to a single firm uses either value weights or equal weights. Factor analysis of this portfolio return yields a statistically insignificant annualized α of 2% to 3% over the sample period.[23] These results indicate that the excess return reported in table 6 does not reflect market inefficiency.

6.4 Multinomial Regression for Mergers

The model does not explicitly distinguish between mergers and asset purchases and sales, though the assumptions and the mechanism may be more suited to capture asset transactions. This section replicates the multinomial logit regressions for mergers and compares the results with that for asset purchases and sales. Table 7 reports the results of a multinomial logit regression for acquirers and targets of completed mergers. The first half of the table reports the coefficients for acquirers, and the second half reports the coefficients for targets. Standard errors adjusted for within-firm serial correlation are reported in parentheses. The predetermined covariates include those used in the multinomial regression for asset purchases and sales.

finding and argue that endogeneity and measurement error problems account for the observed improvements.

[23]These results are available from the author on request.

The results for acquirers in mergers share many similarities with those for asset purchasers. The coefficients on all the variables except cash retain their size and statistical significance. The comparison of odds ratios in tables 3 and 7 shows similar values for sales growth, PPE growth, size and stock return. RoA does not have as strong an impact on the choice of firms to acquire another firm. The positive and statistically significant coefficient on cash indicates evidence of empire-building. This suggests that agency conflicts have a greater impact on mergers than on asset purchases. High leverage restrains the amount of cash available for discretionary spending by managers and lowers the probability of an acquisition. Broadly, financially and operationally healthy firms exhibit a greater likelihood of growing through an asset purchase or a merger. The similarities between the two transactions indicate that managers view both as means of growing the firm.

The results differ between targets of completed mergers and asset sellers. The coefficient on RoA is negative and significant, suggesting that firms with low profitability attract buyers. In comparison to asset sales, the impact of RoA on merger targets drops from 35% to 11%. Leverage, stock return and cash cease to be significant determinants of the choice of a firm to sell itself in a merger. Like firms that sell assets, merger targets have poor sales growth and PPE growth compared to other firms. The independent variables display less power to predict the targets of mergers than they do for the previous regressions. This indicates that targets of mergers exhibit greater heterogeneity, and suggests that valuation, control rights and efficiency considerations could all influence merger decisions.

The results indicate that while models similar to the one in Section 3 have value for the prediction of buyers in mergers, they would be less suited for forecasting targets of mergers. An alternative view differentiates asset sales and mergers through their impact on the control rights of management. Managers who value control rights will sell the firm only reluctantly and at a substantial premium, while they will sell some assets when needed to. The above statistical evidence indicates that control rights may play an important role in mergers.

7 Conclusion

The paper analyzes the choice of firms to buy and sell existing assets. The study analyzes these transactions in the context of an efficiency based model: asset purchases and sales act to counteract inefficient capital allocation arising from heterogenous productivity shocks to firms. Conditional on a firm buying or selling existing assets, the model links purchases or sales of existing assets to the marginal value of capital inside the firm. The profitability and size of the firm determines whether the firm chooses to buy or sell existing assets.

The paper tests the implications of the model using an hitherto unexplored data set of asset purchases and sales from the SDC Platinum database. The estimation of the selection models for investment demonstrates a positive link between the quantity of assets purchased or sold and the value of capital inside the firm. The impact of Tobin's Q on investment is greater for asset purchases than sales. Return on assets and size strongly predict the likelihood of a firm engaging in an asset purchase or sale. A unit standard deviation increase in RoA increases the probability of an asset purchase by 29%, while a corresponding decrease in RoA increases the likelihood of an asset sale by 35%. The empirical analysis also finds that financing considerations influence the decision of firms to sell assets, with lower levels of liquid assets leading to more asset sales. On the other hand, increased cash stocks do not lead to increased asset purchases, indicating that empire-building tendencies do not influence asset purchases.

The study finds similarities and differences between mergers and asset purchases. While both merger acquirers and asset purchasers demonstrate strong returns and earnings, merger targets do not demonstrate a clear pattern of returns or earnings. The announcement of the asset transaction generates positive abnormal returns for buyers and sellers, whereas in mergers acquirers suffer a negative announcement effect. The positive responses indicate that the market views asset transactions as creating value for both parties. Asset purchases typically follow a period of strong returns for buyers, while firms sell assets after a period of poor returns. The model provides intuition for this result, as positive (negative) shocks to profitability lead to high (low) realized returns and increased asset purchase (sale) activity.

The study demonstrates that a value maximizing investment model can explain both corporate asset purchases and asset sales. The model does not account for the positive announcement effects for buyers and sellers, and the cyclical nature of asset transactions. Further research into these facts may enhance our knowledge of asset purchases and sales.

