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To my parents Jianguo Xiong and Baihua Zhu

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Chapter 1

How Costly Are External Financing and Agency for Private Firms?

I estimate the magnitude of manager-shareholder conflicts and external financing costs for large private firms in the U.S. I compare the results of the estimation to those from a sample of comparable public firms. Equity issuance costs are 8.19% for large private firms, much higher than 4.88% for large public firms. Managerial diversion of cash is more severe in public firms. Per dollar, managers of public firms can consume a higher fraction of corporate cash as a private benefit. My estimates also show that, in addition to agency and external financing, large private and public firms differ along two technology dimensions: the volatility of their productivity shocks and their capital adjustment costs. Counterfactual experiments provide an insight into why many large firms remain private. [1]

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1.1 Introduction

Privately owned firms play a substantial role in the U.S. economy. Asker, Farre-Mensa, and Ljungqvist (2013) estimate that U.S. private firms accounted for 52.8% of aggregate non-residential fixed investment, 58.7% of sales, and 48.9% of aggregate before-tax profits in 2010. Naturally, we expect that privately owned firms differ from publicly traded firms in two dimensions. Public ownership involves better access to capital markets, but it implies diffused ownership structure. Thus, public firms are expected to suffer more from agency problems, as shown in Jensen and Meckling (1976). In contrast, private firms typically operate under concentrated ownership and control, but may face higher costs of issuing equity (see Boot, Gopalan, and Thakor 2006; Brav 2009).

What is the magnitude of agency and costs of external financing for private firms? How do these costs compare with those for public firms? How much value does a private firm lose because of agency and external equity costs? Given the substantial role of private firms, these are important, however still open questions. To answer these questions, I estimate a dynamic model of investment and financing with the presence of conflicts of interests between shareholders and the manager. The parameters of the model describe the firm's production environment, external financing costs and agency conflicts. I estimate the structural parameters of the model using a sample of private and public firms in the U.S.

I use a structural estimation approach, because agency and external financing costs are not easy to measure directly in the data. The structural approach allows me to infer unobservable quantities from firm policies, such as managerial diversion of cash. Further, I can perform counterfactual experiments using the estimated model.

The paper contributes to the literature about private companies in several ways. First, I estimate the magnitude of agency conflicts and external financing costs for large private firms. Second, I quantify the impact of frictions on firm value. Third, I show that, in addition to agency and external financing, large private and public firms differ in technology parameters. These new channels have never been documented in the literature. Finally, counterfactual analysis provides a new insight into why many large firms remain private.

The model features dynamic investment and financing, costly external equity, and a self-interested manager who may not maximize firm's value. Each period, the manager makes investment and financing decisions. He can finance projects through internal operating cash flows, debt, retained cash or new issued costly equity. Moreover, the manager's decisions can be distorted by three channels: the manager's cash bonus, managerial diversion of cash, and the manager's limited ownership of the firm. The manager shares from operating profits as cash bonus, consumes a fraction of corporate cash as a private benefit, and owns a fraction of the firm. By making investment and financing decisions, the manager maximizes the expected value of a mixture of his cash bonus, cash tunneling and a fraction of cashflows to shareholders.

I use data containing information for U.S. private firms with audited financial statements from Capital IQ. My sample contains large private firms over the period 2001-2013. All private firms in the sample are required to file audited financial statements with the Security and Exchange Commission (SEC), because they have more than $10 million total assets and 500 shareholders or issue public debt. The sample allows me to investigate the impact of manager-shareholder conflicts on private firms, since there still exists a separation of ownership and control among these large private firms. It also allows the examination of comparable private and public firms in terms of firm size, industry, and information availability through SEC filings.

My estimation produces several results. First, I find that the manager of public firms can divert a higher fraction of corporate cash than the manager of private firms. On average, the manager of private firms consumes about 2bps of corporate cash as private benefits. In contrast, the manager of public firms consumes about 7bps of corporate cash as private benefits. I also find that linear issuing costs of equity are 8.19% for private firms, much higher than 4.88% for large public firms.

Second, I quantify the effects of agency and external financing on firm value by counterfactual analysis. If I increase the agency conflicts by 5% from the estimated values, private firm value would decrease by 2.46%, and public firm value would decrease by 11.14%. This 11.14% loss translates into $538.8 million loss of firm value due to a 5% increase in the agency conflicts. Therefore, agency conflicts are more harmful to large public firms relative to large private firms. These results are in line with Jensen and Meckling 1976 that the separation of ownership and control can lead to greater agency problems among public firms. If the cost of external equity rises by 5%, private firm value would decrease by 0.44% and public firm value would decrease by 0.18%. This result is intuitive, since private firms face higher costs of external equity than public firms.

Third, my estimates show that, in addition to the agency and financing parameters, large private and large public firms differ in other economic dimensions. Such differences have never been documented in the literature. Specifically, I find that large private and large public firms significantly differ in two technology parameters: the volatility of their productivity shocks and their capital adjustment costs. Further analysis shows that the age of the firm can be an explanation of the differences in technology.[2]

Fourth, the model provides an insight into why many private firms in the sample remain private. I consider a hypothetical firm that has the sample estimates of agency and financing parameters from public firms and has the remaining parameters from private firms. This counterfactual mimics the case in which a private firm provides the same compensation and ownership structure as a public firm, and consequently would enjoy the lower cost of external equity. If the average private firm goes public, inheriting the estimates of the financing and agency parameters from public firms, the artificial private firm would maintain more cash, consistent with Gao, Harford, and Li (2013). However, the artificial private firm would lose value in terms of Tobin's q. The artificial private firm would reduce the value loss due to costly external financing, but it would face higher agency problems. The loss due to agency dominates the gain from external financing. And thus, the average private firm would not benefit from going public.

My model builds on DeAngelo, DeAngelo, and Whited (2011). In their model, the manager maximizes the expected value of cash flows to shareholders. I introduce agency conflicts into this dynamic setting. Nikolov and Whited (2013) also use a dynamic model of investment with agency conflicts. They focus on the impact of manager-shareholder conflicts on corpo-

[2]I thank the referee for suggesting this point.

rate cash, whereas my goal is to identify the economic differences of private firms relative to public firms.

There is a growing literature using data on private companies. However, to the best of my knowledge, the paper is the first to economically quantify the effects of agency and financing frictions for private firms by using a structural approach. Many papers provide an ordinary comparison between private and public firms. For example, Sheen (2012) and Asker et al. (2013) find that private firms invest more and are more responsive to investment opportunities. Gilje and Taillard (2016) examine a unique dataset of U.S. natural gas producers and show that investment by private firms react less to changes in natural gas prices. Gao et al. (2013) show that private firms hold about half as much cash as public firms do, and attribute the results to agency problems. My paper is consistent with their findings, supporting that public firms on average suffer more from agency problems. Further, using a plant-level data for manufacturing firms in the U.S., Maksimovic, Phillips, and Yang (2013) document that public firms participate more in mergers and acquisitions than private firms, and their participation is affected more by aggregate market valuation.

Some papers shed light on financing costs for private firms. Brav (2009) finds that private firms rely almost exclusively on debt financing and tend to avoid external capital markets. Then, he argues that "these differences are due to private equity being more costly than public equity." While there is no quantitative measure in Brav (2009), my paper provides estimates of the magnitude of these costs. Using a sample of firms in U.K., Saunders and Steffen (2011) find that private firms face higher borrowing costs in loan markets than public firms, but they do not measure the cost of equity issuance.

The paper is organized as follows. Section 1.2 presents and analyzes the model. Section 1.3 describes the data. Section 1.4 discusses estimation and identification. Section 1.5 presents estimation results, counterfactual analysis, and robustness check. Section 1.6 concludes.

1.2 Model

I consider a dynamic model of investment with costly external equity and three mechanisms that misalign the interests between the manager and shareholders: the manager's cash bonus, managerial diversion on cash, and the manager's limited ownership of the firm. Time is discrete.

1.2.1 Production

A firm employs physical capital k for production. The price of capital is normalized to unity. The firm's operating profits are

$$\pi = zk^{\alpha}, \tag{1.1}$$

in which $\alpha \in (0,1)$ captures decreasing returns to scale, and z is the firm's productivity, which follows an AR(1) process in logs:

$$\ln z' = \rho \ln z + \epsilon, \tag{1.2}$$

in which ϵ is a shock distributed according to $N(0,\sigma^2), \sigma > 0$ and a prime denotes values in the next period. The manager makes decisions after he has observed z. The evolution of capital stock k is described by

$$k' = (1-\delta)k + i, \tag{1.3}$$

where $\delta \geq 0$ is the depreciation rate and i is gross investment. Undertaking gross investment i, the firm will incur quadratic adjustment costs

$$\Phi = \frac{\gamma}{2}\left(\frac{i}{k}\right)^2 k,\ \gamma > 0. \tag{1.4}$$

The five parameters $(\alpha, \sigma, \rho, \delta, \gamma)$ describe the firm's production environment. I label them as technology parameters.