Appendix

A Proofs

Proposition 1 *There exists a threshold* $\tilde{I} = \left[\frac{a}{1-p}\right]^{1/(1-\theta)}$ *below which all investment consists of new investment and above which all investment consists of purchased existing capital*

$$\begin{aligned} I &= N \;\; \text{if} \qquad 0 \leq I \leq \tilde{I} \\ &= M \;\; \text{if} \qquad I < 0 \text{ or } I > \tilde{I}. \end{aligned} \tag{A.1}$$

Corollary *The investment cost function* $C^*(I, K)$ *obtained by substitution of the above allocation choice is continuous.*

Proof. The differentiation of (5) yields the first-order conditions for optimality:

$$\begin{aligned} \frac{\partial C}{\partial N} &= 1 + \frac{\partial \Phi(I, K)}{\partial I} \\ \frac{\partial C}{\partial M} &= p + \frac{\partial \Phi(I, K)}{\partial I} + a\theta M^{\theta-1} \cdot \mathbf{1}_{(M>0)}. \end{aligned}$$

There does not exist an interior solution to the problem. The boundary conditions imply that

$$C(\tilde{I}, 0, K) = C(0, \tilde{I}, K).$$

The solution to the above equation yields that $\tilde{I} = \left[\frac{a}{1-p}\right]^{1/(1-\theta)}$. As asset purchases have a lower marginal cost of investment for $I \geq \tilde{I}$, $(p + (1-p)\theta < 1)$, the firm will buy assets. The transaction cost of asset purchases $\Psi(M)$ leads firms to grow via new investment for $0 < I < \tilde{I}$. By construction, all disinvestment enters the model as M. This establishes the allocation choices given above in (A.1).

The following equation yields the minimum cost of an investment of I at current capital K:

$$C^*(I, K) = I + \Phi(I, K) - (1-p)I \cdot \mathbf{1}_{(I<0 \text{ or } I>\tilde{I})} + aI^{\theta} \cdot \mathbf{1}_{(I>\tilde{I})}. \tag{A.2}$$

Substitution of the optimal allocation to asset purchases, new investment and asset sales to the investment cash flow equation given in (5) yields the investment cost function (A.2). The continuity of $C^*(I, K)$ over K and at points in the interior of the investment regions follows trivially. The continuity of the function at $\tilde{I}$ follows from the value matching condition to the allocation problem. Taking left and right limits of $C^*(I, K)$ as $I \to 0$, one obtains

$$\lim_{I \to 0^-} C^*(I, K) = \lim_{I \to 0^+} C^*(I, K) = 0.$$

This establishes continuity of $C^*(I, K)$ at 0. Therefore, $C^*(I, K)$ is continuous on its domain. ■

Proposition 2 *There exists a unique function $V(K, z)$ that solves for the current value of the firm. $V(K, z)$ is continuous and strictly increasing in its components.*

Proof. The return function $F(K, z) - C^*(I, K)$ is continuous. Therefore, assumptions 9.4 - 9.7 of Stokey and Lucas (1989) hold. Theorem 9.6 yields the existence and uniqueness of the value function $V(K, z)$. The return increases with the current level of capital K. Assumptions 9.8 and 9.9 of Stokey and Lucas (1989) hold, and Theorem 9.7 yields that the value function is strictly increasing in K. ■

Proposition 3 *For values of K and z that are in the interior of the regions where the firm buys existing assets, invests in new capital or sells assets, the value function $V(K, z)$ is concave and differentiable with respect to K, with the derivative given by*

$$V_K(K, z) = \alpha e^z K^{\alpha-1} - \frac{\partial C^*(I, K)}{\partial K} + \frac{\partial C^*(I, K)}{\partial I}(1 - \delta). \tag{A.3}$$

Proof. Within each region, the return function $F(K, z) - C^*(I, K)$ is concave and differentiable. Theorem 9.8 of Stokey and Lucas (1989) implies strict concavity of $V(K, z)$ at any point (K_0, z_0) in the interior of these regions. Theorem 1 of Benveniste and Scheinkman (1979) implies differentiability of $V(K, z)$ and yields the above derivative. ■

Proposition 4 *For a fixed size K, there exists a profitability threshold $z_a(K)$ above which the firm purchases assets from another, and a profitability threshold $z_s(K)$ below which the firm sells assets.*

Proof. Fix size K. The first-order conditions for optimality yields

$$\frac{\partial C^*(I, K)}{\partial I} = \beta E\left[\frac{\partial V(K(1-\delta) + I, z')}{\partial I} | z\right]. \tag{A.4}$$

In the interior points, the partial derivative of the investment cost function is the following:

$$\frac{\partial C^*(I, K)}{\partial I} = 1 + \frac{\partial \Phi(I, K)}{\partial I} - (1 - p) \cdot \mathbf{1}_{(I<0 \text{ or } I>\tilde{I})} + a\theta I^{(\theta-1)} \cdot \mathbf{1}_{(I>\tilde{I})}. \tag{A.5}$$