1.2.2 Financing

There are four methods of financing in the model: internal operating profits, debt, cash or external equity. In addition to internal operating cash flows, the firm can use the stock of net debt p. A positive value of p means that the firm holds debt $d = \max\{0, p\}$. Debt is modeled as a riskless perpetual bond, and interest payments are deductible from corporate tax. The firm can issue perpetual bonds p' and must pay back current debt holdings plus interests, $p(1 + r(1 - \tau_c))$, where τ_c is the corporate tax rate. Following DeAngelo et al. (2011), we impose an upper bound constraint on the stock of net debt p:

$$p \leq \bar{p}, \tag{1.5}$$

where $\bar{p}$ is a parameter to be estimated in the model.[3] This assumption is motivated by the literature of credit rationing (Jaffee and Russell 1976; Stiglitz and Weiss 1981). Accordingly, as the amount borrowed rises, lenders do not allocate funds with higher interest rates. But they ration credit to make sure that the loan can be paid back in all states. Thus, the firm faces an upper bound on debt holdings, as a kind of collateral. A negative value of p means that the firm maintains cash $c = -\min\{0, p\}$, which earns the same after-tax returns, $r(1 - \tau_c)$. The corporate tax on interest earned on cash promises bounded cash savings.

Finally, the firm can issue external equity e, which will incur a cost of $c(e)$. Following Hennessy and Whited 2005, 2007; DeAngelo et al. 2011; Nikolov and Whited 2013, we treat the cost c in a reduced-form fashion for the purpose of estimation. For simplicity,[4] c is assumed to be a linear function:

$$c(e) = \phi e, \tag{1.6}$$

where $\phi > 0$ denotes the equity issuance cost parameter. The cost ϕ may reflect the existence of floatation costs or underwriting fees for equity, the delay to obtain external financing, or

[3] As in DeAngelo et al. (2011), I do not estimate an absolute value of $\bar{p}$, and estimate the upper bound limit on debt as a fraction of assets. In particular, I estimate the ratio of $\bar{p}$ to the steady state capital stock k^*, where k^* equates the marginal product of capital for a neutral z with $r + \delta$.

[4] Here, we focus on the intensity of access to external capital. It is possible to add a quadratic cost of external equity, consistent with the convexity of underwriting fees in Altinkilic and Hansen (2000). However, this does not add new qualitative effects on our results. In a robustness check, I relax this linear assumption.

searching costs.

1.2.3 Manager-shareholder Conflicts

Now, I discuss the channels to distort the manager's decisions. Managerial compensation is approximated by the manager's cash bonus related to operating profits and the manager's equity share. Broadly, these two channels will affect the manager's decisions in the model. I also consider managerial diversion of cash, another channel to misalign the interests between the manager and shareholders.

First, the manager can share a fraction $b \in (0, 1)$ of operating profits π. Following Porta, Lopez-De-Silanes, Shleifer, and Vishny (2002), Albuquerue and Wang (2008), and Nikolov and Whited (2013), the cash bonus is approximated as a linear function of operating profits.[5] In other words, the after-tax and after-bonus cash flows to equity are $(1 - \tau_c)(1 - b)\pi$. b is taken as a parameter rather than derived from an optimal contract as in DeMarzo, Fishman, He, and Wang (2012). From the perspective of the manager, his profit share will increase with capital. Thus, the cash bonus parameter b induces the manager to increase firm size.

Then, a fraction s of corporate cash will go to the manager as a private benefit. This managerial diversion on cash reflects some agency problems related to cash holdings. For example, the manager may utilize corporate resources to book private jets, or use luxury hotels. Thus, the net cash to the firm will be $(1 - s)c(1 + r(1 - \tau_c))$, where s is a parameter to be estimated.

Define div as distributions to shareholders

$$div = (1 - \tau_c)(1 - b)\pi + \tau_c \delta k - i - \Phi + p' - (1 - s\mathbb{1}_{p<0})p(1 + r(1 - \tau_c)), \tag{1.7}$$

where $\mathbb{1}$ is an indicator function. div represents net cash flows to shareholders, which should be after tax and bonus operating profits less investment less adjustment costs, and adjusted

[5] In unreported analysis, I regress the managerial bonus on the operating profits with firm and year fixed effects, and find that the coefficient on operating profits is significant. That is, the cash bonus is significantly related to operating profits.

by net debt p and p'. External equity is costly, and thus shareholders actually get

$$div \times (1 + \phi \mathbb{1}_{div<0}). \tag{1.8}$$

If $div > 0$, shareholders get dividends div. Otherwise, external equity $-div$ are needed, and shareholders must pay additional costs of external equity.

The manager only owns a fraction β of the firm because of the separation of ownership and control. He runs the firm through his equity holdings. If the manager owns 100% of the firm, he would maximize the expected value of cash flows to shareholders, $div(1 + \phi \mathbb{1}_{div<0})$; but due to the agency problems, the manager's one period payoffs are[6]

$$u = b\pi + sc(1 + r) + \beta div(1 + \phi \mathbb{1}_{div<0}). \tag{1.9}$$

The lower β is, the less the manager works in the interest of maximizing shareholders' value. In one extreme case ($\beta = 0$), the manager would only care about the cash bonus and cash tunneling. In the second polar example ($b = 0, s = 0, \beta = 1$), the manager would maximize firm's value. Following Morellec, Nikolov, and Schurhoff (2012) and Nikolov and Whited (2013), I identify β as the managerial ownership of the firm in the data.

The risk-neutral manager maximizes

$$U(k, z, p) = \max_{k', p'} \left\{ u(k, z, p) + \frac{1}{1 + r} \int U(k', z', p') dq(z', z) \right\}, \tag{1.10}$$

where $dq(z', z)$ denotes the transition probabilities from z to z'. The manager implicitly chooses dividends div, and external equity e. Note that $U(k, z, p)$ is the manager's utility, not firm's value. The firm's value is defined as

$$V(k, z, p) = \max_{k', p'} \left\{ div^*(1 + \phi \mathbb{1}_{div^*<0}) + \frac{1}{1 + r} \int V(k', z', p') dq(z', z) \right\}, \tag{1.11}$$

[6] The manager generally does not simultaneously hold positive of both cash and debt. Since β is much larger than s, the manager would be better off to use cash to pay off debt. Doing so will not only relaxes collateral constraint, increasing debt capacity, but also relaxes taxes imposed on cash, and therefore will increase dividends which the manager cares about. Thus we can use one variable p to represent cash or debt.

where div^* is the solution to managerial optimization problem (1.10). Because of manager-shareholder conflicts, the optimal choice div^* diverges from the choice that would be made if the manager acts completely in maximizing firm's value. Thus, the firm has a lower value than it would have in the absence of agency conflicts (i.e., $b = 0$, $s = 0$, and $\beta = 1$). I refer to b, s and β as agency parameters.

Finally, I do not model the listing status as a decision choice for the firm, since the main goal of the paper is to estimate the magnitude of agency and external financing for private firms, not to explain why firms decide to go public or remain private.[7]

1.2.4 Comparative Statics

The model does not admit analytical solutions, and thus will be solved numerically. APPENDIX 1.7 describes the numerical algorithm of the model. I investigate the model's comparative statics. This is particularly useful to illustrate the validity of this dynamic model, and useful to gain intuition on which moments are informative to identify parameters. To obtain comparative statics, I simulate the model based on the parameter values in Table 1.5. I only change one parameter in question, and fix other parameters. For each simulation, I run the model for 100,000 firms over 50 years, and only keep the last 10-year observations. Then, I investigate the average moments related to financing decisions over the simulated panel, such as equity issuance, debt or cash holdings, against the model's parameters.

Agency and financing parameters

I let the financing and agency parameters in a range: $\phi \in [0, 0.15]$, $\beta \in [0.05, 0.2]$, $b \in [0, 0.01]$ and $s \in [0, 0.0015]$. Table 1.1 presents the ratio of equity issuance, debt, and positive cash to assets against the agency or financing parameters in questions. First, the simulated equity issuance sharply decreases with the cost of external equity ϕ, while other agency parameters have small effects. Intuitively, higher costs of equity dampen the usage of external equity. As equity becomes more expensive, the manager will be reluctant to use external equity for financing.

[7] See Section 1.5.4 for a counterfactual experiment that provides insights into why many large firms remain private.

Next, I investigate the ratio of debt to assets. I find that higher ϕ leads to lower leverage of the firm, indicating that the manager will hold more debt when facing cheaper costs of equity. This is consistent with DeAngelo et al. (2011). Debt capacity is valuable in the model because of the collateral constraint equation (1.5). As the cost of equity rises, the opportunity cost of relaxing debt capacity also increases, since the manager tends to preserve debt for future needs of financing. Next, I find that the ratio of debt to assets is increasing in the managerial ownership parameter β and decreasing in the profit sharing parameter b. When the manager's and shareholders' interests are aligned, the manager will hold more debt. From the perspective of the firm, utilizing debt can take advantage of the tax shield from corporate tax. Another reason is that the relative importance of cash as private benefits will decrease for the manager, as β rises and b decreases. Thus, the manager will use more debt as the source of financing. Finally, the cash diversion parameter s only has a small effect on the average leverage. The reason is that the manager will be strongly motivated by corporate taxes themselves to maintain debt, while s adds a little to affect the leverage.