First consider two firms that buy assets, with profitability levels z_1 and z_2. Assume that $z_2 > z_1$. Denote the associated optimal investment levels by I_1 and I_2. The first-order conditions yield

$$\begin{aligned} p + \frac{\partial \Phi(I_1, K)}{\partial I} + a\theta I_1^{(\theta-1)} &= \beta E\left[\frac{\partial V(K(1-\delta) + I_1, z')}{\partial I} | z_1\right] \\ p + \frac{\partial \Phi(I_2, K)}{\partial I} + a\theta I_2^{(\theta-1)} &= \beta E\left[\frac{\partial V(K(1-\delta) + I_2, z')}{\partial I} | z_2\right]. \end{aligned}$$

Monotonocity of the transition function for z implies that

$$E\left[\frac{\partial V(K(1-\delta)+I_2,z')}{\partial I}|z_2\right] > E\left[\frac{\partial V(K(1-\delta)+I_2,z')}{\partial I}|z_1\right].$$

Substituting the F.O.C. conditions to the above inequality yields

$$E\left[\frac{\partial V(K(1-\delta)+I_1,z')}{\partial I}|z_1\right] - \frac{\partial\Phi(I_1,K)}{\partial I} - a\theta I_1^{\theta-1} > \\ E\left[\frac{\partial V(K(1-\delta)+I_2,z')}{\partial I}|z_1\right] - \frac{\partial\Phi(I_2,K)}{\partial I} - a\theta I_2^{\theta-1}. \qquad (A.6)$$

A proof by contradiction establishes that $I_2 > I_1$. Assume that $I_2 \leq I_1$. Then, concavity of the value function and convexity of the adjustment cost function imply the following inequality:

$$E\left[\frac{\partial V(K(1-\delta)+I_1,z')}{\partial I}|z_1\right] - \frac{\partial\Phi(I_1,K)}{\partial I} - a\theta I_1^{\theta-1} \leq \\ E\left[\frac{\partial V(K(1-\delta)+I_2,z')}{\partial I}|z_1\right] - \frac{\partial\Phi(I_2,K)}{\partial I} - a\theta I_2^{\theta-1}.$$

This contradicts (A.6). Therefore $I_2 > I_1$. The proof requires a low marginal transaction cost ($a < \frac{\lambda}{\overline{K}\theta(1-\theta)}$ when $\frac{\partial\Phi(I,K)}{\partial I} = \frac{\lambda I}{K}$).

A similar proof establishes that for two firms both of which either sell assets or invest in new capital, the firm with higher profitability will invest more ($z_2 > z_1 \Rightarrow I_2 > I_1$). Investment increases monotonically with z, and a firm buys assets if $I > \tilde{I}$ and sells assets when $I < 0$. This establishes the proposition. ■

Proposition 5 *For a given level of profitability z, there exists a size threshold $K_s(z)$ above which the firm sells assets.*

Proof. Fix profitability z. Consider a firm with capital K_1 that optimally engages in asset sales, and another firm with capital $K_2 > K_1$. The result requires that $I_2 < 0$. Assuming that these are in the interior of the action regions, the first-order conditions imply

$$\begin{aligned} p + \frac{\partial\Phi(I_1,K_1)}{\partial I} &= \beta E\left[\frac{\partial V(K_1(1-\delta)+I_1,z')}{\partial I}|z\right] \qquad (A.7) \\ p + \frac{\partial\Phi(I_2,K_2)}{\partial I} &\leq \beta E\left[\frac{\partial V(K_2(1-\delta)+I_2,z')}{\partial I}|z\right]. \end{aligned}$$

The constant returns to scale assumption implies that $\frac{\partial\Phi(I,K)}{\partial I}$ is an increasing function of $\frac{I}{K}$. A proof by contradiction establishes that $I_2 < 0$. Assume that $I_2 \geq 0$. Therefore $\frac{I_1}{K_1} \leq \frac{I_2}{K_2}$. This implies that

$$\frac{\partial\Phi(I_1,K_1)}{\partial I} \leq \frac{\partial\Phi(I_2,K_2)}{\partial I}.$$

Substituting the above into the F.O.C.s given in (A.7), one obtains:

$$E\left[\frac{\partial V(K_1(1-\delta)+I_1,z')}{\partial I}|z\right] \leq E\left[\frac{\partial V(K_2(1-\delta)+I_2,z')}{\partial I}|z\right].$$

The concavity of the value function implies that

$$\begin{aligned} K_1(1-\delta)+I_1 &\geq K_2(1-\delta)+I_2 \\ I_1 &\geq (K_2-K_1)(1-\delta)+I_2. \end{aligned}$$

Therefore $I_1 \geq 0$. This contradicts the initial assumption of an asset sale. ■