The cash diversion parameter s strongly affects positive cash balances. This positive effect is due to the fact that the manager can consume a higher fraction of cash balances as private benefits, as s increases. I also observe that cash decreases with the managerial ownership parameter β and increases with the profit sharing parameter b. Similarly, the misalignment of the manager's and shareholders' interests helps explain the results. Cash also increases with the cost of equity ϕ. Intuitively, more costly external equity results in higher precautionary savings. This is why we see a monotonic relation between ϕ and cash balances.

All of the results depend on the tradeoff between agency and costly external financing. Because external equity is costly, the manager prefers debt or cash as the source of financing. Tax shield provides a strong incentive to maintain debt over cash. However, the firm cannot issue as much debt as it wants because of the upper bound limit on debt. Instead, the manager can maintain cash balances as buffer for future financing. In addition to precautionary reasons, holding cash is also valuable to the manager because of managerial diversion on cash. Maintaining too much cash will destroy distributions div, of which the manager can share a fraction through his equity holdings. Therefore, from the perspective of the manager, there will be a tradeoff between positive debt holdings, cash balances, and equity issuance in this dynamic setting.

Technology parameters

Next, I investigate the financing decisions against the technology parameters. I let four technology parameters to be set by a low or high value. Table 1.2 presents the ratio of equity issuance, debt, and positive cash to assets against the technology parameters in questions. The effects of the technology parameters are similar to those in DeAngelo et al. (2011). For example, firms with high volatility of investment shock and low adjustment costs will have lower leverage ratios, because they face more volatile need for investment, and thus reserve debt capacity for future financing. The same intuition applies to shock persistence ρ and curvature of profit function θ.

1.3 Data

Our sample of private U.S. firms is from Capital IQ from 2001 to 2013 at an annual frequency. Private firm observations mainly come from Form 10-K and from Form S-1. In the U.S., firms have to file financial reports with the Securities and Exchange Commission (SEC), if they have \$10 million or more in total assets and 500 or more shareholders (2,000 shareholders since April 2012), or if they list their securities with the SEC, like public debt. Capital IQ collects private firms' financial and managerial compensation data from the SEC through 10-K or S-1.

To construct the sample of private firms, I omit all firms that violate basic accounting identities. I delete firm-year observations with missing data, and delete observations where total assets, the gross capital stock, or sales are zero or negative. I also remove all regulated or financial firms. I require that a private firm has information on managerial compensation in Capital IQ. Finally, I require a firm to have at least two annual observations so that I can lag some of the variables; and firms' operating cash flows over total assets is no less than -50%. I end up with an unbalanced panel of 1,585 U.S. private firms with 5,643 observations. In unreported analysis, I also show that my sample of private firms has broad industry representation, covering all 48 industries of Fama and French (1997).

I also estimate the model on a sample of public firms. Estimation results from public firms serves as a benchmark to illustrate how costly are agency and external equity to private firms relative to public firms. For public firms, I collect financial data from Compustat and managerial compensation data from ExecuComp. I require that public firms be traded on the NYSE, Amex, or Nasdaq. I apply the same filtering. The final unbalanced panel has 7,027 firm-year observations from 1,457 U.S. public firms.

Note that the sample is not representative of a typical private firm in U.S., since most private firms in the sample are large or have access to public debt. However, this feature of data is particularly useful in our study. First, it allows us to investigate the impact of agency conflicts on private firms. Although these firms are private, they are not completely owned by the manager and there still exists a separation of ownership and control among these large private firms. Second, private firms in the sample are observably comparable to public firms in terms of firm size, industry, and information availability through 10-K or S-1.

Table 1.3 presents the definitions of all variables. And Table 1.4 reports summary statistics. In Table 1.4, the differences in means between public and private firms are significant at the 1% level, except for the average equity issuance. Similar to Sheen (2012) and Asker et al. (2013), I find that, on average, private firms invest more than public firms. Compared to public firms, private firms are less profitable, distribute fewer funds to shareholders, and rely more on external finance. The mean managerial ownership is 13.61% for the private firm sample, while the mean managerial ownership is 4.93% for the public firm sample.[8] This result is intuitive, since private firms typically have less diffused ownership compared to public firms. The mean bonus paid to managers in public firms is $817.2 thousand , while the mean bonus in private firms is $502.7 thousand. Thus, manager's bonus compensation in private firms is significantly lower than those in public firms.

[8] I greatly thank Kai Li for sharing data on ownership of private firms in Capital IQ, which are hand-collected from SEC disclosure reports or proxy statements.

1.4 Estimation

1.4.1 Estimation Method

The seven parameters $(\alpha, \sigma, \rho, \gamma, \phi, \bar{p}/k^*, s)$ are estimated through simulated method of moments (SMM). Instead of estimating an absolute value of $\bar{p}$, I estimate the ratio of $\bar{p}$ to the steady state capital stock k^*. I estimate the upper bound limit on debt as a fraction of assets. The remaining parameters have direct measures in the sample. The risk-free rate, r, is 1.5%, the average three-month t-bill rate from 2001 to 2013. The corporate tax rate τ_c is set to 35%, its statutory value. The depreciation rate δ is approximately set to the average ratio of depreciation to the capital stock. In the sample, δ is 0.12 for private firms and 0.11 for public firms. β comes from managerial ownership data. On average, the managerial ownership, β, is 4.93% for public firms, and 13.61% for private firms. The parameter b directly corresponds to the average bonus paid, one observed moment from compensation data. I identify b by using the ratio of total bonus received by top 5 managers to operating profits. The average managerial bonus ratio for public firms is 0.50% and 0.73% for private firms.

SMM proceeds as follows. Given a vector of structural parameters $\theta = (\alpha, \sigma, \rho, \gamma, \phi, \bar{p}/k^*, s)$, we obtain the numerical solution to the model, characterized by the policy function $\{k', p'\}$. I then simulate a panel of productivity z based on the distributional assumptions. The panel of z and the policy function yield a panel of simulated firms. Next, we can compute moments using both the actual data and the simulated data. Finally, we choose θ by matching the actual data moments and the corresponding simulated moments as closely as possible. The SMM estimator $\hat{\theta}$ is

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \left(\hat{M}_N - \frac{1}{S} \sum_{s=1}^{S} \hat{m}_{N'}^{s}(\theta) \right)' W \left(\hat{M}_N - \frac{1}{S} \sum_{s=1}^{S} \hat{m}_{N'}^{s}(\theta) \right), \tag{1.12}$$

where $\hat{M}_N$ is the vector of actual data moments, and $\hat{m}_{N'}^{s}(\theta)$ are the corresponding moments from sth simulated sample using θ. I set the inverse of the estimated covariance of moments $\hat{M}_N$ as the weighting matrix W. In estimation, I simulate $S = 10$ artificial panels, each panel consisting of 10,000 firms over 50 years, and I only keep the last 13 years years.[9] I use a simulated annealing algorithm to avoid local minima. Additional details are available in APPENDIX 1.8.

1.4.2 Identification

I now discuss the moments used in the estimation. The first sets of moments are related to investment and operating income. The curvature parameter, α, is identified by the mean operating income, which is defined as zk^{α}/k in the simulation. The parameter α has a positive effect on this moment. Higher α implies the higher mean operating income. The variance of the investment rate i/k helps identify the adjustment cost parameter γ. Intuitively, firms facing higher adjustment costs would not change investment too frequently. Note that the curvature α also affects the volatility of investment rate. But, α has been identified by the mean operating income. To identify the parameters describing the process for z, I include the variance of operating income and the serial correlation of investment and operating income. The serial correlation is estimated using the method in Holtz-Eakin, Newey, and Rosen (1988). Specifically, the volatility of investment and operating income are affected by the standard deviation of shocks, σ. Knowledge of the serial correlation helps back out the persistence ρ driving z.

To identify the financing parameter ϕ, I match the first and second moments of equity issuance, which is defined as e/k in the model. Higher ϕ dampens the usage of external equity. To pin down the value of ϕ, I also match the mean and variance of dividends, defined as div/k in the simulation. As shown in the comparative statics in section 1.2.4, the agency parameter s strongly affects the positive cash balances, and it only has small effects on the simulated equity issuance. Thus, to identify s, I match the moments including the mean and variance of simulated c/k, conditional on $c > 0$. I finally match the mean and variance of the leverage, d/k, to identify $\bar{p}/k^{*}$. A higher value of $\bar{p}/k^{*}$ allows the firm to have higher debt capacity, and consequently more debt.

Note that my model describes one average firm. Thus, all moments except the first

[9] Michaelides and Ng (2000) find that good small sample performance requires a simulated sample 10 times as large as the actual data sample. Thus, I choose 10 simulated samples to be conservative.

moments have to reflect within-firm, and not cross-firm variation. Following Hennessy and Whited (2005, 2007) and Nikolov and Whited (2013), I eliminate the heterogeneity in the actual data as follows: I demean each variable at the firm level when computing variances, and I use firm fixed effects to estimate autoregressive coefficients. In other words, the model fits within-firm variance and within-firm serial correlation.

1.5 Results

First, I present the parameter estimates and the empirical versus simulated moments. Then, I conduct out-of-sample tests, counterfactual experiments and robustness checks.

1.5.1 Parameter Estimates

Table 1.5 contains the point estimates for private firms. All of the estimates are new and never documented in the literature. The estimated curvature of the profit function, α, is 0.7665. The estimated adjustment cost γ is 0.5029. The cost of external equity, ϕ, is 8.19%, which means that, on average, large private firms pay 8.19% cost of equity raised externally. I also find that the estimated value of $\bar{p}/k^*$ is 0.5257, much higher than the average leverage ratio. Therefore, the manager uses debt conservatively because of the upper bound limit on debt. The manager tends to preserve debt capacity for future financing. The most interesting estimate is the managerial cash diversion parameter s. The magnitude shows that the manager of average private firms consumes about 2(bps) of corporate cash as private benefits.

Next, to better understand the magnitude of private firms, I compare the estimates of private firms to those of public firms in Table 1.6. First, the estimated curvature of the profit function for public firms, α, is 0.7848, comparable to the estimated value of 0.773 in Nikolov and Whited (2013). The estimates of parameters describing the process for z are similar to those in the previous literature. Second, the estimated financing parameter, ϕ, is 4.88%, consistent with Hennessy and Whited (2007). They find that "for large public firms, estimated marginal equity flotation costs start at 5.0%." However, our estimate for public firms is much lower than 8.19% of private firms. This is intuitive, pointing to the fact that private firms typically face higher costs of external equity (Pagano, Panetta, and Zingales 1998; Brav 2009; Saunders and Steffen 2011; Maksimovic et al. 2013). Third, consistent with Gao et al. (2013), my estimation shows that managerial diversion on cash is more severe in public firms. The value of s indicates that the manager diverts about 7(bps) of cash balances as private benefits in public firms, much higher than 2(bps) in private firms. Fourth, private firms have lower value of the estimated $\bar{p}/k^*$ than public firms. Thus, private firms face more constraints of debt capacity. This is in line with Saunders and Steffen (2011) who find that privately held firms in UK face a cost disadvantage in loan markets. Finally, in addition to the agency and financing parameters, the average public and private firm significantly differ in two technology parameters: the volatility of productivity shocks (σ), and the adjustment cost parameter (γ). I find that the average private firm faces higher σ and lower γ.

1.5.2 Moment Estimates

Now, we assess how well the estimated model matches empirical moments. We investigate where the model fails by examining the 14 simulated moments individually. For both private and public firms, I present each individual moment's actual value, simulated value, and a t-statistics that tests whether the actual and simulated moment is equal. For private firms, the model does a good job of fitting, with 3 out of 14 simulated moments statistically different from the actual moments. The model statistically fails to match the mean operating income, the mean dividends, and the variance of leverage. The variance of leverage is the only one that is economically lower than the actual value 0.0261. Turning to public firms, Table 1.6 contains the results. Among 16 moments, 4 simulated moments are statistically different from the actual moments. However, the differences are not quantitatively large.

As a kind of out-of-sample test, I check whether the model can generate data patterns not used in the estimation. Note that I do not use Tobin's q and the signs of correlations in SMM. First, I compare the value of simulated Tobin's q to the real value for public firms. In the model, I simulate Tobin's q as $(V + p)/k$. Second, I investigate whether the model can match the signs of the correlations among variables in the real-data. All possible correlations between leverage and other moments are included in this check. Table 1.7 contains the results. I remove fixed effects before computing all of actual correlations. The simulated Tobin's q is 1.9232 for public firms, indistinguishable from the real value 2.0287. Obviously, Tobin's q is not available for private firms. Further, the model matches the signs of 4 out of 5 correlations for private firms, and fails to match the sign of the correlation between leverage and operating income. Among 5 correlations for public firms, the model matches the signs of four, and fails to match the sign of the correlation between leverage and equity issuance. It is hard to interpret the magnitude of correlations in a neoclassical setting.

1.5.3 Interpretation of the technology parameters

In addition to agency and external financing, I find that the average private firm faces higher σ and lower γ. In the model, the parameter σ describes the volatility of investment shocks. The estimated σ means that the uncertainty in production is much higher for private firms than for public firms. The estimated γ means that private firms find it less costly to adjust capital stock.

The age of the firm can be a potential explanation for these results,[10] since a younger firm is expected to face more uncertainty and has more flexibility, and thus finds it easier to change capital stock. Note that, on average, private firms are younger than public firms. I sort public firms based on the firm age, and split the sample into two groups: younger firms (mean age 21.03) and older firms (mean age 77.01).[11] The average managerial ownership β is 0.057 for younger firms and 0.052 for older firms. The average bonus ratio b is 0.61% for younger firms and 0.57% for older firms. There are no big differences of managerial ownership and manager's pay sensitivity between younger firms and older firms. Therefore, I do not expect that the agency and financial costs to differ substantially between young and old firms. Note that σ and γ are idenitified by using the moments related to investment and operating income. I investigate all moments related to investment and operating income between these two groups. Table 1.8 shows the results. I find that all variances are much higher in the

[10] I greatly thank the referee for suggesting this point.

[11] I collect all firms in the sample with available information of the age of the firm in Capital IQ. The sample shrinks to 4,383 public firms and 4,799 private firms.

group of younger firms, and that the investment rate is much lower and more volatile in the group of younger firms. This is consistent with the predictions that younger firms will face more uncertainty and lower adjustment costs. I also employ the same analysis on private firms, and the results are similar.

1.5.4 Counterfactual Experiments

Value loss

How large are agency and external equity costs for public and private firms? The structural approach allows us to quantify the impacts of these two frictions on firm value. I consider the following counterfactuals: a 5% increase in the cost of equity, and a 5% increase in the agency conflicts from the estimated values. For private firms, I calculate the average Tobin's q of firms over the simulated panels using the estimates in Table 1.5. I re-simulate S panels of firms, using the estimates of all technology parameters $(\alpha, \sigma, \rho, \delta, \gamma)$ in Table 1.5, but increasing the financing parameter ϕ by 5% or increasing the agency parameters (b, s, β) by 5%. I then calculate the average Tobin's q of firms over the re-simulated panels. The value loss is expressed in terms of percentage changes in Tobin's q between these two cases, which measures what fraction of firm value would be destroyed if following a 5% increase in the cost of equity or in agency conflicts. I conduct a similar analysis on public firms.

Table 1.9 presents the value loss. If I increase agency conflicts by 5% by changing the agency parameters (b, s, β), private firm value would rise by 2.46%. In contrast, following a 5% increase in agency conflicts, public firm value would rise by 11.14%. Since the average market value of public firms is \$4.83 billion in 2009 purchasing dollars, a 11.14% loss means that shareholders of an average public firm bear the cost of \$538.8 million. Therefore, agency conflicts are more harmful to large public firms relative to large private firms. These results are in line with the agency theory of Jensen and Meckling (1976) that the separation of ownership and control can lead to greater agency problems among public firms.

Consider now an increase in the costs of equity. If the cost of external equity ϕ rises by 5%, private firm value would increase by 0.44% and public firm value would increase by 0.18%. This result is intuitive, since private firms face higher costs of external equity than public firms.

Transition of firms

In the sample, large private firms are observably comparable to public firms in terms of firm size, industry, and information availability through 10-K filings. These private firms in the sample do not go public over the sample period. We next perform a counterfactual experiment to understand whether it is a good choice to remain private for these large private firms. To answer this question, I consider a hypothetical firm that has the sample estimates of agency and financing parameters from public firms, but it assumes the remaining parameters from private firms. That is, I re-simulate S panels of artificial private firms, using the estimates of (ϕ, b, s, β) in Table 1.6 and the estimates of remaining parameters in Table 1.5. This counterfactual mimics the case that a private firm would provide the same compensation package and managerial ownership as a public firm, and consequently enjoy the lower cost of external equity. Then, I compute several average moments over the panels of the artificial private firm, and compare these moments to the moments over the panels of the private firm using all estimates in Table 1.5.

Table 1.10 presents this counterfactual. First, the artificial private firm increases corporate cash balances by 7.34% of total assets relative to the private firm. The manager of the artificial private firm owns fewer shares of the firm and divert more fractions of corporate cash, compared to the private firm. Therefore, the manager has a stronger incentive to maintain cash. Gao et al. (2013) employ a sample of secondary IPOs. They find that "on average, cash holdings of IPO firms increases from 8.43% from the year prior to the IPO to 10.28% in the year after," indicating an increases in cash balances as firms transition from private to public. This is consistent with the model's prediction on cash balances. Second, facing lower costs of external equity, the manager of the artificial private firm would issue more equity relative to debt. Intuitively, as equity becomes cheaper, the manager is willing to use external equity for financing. Third, I observe that the ratio of debt to assets decreases, as the firms transition from private to artificial private. This is mainly because of the manager's preference over cash. Finally, I find that the artificial private firm would lose value in terms of Tobin's q. Thus, in the sense of firm value, the firm would not benefit by the transition from private to artificial private.