B Numerical Solution and Simulations

The numerical solution employs value function iteration over a grid of values for current capital, investment and profitability. The capital grid consists of 300 equally spaced points, while the investment grid contains 3000 points. The Gallant and Hussey (1991) approximation for AR(1) processes yields the grid of values for profitability. This grid contains 10 points. The solution uses the optimal allocation choices derived as the solution to (9). The solution yields an optimal policy for new investment, asset purchases and asset sales. For a given level of capital, the transaction costs of asset purchases lead to an upper and lower bound for profitability beyond which the firm buys and sells assets, respectively. These bounds follow a smooth function as K varies. The acquisition boundary for a given capital level is approximated by the interpolated value of z, which yields an optimal total investment of $\tilde{I}$. The mid-point of the profitability levels over which the firm begins to disinvest yields the approximate sale threshold. These values act as inputs to a polynomial approximation of the acquire and sell thresholds as a function of $\log(K)$. The solution uses a second-order approximation with Hermite polynomials. Within each action region, linear interpolation provides the investment decisions and firm values.

The simulations apply the policy functions derived above to a panel of firms. The simulated sample consists of 1000 firms over 1000 time periods. The simulation employs the boundaries for asset purchases and sales obtained in the numerical solution. The initial 250 periods function as a burn-in sample. Approximately 3% of firms in the sample exit each period, and these are replaced by firms with random profitability and size. The sequence of solutions to the value function and simulation iterates until the equilibrium value of p at which total demand for asset purchases equals total asset sales is obtained. This corresponds to the steady state of the economy, where the interfirm market for assets clears. Hopenhayn (1992) provides the theoretical foundation for this approach.

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Table 1: Characteristics of Buyers and Sellers of Existing Assets

The table reports end of fiscal year summary statistics for firms that purchase and sell operating assets during the next fiscal year. The list of acquirers and sellers is obtained from the SDC Platinum database, and the targets may be public, private or subsidiaries of firms. These are linked to Compustat and CRSP using CUSIP numbers. The sample consists of all firms listed on Compustat from 1984 to 2004 that contain information on the independent variables. Return on assets is the operating income before depreciation scaled by book assets at the beginning of the fiscal year. Size measures the book value of assets in millions of dollars. Stock return is computed over the fiscal year. Tobin's Q is computed as the ratio between the market value of assets and the book value of assets. Market to book is the ratio of market value of equity to the book value of equity. Cash denotes cash and short-term investments scaled by the book value of assets. Leverage denotes book value of debt scaled by book value of debt plus equity. Sales growth and PPE growth measure growth in net sales and net plant, property and equipment over the previous fiscal year. The deal value reports the value of the asset purchase or sale in millions of dollars, as reported by SDC Platinum. The sample size is reported in thousands.

Firm Characteristic	All				Buyers			Sellers		
	N(000)	Mean	Median	Std.	N(000)	Mean	Median	N(000)	Mean	Median
Return on Assets	113	0.05	0.12	0.33	13	0.13	0.16	6	0.08	0.11
Size	119	1.07	0.08	3.57	13	2.46	0.27	6	5.86	0.76
Stock Return	105	0.15	0.12	0.62	12	0.22	0.18	6	0.10	0.11
Tobin's Q	110	1.94	1.32	1.85	12	1.99	1.46	6	1.59	1.25
Market to Book	113	3.12	1.78	4.52	12	3.20	2.12	6	2.82	1.82
Cash	119	0.17	0.08	0.21	13	0.15	0.07	6	0.10	0.05
Leverage	113	0.25	0.18	0.24	12	0.27	0.23	6	0.34	0.33
Sales Growth	98	0.29	0.09	0.94	12	1.41	0.13	6	0.15	0.06
PPE Change	100	0.30	0.04	1.03	12	0.39	0.09	6	0.16	0.03
Deal Value					6	77.5	16.0	3	107.5	21.5

Table 2: Ordered Logit Regression for Purchase and Sale of Existing Assets

The table represents the results from an ordered Logit regression of the choice of a firm to purchase or sell existing assets:

$$\Pr(y_{i,t+1} = 1) = \frac{\exp(a_t + \beta x_{i,t})}{1 + \exp(a_t + \beta x_{i,t})}.$$

The dependent variable ($y_{i,t+1}$) equals one if the firm or a subsidiary acquired some operations, minus one if the firm or a subsidiary sold assets, and zero otherwise. The list of purchasers and sellers is obtained from the SDC Platinum database, and the participants may be public firms or subsidiaries of public firms. The restricted sample looks only at transactions for which SDC reports a deal value. The sample consists of all firms listed on Compustat from 1984 to 2004 that contain information on the independent variables. The independent variables are all measured at the end of the previous fiscal year. Return on assets is operating income before depreciation scaled by book assets at the beginning of the fiscal year. Size measures the log of the book value of assets in millions. Stock return is computed over the fiscal year. Tobin's Q is computed as the ratio between the market value of assets and the book value of assets. Cash denotes cash and short-term investments scaled by the book value of assets. Leverage denotes book value of debt scaled by book value of debt plus equity. Sales growth and PPE growth measure growth in net sales and net plant, property and equipment over the previous fiscal year. The regressions include year and industry dummies. Standard errors adjust for clustering at the firm level. The odds ratios report the increase in the relative odds of a purchase for a firm whose independent variable increases by 1 standard deviation.

	Full		Restricted	
	Coefficients	Odds Ratio	Coefficient	Odds Ratio
Return on Assets	0.86	1.25	0.92	1.27
	(0.04)		(0.05)	
Size	0.03	1.07	0.00	1.00
	(0.01)		(0.01)	
Stock Return	0.11	1.08	0.11	1.07
	(0.01)		(0.02)	
Leverage	-0.31	0.93	-0.21	0.95
	(0.05)		(0.06)	
Cash	0.24	1.05	0.53	1.11
	(0.05)		(0.06)	
Sales Growth	0.10	1.09	0.11	1.10
	(0.01)		(0.01)	
PPE Growth	0.06	1.06	0.07	1.07
	(0.01)		(0.01)	
Observations	84566		84566	
Pseudo R-square	0.02		0.02	

Table 3: Multinomial Logit Regression for Purchase and Sale of Existing Assets

The table represents the results from a multinomial Logit regression of the choice of a firm to purchase or sell existing assets:

$$\Pr(y_{i,t+1} = j) = \frac{\exp(a_t + \beta_j x_{i,t})}{1 + \exp(a_t + \beta_j x_{i,t})}.$$

The dependent variable ($y_{i,t+1}$) takes three values depending on whether the firm or a subsidiary bought existing assets, sold existing assets or did neither. The table reports the coefficients for purchasing or selling assets compared to doing neither. The list of purchasers and sellers is obtained from the SDC Platinum database, and the participants may be public firms or subsidiaries of public firms. The sample consists of all firms listed on Compustat from 1984 to 2004 that contain information on the independent variables. The independent variables are all measured at the end of the previous fiscal year. Return on assets is operating income before depreciation scaled by book assets at the beginning of the fiscal year. Size measures the log of the book value of assets in millions. Stock return is computed over the fiscal year. Tobin's Q is computed as the ratio between the market value of assets and the book value of assets. Cash denotes cash and short term investments scaled by the book value of assets. Leverage denotes book value of debt scaled by book value of debt plus equity. Sales growth and PPE growth measure growth in net sales and net plant, property and equipment over the previous fiscal year. The regressions include year and industry dummies. Standard errors adjust for clustering at the firm level. The odds ratios report the change in the relative odds of a purchase or a sale for a firm whose independent variable increases by 1 standard deviation.

	Purchase		Sale	
	Coefficients	Odds Ratio	Coefficient	Odds Ratio
Return on Assets	0.99	1.29	-1.67	0.65
	(0.08)		(0.07)	
Size	0.26	1.76	0.44	2.59
	(0.01)		(0.01)	
Stock Return	0.14	1.09	-0.08	0.95
	(0.02)		(0.03)	
Leverage	-0.18	0.96	0.50	1.13
	(0.07)		(0.10)	
Cash	-0.19	0.96	-1.82	0.69
	(0.09)		(0.15)	
Sales Growth	0.11	1.10	-0.20	0.84
	(0.01)		(0.04)	
PPE Growth	0.05	1.04	-0.13	0.89
	(0.01)		(0.04)	
Observations	84566		84566	
Pseudo R-square	0.09		0.09	

Table 4: Investment Regression for Asset Purchases and Sales

The table reports the results from the following equation:

$$\frac{I}{K} = c + a * Q + b * ROA + \epsilon,$$

conditional on the firm either purchasing or selling existing assets. The resulting model is estimated using a Heckman two-step estimator. The selection equation includes size, return on assets, stock return, leverage, cash, sales and PPE growth as independent variables. The selection equation and the investment equation include year and industry dummies. The sample of asset purchases and sales is obtained from SDC Platinum and consists of all asset transactions from 1985 to the 3[rd] quarter of 2005. Panel A reports the results obtained for the purchase of assets and Panel B reports the results for the sale of assets. The tables report the adjusted R-square of the investment regression and the number of uncensored observations.

Panel A: Investment Regression for Asset Purchasers

	(1)	(2)
Constant	-0.132	-0.569
	(0.101)	(0.142)
Tobin's Q	0.015	0.015
	(0.001)	(0.001)
Return on Assets		0.135
		(0.010)
Mill's Ratio	0.254	0.346
	(0.010)	(0.012)
Observations	5776	5776
Adj. R-square	0.16	0.18

Panel B: Investment Regression for Asset Sellers

	(1)	(2)
Constant	0.015	-0.005
	(0.043)	(0.042)
Tobin's Q	0.004	0.004
	(0.001)	(0.001)
Return on Assets		0.053
		(0.005)
Mill's Ratio	-0.067	-0.064
	(0.003)	(0.003)
Observations	2600	2600
Adj. R-square	0.29	0.32

Table 5: Announcement Effects on Stock Prices of Buyers and Sellers of Existing Assets

The table reports the abnormal return for buyers and sellers in asset transactions for a window of 3 days around the date of the transaction. The CAPM serves as the pricing model for the computation of the abnormal returns. The list of acquirers and sellers is obtained from the SDC Platinum database, and the targets may be public or private firms. The sample consists of all asset purchases or sales from 1985 to the 3rd quarter of 2005 for which CRSP reports returns for at least a month prior to the transaction. The restricted sample consists of deals for which SDC Platinum reports a non-zero deal value. The abnormal return for each firm is normalized by its own standard deviation to form standardized abnormal returns, and these form the basis for the t-statistics. The sample size is reported in thousands.