To better understand the loss in Tobin's q, I also conduct the analysis of value loss on the artificial private firm. That is, I increase the cost of equity and the agency conflicts by 5% for the artificial private firm by changing the corresponding parameters ϕ or (b, s, β). For the artificial private firm, I then calculate the value loss in terms of Tobin's q as before. Table 1.16 shows that, as the firm transits from private to artificial private, a 5% increase in agency conflicts destroys firm value by 5.33%, and a 5% increase in the cost of equity destroys firm value by 0.11%.

This experiment provides an insight into why private firms in the sample remain private. If the average private firm "goes public", inheriting the estimates of the financing and agency parameters from public firms, it can benefit from lower costs of external financing. However the managerial decisions will be distorted more by agency problems in the artificial private firm. The estimated magnitudes show that the loss due to agency dominates the gain from external financing. Thus, the average private firm would not benefit by "going public".

This counterfactual analysis faces some limitations.[12] First, the counterfactual assumes that, as in the transition from public to private, the estimated private firm only changes the financing and agency parameters (ϕ, b, s, β) and keeps the remaining parameters fixed. However, the costs and benefits of going public may be linked to the characteristics represented by the technology parameters in the way which is not captured by the model. Based on the model setting, the right interpretation of current experiments is that the current characteristics rationalize the choice of being private. Since some characteristics may change as the firm matures, private firms may eventually benefit by going public. Second, the calculations here do not consider direct or indirect costs related to the IPO itself. When a private firm decides to go public in reality, it will incur such costs, which are omitted in calculating the artificial private firm value. Therefore, the loss of Tobin's q in Table 1.10 should be loosely interpreted as a lower-bound estimate for the value loss as private firms go public. A 9.86% loss indicates that the average private firm would not benefit from providing the same own-

[12]I greatly thank the referee for pointing this out.

ership and compensation structure as a public firm, even if it does not pay any costs for IPO.

1.5.5 Robustness Check

I introduce three agency channels into the dynamic setting. It is possible that a dynamic model containing no agency problems can fit the data as well. To justify the addition of the agency parameters, I estimate the model without agency conflicts using the sample of both private and public firms. That is, I set $b = 0, s = 0$, and $\beta = 1$ in the model. Table 1.12 presents the estimation on private firms. Comparing between Table 1.5 and Table 1.12, we see that the model with agency does a better job matching average equity issuance, average leverage, and average cash balances. In Table 1.12, those simulated moments are statistically different from the actual moments. The results about public firms without agency are presented in Table 1.13. In Table 1.13, several simulated moments are statistically different from the actual moments. Thus, the model without agency does not fit the data very well. Note that the estimated cost of equity ϕ is unreasonably high in Table 1.12 and 1.13. In the model without agency, there is no agency reason for holding cash, and the manager maintains cash only due to precautionary reasons. Thus, the model without agency needs a high value of ϕ to match cash balances, and to lower average leverage as shown in DeAngelo et al. (2011).

A second concern is that the cost of external equity is assumed to be linear. I relax the cost of equity to be linear-quadratic. Whenever a firm issues equity e, it must pay the cost $c(e) = \phi_1 e + \phi_2 e^2$. This specification is consistent with the convexity of underwriting fees in Altinkilic and Hansen (2000). The quadratic cost of equity will mainly affect the variance of equity issuance. In Table 1.14 and 1.15, I re-estimate the model with linear-quadratic cost of equity on the samples of private and public firms. Adding a quadratic cost of equity improves the fitting of the model. Specifically, the model with ϕ_2 does a better job matching the mean and variance of equity issuance than the model without ϕ_2. However, the parameter estimates change little relative to the base case.

Finally, I mimic the transitions of several types of firms. I investigate “going public” of the following firms: (1) a private firm with shock volatility σ equal to the public firm's (2) a private firm with adjustment costs γ equal to the public firm's (3) a private firm with σ and γ equal to the public firm's. By going public, I let the private firms in question take the agency and financing parameters (ϕ, β, b, s) from public estimates in Table 1.6, and keep the other parameters unchanged. Similarly, I also investigate going private of a public firm. Table 1.16 presents the percentage changes in Tobin's q for those transitions. Tobin's q would decrease, if the private firm with shock volatility or adjustment costs equal to public firms goes public, therefore changing the agency and financing parameters as the public firm's values. Moreover, Tobin's q would increase, if the public firm with public technology characteristics goes private by facing the same agency and external financing level as private. Note that the increase in Tobin's q does not mean that public firms should go private, since the change of Tobin's q is only a lower bound estimate for the value loss. In terms of Tobin's q, the firm would always benefit by reducing agency problems. Thus, the main mechanism at play is the tradeoff between agency and external financing. The intuition is that the loss due to agency conflicts would dominate the gain from lower financing costs, if the private firm "goes public".

1.6 Conclusion

I economically quantify the effects of manager-shareholder conflicts and issuing equity for privately held firms by estimating a dynamic model. The parameters of the model describe a firm's production environment, agency conflicts, and external financing costs. I compare the results of private firms to those from a sample of comparable public firms. Large private firms pay 8.19% costs of external equity, much higher than 4.88% for large public firms. Managerial diversion on cash is more severe in public firms. Per dollar, the manager of private firms can divert about 2(bps) of corporate cash as private benefits, much lower than 7(bps) for public firms.

I also investigate the effects of agency and external financing on firm value. Counterfactual analysis shows that a 5% increase in agency conflicts would imply a $538.8 million loss for the average public firm. Indeed, agency conflicts are more harmful to large public firms relative to large private firms. These results are in line with Jensen and Meckling 1976 that the separation of ownership and control can lead to greater agency problems among public firms. Moreover, I find that private firms are more concerned with the costs of external financing.

In addition to the agency and financing parameters, private and public firms differ in other technology parameters. The volatility of productivity shocks and their capital stock adjustment costs are different between public and private firms. Further analysis shows that the age of the firm can be an explanation of the differences in technology.

Finally, counterfactual experiments provide new insights into why large private firms remain private. By going public, private firms can reduce the value loss due to costly external financing, But managerial decisions will be distorted more by agency problems. The estimated magnitudes show that the loss due to agency dominates the gain from external financing. Thus, the average private firm would not benefit by going public.

1.7 Numerical Solution

This Appendix describes how I numerically solve the Bellman equation to find the manager's optimal decisions. To find a numerical solution, I discretize the state space for z by transforming (1.2) into $[-4\sigma, 4\sigma]$ with 11 points of support using the method in Tauchen (1986). The capital stock, k, lies in the interval $[0, \bar{k}]$, where $\bar{k}$ is determined by

$$(b+\beta)(1-\tau)z_{max}(\bar{k})^{\alpha} - \delta\beta\bar{k} = 0 \tag{1.13}$$

$\bar{k}$ is the upper bound for the capital stock that is economically profitable. This is an analogue of the condition $z_{max}(\bar{k})^{\alpha} - \delta\bar{k} = 0$ in Gomes (2001), and Hennessy and Whited (2005). We let k on a grid of 25 points, centered at the steady-state k^*. k^* equates the marginal product of capital for a neutral z with $r + \delta$. Finally, p lies on the interval $[-\bar{p}/2, \bar{p}]$ with 10 equally spaced points. The optimal choice of p sometimes hits $\bar{p}$, but never hits $-\bar{p}/2$. I solve the Bellman equation (1.10) via value function iteration. This will produce the policy function $\{k', p'\}$. I use interpolation in the following model simulation.