Participant	Sample	N(000s)	Mean	Median	t-statistic
Buyers	Full	21	1.18%	0.29%	24.2
	Restricted	9	1.66%	0.56%	23.6
Sellers	Full	8	1.17%	0.30%	16.3
	Restricted	4	1.76%	0.57%	18.4

Table 6: Portfolio Returns of Acquirers and Sellers

The table reports the summary statistics for the excess return of portfolios consisting of participants in the asset market. The excess return is computed by subtracting the value-weighted market return from the portfolio return. The returns are reported in annual percentage terms. Each portfolio is constructed using three years of returns either prior to or after a purchase for a given firm. These returns are aggregated for each year using equal weights. Panel A reports the results obtained from matching the SDC Platinum sample of firms that engage in asset purchases and sales to CRSP returns. Panel B reports the results from the simulation of the model economy with the following calibrated parameters: scale parameter of production $\alpha = 0.9$, depreciation rate $\delta = .12$, discount factor $\beta = 0.95$, persistence of profitability $\rho = 0.85$, standard deviation of profitability 0.15, adjustment cost factor $\lambda = 1$ and cost of asset purchases $a = 0.02$. Panel C reports the results from matching the SDC Platinum merger sample with CRSP returns.

Panel A: Portfolios of Participants in Asset Transactions

Portfolio	Period	Mean	Median	Std.
Buyers	Before	10.6	7.8	4.2
	After	0.6	-0.3	4.4
Sellers	Before	-13.7	-11.6	5.3
	After	4.8	7.3	4.7

Panel B: Simulated Portfolios of Participants in Asset Transactions

Portfolio	Period	Mean	Median	Std.
Buyers	Before	14.4	14.4	2.0
	After	0.1	0.1	2.7
Sellers	Before	-13.3	-13.3	1.2
	After	-0.1	-0.1	2.2

Panel C: Portfolios of Participants in Mergers

Portfolio	Period	Mean	Median	Std.
Buyers	Before	12.3	10.6	5.3
	After	-0.1	-3.4	4.9
Sellers	Before	-2.0	-4.7	5.9

Table 7: Multinomial Logit Regression for Merger Acquirers and Targets

The table represents the results from a multinomial Logit regression of the choice of a firm to acquire another firm or be sold to another in a merger:

$$\Pr(y_{i,t+1} = j) = \frac{\exp(a_t + \beta_j x_{i,t})}{1 + \exp(a_t + \beta_j x_{i,t})}.$$

The dependent variable ($y_{i,t+1}$) takes three values depending on whether the firm acquired another in a merger, was the target of a successful merger or did neither. The list of acquirers and sellers is obtained from the SDC Platinum database, and the counterparties may be public or private firms. The sample consists of all firms listed on Compustat from 1984 to 2004 that contain information on the independent variables. The independent variables are all measured at the end of the previous fiscal year. Return on assets is operating income before depreciation scaled by book assets at the beginning of the fiscal year. Size measures the log of the book value of assets in millions. Stock return is computed over the fiscal year. Tobin's Q is computed as the ratio between the market value of assets and the book value of assets. Cash denotes cash and short-term investments scaled by the book value of assets. Leverage denotes book value of debt scaled by book value of debt plus equity. Sales growth and PPE growth measure growth in net sales and net plant, property and equipment over the previous fiscal year. The regressions include year and industry dummies. Standard errors adjust for clustering at the firm level. The odds ratios report the change in the relative odds of an acquisition or sale for a firm whose independent variable increases by 1 standard deviation.