1.8 Details on SMM Estimation

This Appendix presents the details of estimation method, construction of weighting matrix and computing standard errors of parameters. Define

$$g(\theta) = \hat{M}_N - \frac{1}{S}\sum_{s=1}^{S} \hat{m}^s_{N'}(\theta), \tag{1.14}$$

in which $\hat{M}_N$ are the moments of actual data vector $x_i (i = 1, 2, ..., N)$, $\hat{m}^s_{N'}(\theta)$ are the moments of sth simulated panel based on a vector of structural parameter θ, and S is the number of simulated data sets (I choose $S = 10$). Note that the SMM estimator $\hat{\theta}$ is defined as

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}}\, g(\theta)' W g(\theta). \tag{1.15}$$

Then $\hat{\theta}$ is asymptotically normal for fixed S (Pakes and Pollard (1989)):

$$\sqrt{N}(\hat{\theta} - \theta_0) \to^d \mathcal{N}(0, \text{avar}(\hat{\theta})), \tag{1.16}$$

$$\text{avar}(\hat{\theta}) = \left(1 + \frac{1}{S}\right) (J(\theta)'\Omega^{-1} J(\theta))^{-1}, \tag{1.17}$$

where $J(\theta)$ is the Jacobian of $g(\theta)$, and I use the efficient weighting matrix $W = \Omega^{-1}$, the inverse of the estimate of moment covariance matrix. I compute $J(\theta)$ by numerically differentiating $g(\theta)$. I estimate the cluster moment covariance matrix, $\hat{\Omega}$, using the influence-function method in Erickson and Whited (2000) and Nikolov and Whited (2013). First, I calculate the influence functions of the actual moments, ψ_{x_i}. Then I stack the influence functions for each of moments, and covary this stack by clustering among time series dimensions and averaging over the cross-sectional dimensions. $\sqrt{N} g(\hat{\theta})$ is also asymptotically normal:

$$\sqrt{N} g(\hat{\theta}) \to^d \mathcal{N}\left(0, \left(1 + \frac{1}{S}\right)\hat{\Omega}\right). \tag{1.18}$$

Table 1.1: **Comparative Statics (Agency and Financing)**

This table reports the average equity issuance, average leverage, and average positive cash balances from simulation of the model against the financing and agency parameters. Each number reports one average moment of a different model simulation with a different value of the parameter in question. We let the financing and agency parameters in a range: $\phi \in [0, 0.15]$, $\beta \in [0.05, 0.2]$, $b \in [0, 0.01]$ and $s \in [0, 0.0015]$. The remaining parameters are set to the value in Table 1.5. For each simulation, we run the model for 100,000 firms over 50 years, and only keep the last 10-year observations.

Model's parameter	Low						High
			Panel A: average equity issuance				
Cost of equity ϕ	0.0615	0.0494	0.0307	0.0250	0.0225	0.0170	0.0154
Managerial ownership β	0.0242	0.0235	0.0234	0.0224	0.0142	0.0142	0.0123
Profit sharing b	0.0198	0.0216	0.0227	0.0229	0.0234	0.0239	0.0247
Cash diversion s	0.0246	0.0243	0.0243	0.0243	0.0242	0.0242	0.0233
			Panel B: average leverage				
Cost of equity ϕ	0.3187	0.3114	0.2751	0.2605	0.2348	0.2192	0.2137
Managerial ownership β	0.1254	0.1369	0.1397	0.2193	0.2528	0.2618	0.2753
Profit sharing b	0.3341	0.2947	0.2706	0.2601	0.2450	0.2276	0.2187
Cash diversion s	0.2512	0.2512	0.2511	0.2509	0.2509	0.2378	0.2271
			Panel C: average positive cash balances				
Cost of equity ϕ	0.0000	0.0010	0.0210	0.0389	0.0820	0.0861	0.0908
Managerial ownership β	0.0816	0.0769	0.0754	0.0748	0.0689	0.0463	0.0414
Profit sharing b	0.0000	0.0347	0.0443	0.0577	0.0672	0.0701	0.0734
Cash diversion s	0.0591	0.0733	0.0816	0.0935	0.0947	0.1526	0.1662

Table 1.2: **Comparative Statics (Technology)**

This table reports the average equity issuance, average leverage, and average positive cash balances from simulation of the model against the technology parameters. Each number reports one average moment of a different model simulation with a different value of the parameter in question. We let the technology parameters set by a low or high value: $\sigma \in \{0.2, 0.4\}$, $\gamma \in \{0.3, 1.2\}$, $\rho \in \{0.5, 0.75\}$ and $\theta \in \{0.65, 0.85\}$. The remaining parameters are set to the value in Table 1.5. For each simulation, we run the model for 100,000 firms over 50 years, and only keep the last 10-year observations.

	σ		γ		ρ		θ	
	low	high	low	high	low	high	low	high
Average equity issuance	0.0126	0.0154	0.0254	0.0052	0.0076	0.0251	0.0126	0.0169
Average leverage	0.5575	0.1807	0.1263	0.3005	0.3691	0.1745	0.3293	0.1366
Average positive cash	0.0000	0.0940	0.1390	0.0000	0.0000	0.1060	0.0000	0.0989

Table 1.3: **Variable Definitions**

This table presents definitions of variables and sources of data used.

Variable	Definition
Investment	Capital Expenditure minus Sale of Property normalized by Gross Property Plant and Equipment
Operating income	EBITDA normalized by Total Assets
Dividends	For private firms, I use Capital IQ equivalent Total Dividends Paid. Then I scale Total Dividends Paid by Total Assets. For public firms, total dividends are computed as Dividends Common/Ordinary (DVC) + Dividends-Preferred/Preference (DVP) + Purchase of Common and Preferred Stock (PRSTKC), normalized by Total Assets.
Equity issuance	For private firms, sales of equity normalized by Total Assets. For public firms, Sale of Common and Preferred Stock (SSTK), normalized by Total Assets.
Cash	Cash and short-term investments scaled by Total Assets
Leverage	For private firms, Total Debt normalized by Total Assets. For public firms, Debt in Current Liabilities (DLC) + Long-Term Debt-Total (DLTT)/Assets-Total (AT)
Managerial Ownership	For private firms, I use the ownership data from firm's annual reports and proxy statements. For public firms, the number of shares owned by the managerial team normalized by the total number of shares outstanding. The number of shares owned by top 5 executives are computed as the sum of Compustat item Shares Owned-Options and item Unexercised Exercisable Options.
Total Bonus Pay	The sum of top five executives' bonus. For private firms, I hand collect managerial bonus from firm's annual report. For public firms, it is ExecuComp item BONUS.

Table 1.4: **Summary Statistics**

This table presents summary statistics for the full sample of public firms and private firms from 2001 to 2013, obtained from Compustat Annual Industrial Files, ExecuComp, and Capital IQ. The table reports means and standard deviations of the key variables as well as pairwise differences in means. *** and * indicate a difference that is statistically significant at the 1% level and the 10% level. All dollar values are of 2013 purchasing power. Table 1.3 gives all variable definitions and details of their construction.

	Private firms		Public firms		Differences in
	Mean	StdDev	Mean	StdDev	mean
Investment	0.1241	0.1516	0.1136	0.0831	0.0105***
Operating income	0.1225	0.2034	0.1408	0.0952	−0.0184***
Dividends	0.0232	0.0765	0.0450	0.0636	−0.0218***
Equity issuance	0.0209	0.0748	0.0211	0.0539	−0.0002
Cash	0.0746	0.1161	0.1890	0.1815	−0.1144***
Leverage	0.2591	0.2363	0.1777	0.1728	0.0814***
Depreciation	0.1209	0.2436	0.1103	0.1127	−0.0146***
Managerial ownership	0.1361	0.2324	0.0493	0.0663	0.0868***
Total bonus pay ($K)	502.7	1362.8	817.2	1386.9	−314.5***
Total assets ($B)	2.5780	7.878	3.2620	6.123	−0.6840***
No. of observations	5643		7027		

Table 1.5: **Simulated Moments Estimation (Private Firms)**

This table reports estimated parameters and moments using SMM on the sample of U.S. private firms. The sample period is from 2001 to 2013. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^{α}. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^*$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. s is the cash diversion parameter. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the sample of U.S. private firms from Capital IQ. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ	$\bar{p}/k^*$	$s \times 1000$
Private firms							
	0.7665	0.3883	0.7074	0.5029	0.0819	0.5257	0.2048
	(0.0309)	(0.0091)	(0.0100)	(0.0741)	(0.0116)	(0.0900)	(0.3284)

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1241	0.1167	−0.9886
Variance of investment	0.0079	0.0084	0.3522
Serial correlation of investment	0.4788	0.5213	0.6806
Average operating income π/k	0.1225	0.1540	2.5230
Variance of operating income	0.0035	0.0038	0.5537
Serial correlation of operating income	0.6435	0.6172	−0.1100
Average dividends div/k	0.0232	0.0347	4.1567
Variance of dividends	0.0014	0.0015	0.9322
Average equity issuance e/k	0.0209	0.0243	1.7564
Variance of equity issuance	0.0033	0.0036	0.5766
Average leverage d/k	0.2591	0.2512	−0.7337
Variance of leverage	0.0261	0.0042	−4.1321
Average cash c/k, conditional on $c > 0$	0.0746	0.0720	−0.4619
Variance of cash	0.0026	0.0034	0.4597

Table 1.6: **Simulated Moments Estimation (Public Firms)**

This table reports estimated parameters and moments using SMM on the sample of U.S. public firms. The sample period is from 2001 to 2013. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^{α}. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^*$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. s is the cash diversion parameter. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the samples of U.S. public firms from Compustat Annual Industrial Files, and ExecuComp. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ	$\bar{p}/k^*$	$s \times 1000$
Public firms							
	0.7848	0.3055	0.7472	0.7954	0.0488	0.6847	0.7234
	(0.0066)	(0.0014)	(0.0023)	(0.0126)	(0.0046)	(0.0441)	(0.0080)

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1136	0.1007	−1.0808
Variance of investment	0.0043	0.0048	1.0169
Serial correlation of investment	0.3936	0.5847	4.1611
Average operating income π/k	0.1408	0.1493	1.5557
Variance of operating income	0.0045	0.0045	−0.0665
Serial correlation of operating income	0.5313	0.6766	2.4949
Average dividends div/k	0.0450	0.0439	−0.3425
Variance of dividends	0.0020	0.0014	−1.6722
Average equity issuance e/k	0.0211	0.0148	−3.1189
Variance of equity issuance	0.0018	0.0017	−0.0361
Average leverage d/k	0.1777	0.1772	−0.0446
Variance of leverage	0.0074	0.0079	0.8527
Average cash c/k, conditional on $c > 0$	0.1890	0.1839	-0.4411
Variance of cash	0.0066	0.0043	−4.2888

Table 1.7: **Out-of-sample Test**

This table compares real-data correlations with model generated correlations. The model is solved using the values of parameters in Table 1.5 and Table 1.6.

	Private Firms		Public Firms	
Correlation	Data	Model	Data	Model
Average Tobin's q $((V+p)/k)$	–	–	2.0287	1.9232
Correlation of leverage and investment	0.0049	0.2055	−0.0614	−0.0585
Correlation of leverage and operating income	0.0954	−0.1741	−0.1823	−0.0442
Correlation of leverage and dividends	−0.0243	−0.0957	−0.0103	−0.1526
Correlation of leverage and equity issuance	0.0960	0.1692	−0.0521	0.1761
Correlation of leverage and cash	−0.0439	−0.0281	−0.1428	−0.4144

Table 1.8: **Moments Comparison Based on Age**

I collect all public firms in the sample with available information of the age of the firm in Capital IQ. I sort the firms based on the firm age, and split the sample into two groups: young firms (mean age: 77) and older firms (mean age: 21). This table compares the moments related to investment and operating income between the two groups.

	Young age firms	Old age firms
Average investment (i/k)	0.1343	0.0901
Variance of investment	0.0060	0.0023
Serial correlation of investment	0.4354	0.4334
Average profits (π/k)	0.1404	0.1501
Variance of profits	0.0064	0.0026
Serial correlation of profits	0.6329	0.6443

Table 1.9: **Value Loss**

This table presents the value loss due to 5% increases in the agency conflicts or the cost of equity. The value loss is expressed in terms of Tobin's q. The column "Private Firm" uses the estimates in Table 1.5 and the column "Public Firm" uses the estimates in Table 1.6.

	Private Firm	Public Firm
5% increase in agency conflict	2.46%	11.14%
5% increase in equity cost	0.44%	0.18%

Table 1.10: **Transition from private to public**

This table presents the changes in average moments of the private firm and those of the artificial private firm. The simulation of the private firm uses the estimates in Table 1.5. The simulation of the artificial private firm uses the estimates of (ϕ, b, s, β) in Table 1.6, and the estimates of remaining parameters in Table 1.5. The sample of secondary IPOs is based on Gao et al. (2013).

Average moments changes	Sample of secondary IPOs
Corporate cash balances	+1.85%
	Model simulation
Positive cash balances	+7.34%
Equity issuance	+0.33%
Leverage	−7.35%
Equity issuance/leverage	+5.87%
Percentage changes in Tobin's q	−9.86%

Table 1.11: **Value Loss for Artificial Private Firm**

This table presents the value loss due to 5% increases in the agency conflicts or the cost of equity. The value loss is expressed in terms of Tobin's q. The column "Private Firm" uses the estimates in Table 1.5 and the column "Artificial Private Firm" uses the estimates of (ϕ, b, s, β) in Table 1.6 and the estimates of the remaining parameters in Table 1.5.

	Private Firm	Artificial Private Firm
5% increase in agency conflict	2.46%	5.33%
5% increase in equity cost	0.44%	0.11%

Table 1.12: **Simulated Moments Estimation (Private Firms without Agency)**

This table reports estimated parameters and moments using SMM on the sample of U.S. private firms. The sample period is from 2001 to 2013. The model contains no agency, i.e., $b = 0, s = 0, \beta = 1$. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^{α}. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^{*}$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the sample of U.S. private firms from Capital IQ. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ	$\bar{p}/k^{*}$	$s \times 1000$
Private firms							
	0.7871	0.3633	0.7778	0.7065	0.1546	0.6262	–
	(0.0065)	(0.0064)	(0.0062)	(0.1312)	(0.0106)	(0.0330)	

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1241	0.1047	-1.6046
Variance of investment	0.0079	0.0080	0.0840
Serial correlation of investment	0.4788	0.6140	2.1610
Average profits π/k	0.1225	0.1534	2.4709
Variance of profits	0.0035	0.0040	1.1850
Serial correlation of profits	0.6435	0.6937	0.2092
Average dividends div/k	0.0232	0.0401	6.1310
Variance of dividends	0.0014	0.0018	1.5552
Average equity issuance e/k	0.0209	0.0158	-2.6382
Variance of equity issuance	0.0033	0.0042	1.8173
Average leverage d/k	0.2591	0.2854	2.4543
Variance of leverage	0.0261	0.0081	-5.0351
Average cash c/k, conditional on $c > 0$	0.0746	0.0628	-2.0908
Variance of cash	0.0026	0.0021	-0.2967

Table 1.13: **Simulated Moments Estimation (Public Firms without Agency)**

This table reports estimated parameters and moments using SMM on the sample of U.S. public firms. The sample period is from 2001 to 2013. The model contains no agency, i.e., $b = 0, s = 0, \beta = 1$. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^{α}. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^*$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the samples of U.S. public firms from Compustat Annual Industrial Files, and ExecuComp. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ	$\bar{p}/k^*$	$s \times 1000$
Public firms							
	0.8230	0.2860	0.7546	0.4567	0.0989	0.5054	–
	(0.0037)	(0.0058)	(0.0030)	(0.0214)	(0.0035)	(0.0214)	

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1136	0.1177	0.9799
Variance of investment	0.0043	0.0068	1.5703
Serial correlation of investment	0.3936	0.5857	4.1837
Average profits π/k	0.1408	0.1758	6.3909
Variance of profits	0.0045	0.0055	1.3897
Serial correlation of profits	0.5313	0.6861	2.6573
Average dividends div/k	0.0450	0.0416	−1.0583
Variance of dividends	0.0020	0.0019	−0.3826
Average equity issuance e/k	0.0211	0.0151	−2.9989
Variance of equity issuance	0.0018	0.0020	1.0029
Average leverage d/k	0.1777	0.1975	1.8453
Variance of leverage	0.0074	0.0049	−4.3114
Average cash c/k, conditional on $c > 0$	0.1890	0.0744	−9.9442
Variance of cash	0.0066	0.0063	−0.4986

Table 1.14: **Simulated Moments Estimation (Private Firms with Quadratic Cost of Equity)**

This table reports estimated parameters and moments using SMM on the sample of U.S. private firms. The sample period is from 2001 to 2013. The model contains a linear-quadratic cost of equity $c(e) = \phi_1 e + \phi_2 e^2$. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^α. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^*$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. s is the cash diversion parameter. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the samples of U.S. public firms from Compustat Annual Industrial Files, and ExecuComp. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ_1	$\bar{p}/k^*$	$s \times 1000$	$\phi_2 \times 1000$
Private								
	0.7664	0.3895	0.7081	0.4965	0.0832	0.5945	0.2243	0.0161
	(0.0301)	(0.0108)	(0.0090)	(0.0413)	(0.0157)	(0.1011)	(0.4515)	(0.0110)

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1241	0.1168	−0.9849
Variance of investment	0.0079	0.0092	0.8804
Serial correlation of investment	0.4788	0.5277	0.7822
Average profits π/k	0.1225	0.1537	2.4973
Variance of profits	0.0035	0.0038	0.5425
Serial correlation of profits	0.6435	0.6163	−0.1137
Average dividends div/k	0.0232	0.0342	3.9829
Variance of dividends	0.0014	0.0015	0.7329
Average equity issuance e/k	0.0209	0.0214	0.2547
Variance of equity issuance	0.0033	0.0028	−1.0442
Average leverage d/k	0.2591	0.2646	0.5146
Variance of leverage	0.0261	0.0039	−4.2156
Average cash c/k, conditional on $c > 0$	0.0746	0.0730	−0.2896
Variance of cash	0.0026	0.0035	0.4747

Table 1.15: **Simulated Moments Estimation (Public Firms with Quadratic Cost of Equity)**

This table reports estimated parameters and moments using SMM on the sample of U.S. public firms. The sample period is from 2001 to 2013. The model contains a linear-quadratic cost of equity $c(e) = \phi_1 e + \phi_2 e^2$. Panel A shows parameter estimates, with standard errors in parentheses. α is the curvature of profit function, zk^{α}. σ is the standard deviation of $\ln z$. ρ is the serial correlation of $\ln z$. γ is the quadratic adjustment cost parameter. ϕ is the linear cost of external equity. $\bar{p}/k^*$ reflects the upper bound limit on debt as a ratio of the steady state capital stock. s is the cash diversion parameter. Panel B shows the 14 moments used in the SMM estimation. Calculations of actual moments are based on the sample of U.S. private firms from Capital IQ. Simulated moments are computed from data simulated from the model using parameter values in Panel A. Panel B also presents the t-statistics for the differences between the simulated and actual moments.