	Purchase		Sale	
	Coefficients	Odds Ratio	Coefficient	Odds Ratio
Return on Assets	0.74	1.21	-0.39	0.90
	(0.11)		(0.07)	
Size	0.29	1.89	0.11	1.26
	(0.01)		(0.01)	
Stock Return	0.20	1.14	-0.03	0.98
	(0.02)		(0.03)	
Leverage	-0.50	0.89	0.10	1.02
	(0.10)		(0.09)	
Cash	0.66	1.14	-0.07	0.99
	(0.11)		(0.12)	
Sales Growth	0.14	1.12	-0.08	0.94
	(0.02)		(0.03)	
PPE Growth	0.09	1.08	-0.07	0.94
	(0.02)		(0.03)	
Observations	84950		84950	
Pseudo R-square	0.06		0.06	

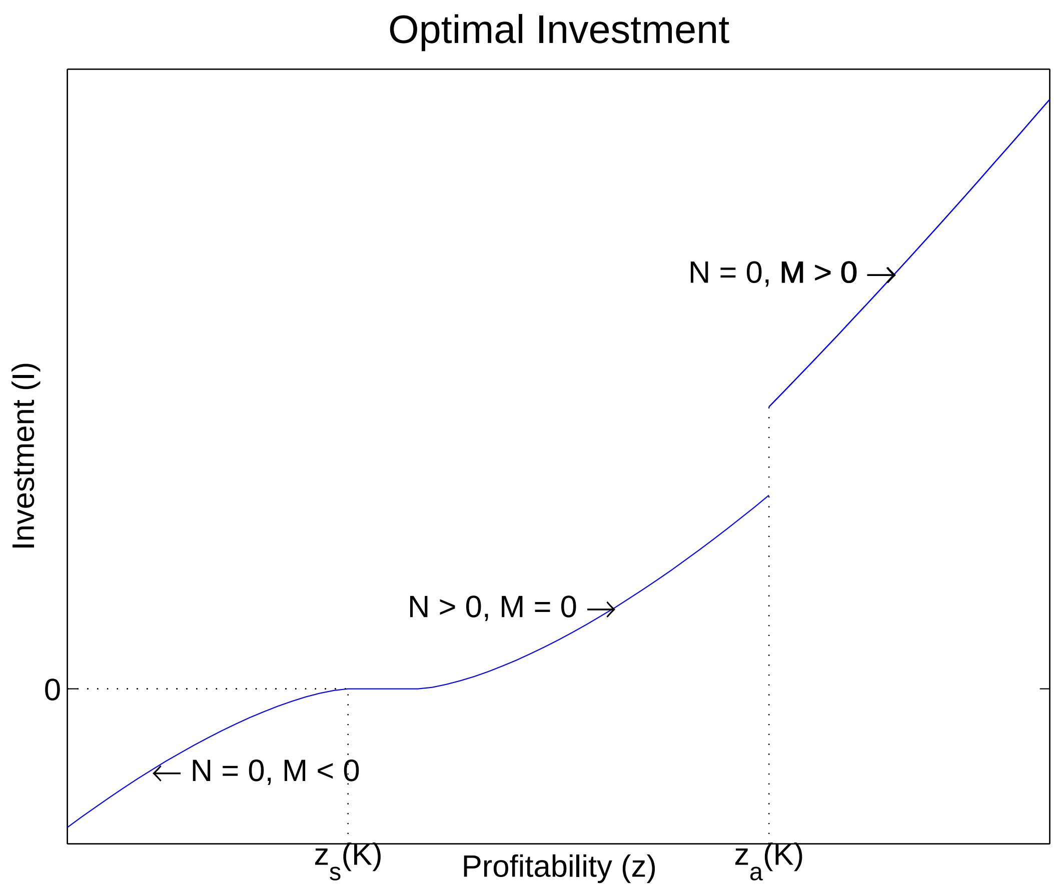

Figure 1: The figure plots optimal investment as a function of profitability z for a firm of fixed size K. $z_a(K)$ denotes the profitability threshold above which the firm buys existing assets from another and $z_s(K)$ denotes the profitability threshold below which the firm sells assets.

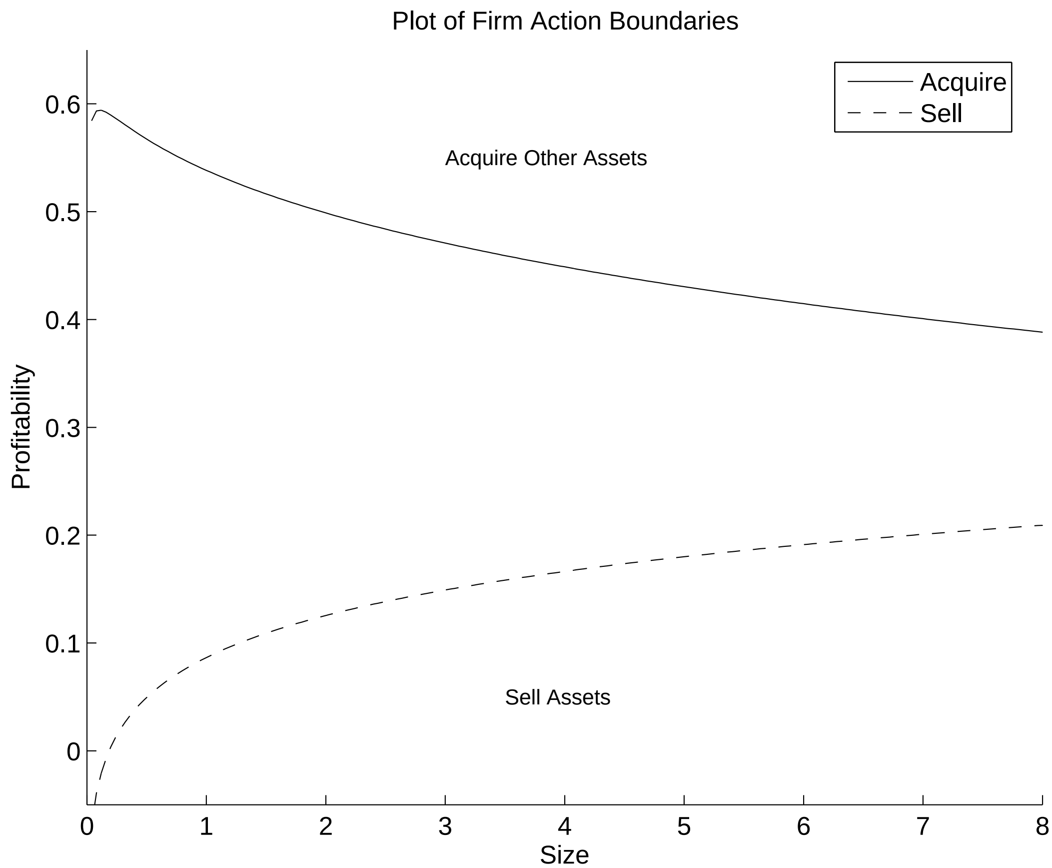

Figure 2: The figure identifies the regions where firms acquire assets from and sell assets to other firms. For a given size, firms with profitability above the top line will acquire assets, and firms with profitability below the bottom line will sell assets. Firms in the interior will invest in new capital. The resale price of capital, $p = 0.98$.

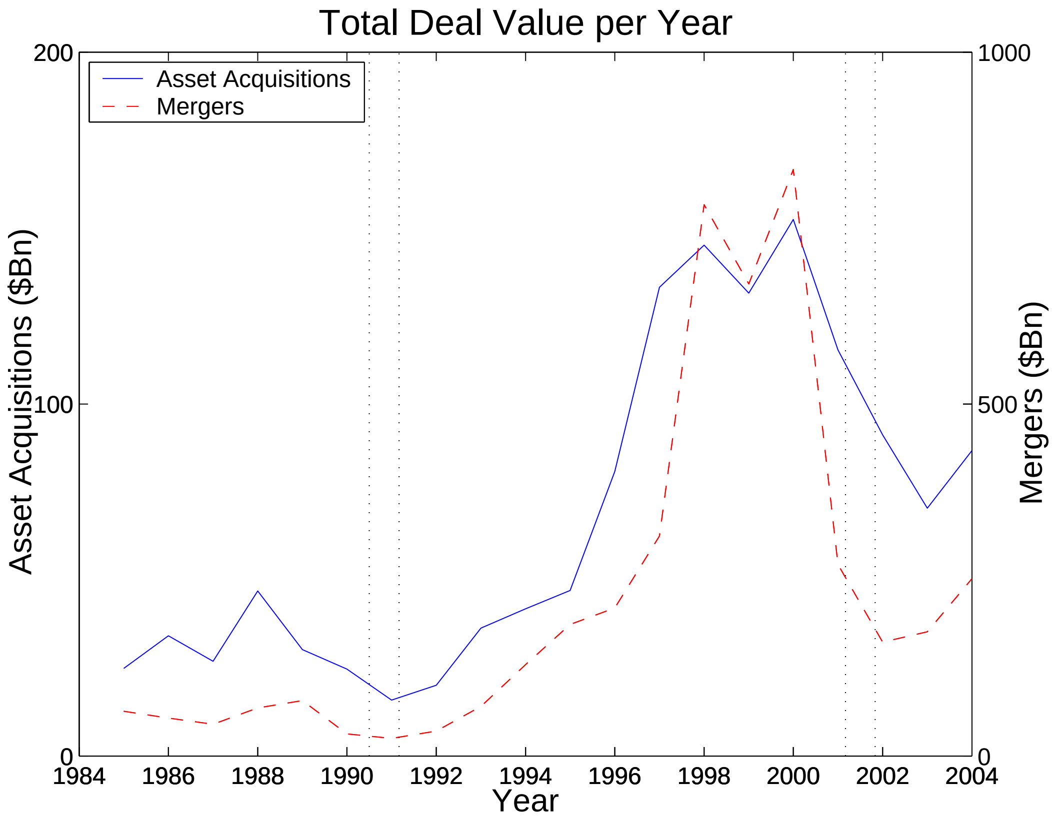

Figure 3: The figure plots the time series of total deal values of asset purchases and mergers. The values adjust for inflation using the deflator for gross domestic investor. Vertical lines mark the NBER recessions. The correlation coefficient between annual changes to merger and asset purchase deal values is 0.59.