Panel A. Parameter Estimates

	α	σ	ρ	γ	ϕ_1	$\bar{p}/k^*$	$s \times 1000$	$\phi_2 \times 1000$
Public								
	0.7918	0.3113	0.7540	0.8019	0.0404	0.6901	0.7347	0.0033
	(0.0088)	(0.0054)	(0.0077)	(0.0223)	(0.0058)	(0.0250)	(0.0142)	(0.0010)

Panel B. 14 Moments Estimation

	Actual moments	Simulated moments	$t-$stats.
Average investment i/k	0.1136	0.1018	−1.5806
Variance of investment	0.0043	0.0048	0.9525
Serial correlation of investment	0.3936	0.5849	4.1654
Average profits π/k	0.1408	0.1495	1.5797
Variance of profits	0.0045	0.0045	−0.0796
Serial correlation of profits	0.5313	0.6765	2.4928
Average dividends div/k	0.0450	0.0445	−0.1686
Variance of dividends	0.0020	0.0015	−1.3039
Average equity issuance e/k	0.0211	0.0154	−2.8469
Variance of equity issuance	0.0018	0.0019	0.4347
Average leverage d/k	0.1777	0.1865	0.8148
Variance of leverage	0.0074	0.0081	1.2163
Average cash c/k, conditional on $c > 0$	0.1890	0.1871	−0.1680
Variance of cash	0.0066	0.0044	−4.0021

Table 1.16: **Changes of Tobin's q in different transitions**

This table presents the percentage changes in Tobin's q for transitions of different firms. The simulation of the private firm with public σ uses the estimate of σ in Table 1.6 and uses the remaining parameter estimates in Table 1.5. The simulation of the private firm with public γ uses the estimate of γ in Table 1.6 and uses the remaining parameter estimates in Table 1.5. The simulation of the private firm with public σ and γ uses the estimates of σ and γ in Table 1.6 and uses the remaining parameter estimates in Table 1.5. The simulation of the public firm uses all estimates in Table 1.6.

Transitions of different firms	Percentage changes in Tobin's q
Private firm with public σ "go public"	−11.97%
Private firm with public γ "go public"	−12.78%
Private firm with public σ and γ "go public"	−10.46%
Public firm "go private"	+15.46%

Chapter 2

The Agency Costs of Public Ownership: Evidence from Acquisitions by Private Firms

joint with Andrey Golubov

We provide the first evidence on value creation in acquisitions by private firms. Acquiring firm ownership type has strong effects on post-takeover performance. Private bidders experience 16-20 per cent greater operating performance improvements following acquisitions relative to public firms. This difference is not due to differences in target types, merger accounting, private equity ownership or subsequent listing of some private firms. Further analysis of governance arrangements allows us to attribute this effect to lower agency costs/better incentive alignment in private firms. Overall, not only do private firms pay lower prices for target firm assets, they also operate them more efficiently.

2.1 Introduction

Corporate takeovers are among the largest forms of corporate investment that a firm may undertake. However, economists have long worried that agency conflicts between managers and shareholders may distort managerial incentives and eventually lead to value-destroying investments, such as acquisitions (see Berle and Means 1932; Jensen and Meckling 1976; Jensen 1986; Stein 1989; Stulz 1990). The extant empirical evidence shows that shareholders of public acquiring firms earn, on average, close-to-zero and often negative abnormal returns around the time of takeover announcement, and that the projected operational efficiencies between the merging firms often fail to materialize.[1]

Would takeovers benefit acquirers in the absence of agency conflicts? The empirical evidence on this question is scarce. The main challenge is to observe an acquiring firm's performance following a takeover in an environment with few agency conflicts. To address this difficulty, we take advantage of a comprehensive dataset of private acquiring firms. We use large private acquirers as a plausible counterfactual for how public firms would have performed in the absence of agency conflicts. As predicted by Jensen and Meckling (1976), the key assumption is that, on average, private firms face fewer agency problems, since private firms typically operate under concentrated ownership and control. This encourages private firms' owners to monitor the management more closely to ensure shareholder value maximization. Thus, private firms should be less affected by agency problems compared to public firms, which, in turn, should have a positive impact on their acquisition decisions.

Using a dataset covering both public and large private firms in the U.S., we examine differences in post-takeover performance between these two types of acquirers. In the absence of stock price data for private firms, we focus on real operational performance improvements. In addition to the agency cost dimension, private acquirers are of great interest in their own right, as the existing literature on value creation in mergers and acquisitions (M&A) is silent on acquisitions by private acquirers due to obvious data limitations.

While the data on private firms are generally unavailable, we take advantage of the fact that certain private firms are required to disclose their financials to the U.S. Securities and Exchange Commission (SEC) because of the size of their assets or because they have publicly traded debt. Although not representative of a typical private firm, these private firms are observably comparable to public firms in terms of size and information availability through

[1]Many recent papers provide abnormal return estimates for takeover announcements, including Fuller, Netter, and Stegemoller (2002), Moeller, Schlingemann, and Stulz (2004, 2005), Masulis, Wang, and Xie (2007), and Golubov, Yawson, and Zhang (2015). See also the review paper by Betton, Eckbo, and Thorburn (2008).

10-K filings. Therefore, ownership and control is the main source of differences between public and private bidders in our sample.

Our analysis is based on a sample of 6,345 acquisition deals over the period 1997-2010 drawn from Capital IQ, which provides both transaction data as well as the firms' financials. Of these deals, 1,032 were conducted by private bidders and the remaining 5,313 by public bidders. We find that, on average, private bidders experience significantly greater operating performance improvements. Public acquirers increase their return on assets (ROA) by 1.69%, 2.52%, and 2.62%, in the first one, two, and three years after the deal completion, respectively. In contrast, private acquirers experience growth in ROA of 15.85%, 18.12%, and 19.24% over the same one, two, and three year periods following deal completion. Asset utilization, as measured by asset turnover (ATO) also improves significantly more for private bidders.

Next, we perform regression analysis to show that an acquirer's listing status rather than observable differences in targets or deal types explain the differences in operating performance improvements. In the baseline model, we regress the percentage change in the return on assets (ROA) and asset turnover (ATO) on an indicator for private bidders and controls for acquiring firms' pre-deal characteristics, bid attributes, as well as year and industry fixed effects (defined by three-digit SIC code). The results confirm that private acquirers have significantly greater increases in ROA and ATO one, two, and three years after the deal. For example, private acquirers realize a 16.0% additional increase in ROA during the year after the acquisition, an 18.1% incremental increase in ROA two years after the acquisition, and a 16.2% incremental increase in ROA in the three years after the acquisition, as compared to to public acquirers. We find that private acquirers achieve additional increases in ROA and ATO after the deal relative to their public counterparts even after controlling for the acquiring firm's growth opportunities (age), target firm types (public versus private), relative deal size, industry relatedness, and hostility. These results are consistent with our conjecture that private bidders are subject to fewer agency conflicts, leading to better investment decisions.

We further investigate several alternative explanations for the private bidder effect. Private bidders could be going after targets with higher levels of ROA or ATO than target firms acquired by public firms, resulting in greater combined firm profitability. This does not appear to be the case. In a subsample of deals where the target firms' financials are available, we show that targets of private bidders are not more profitable than those of public bidders.[2] Another potential explanation has to do with merger accounting. If public bidders pay higher prices for target firm assets (as shown by Bargeron, Schlingemann, Stulz, and Zutter (2008) for public targets), then more accounting goodwill is created in acquisitions by public firms, resulting in a higher enlarged book value of assets of the combined firm. Holding cashflows constant, a larger denominator in ROA and ATO ratios would lead to smaller post-deal ROA figures for public bidders. We examine transaction multiples (EV/Book, EV/Sales, EV/EBITDA) paid by private versus public bidders, and find that private bidders, indeed, pay lower prices for target firm assets. However, we show similar private bidder effects on post-takeover performance when using changes in return on sales (ROS) - a measure of profitability that is free from merger accounting effects. Finally, private acquirers could be going public following acquisitions. If so, greater operating performance improvements of private bidders could be due to IPO-enabled opportunities and not due to better acquisition decisions. Nevertheless, we show that the results continue to hold when we exclude firms that change their listing status in the post-acquisition period.[3]

Finally, we investigate whether the private bidder effect can, indeed, be attributed to differences in agency costs/incentive alignment between public and private firms. First, looking within public firms, we find that public acquirers with higher insider ownership (potentially better-governed firms) realize higher gains in operating profitability after the deal than public acquirers with lower insider ownership (potentially poorly-governed firms). We also find that the difference in operating performance improvements within public acquirers of different insider ownership levels is smaller than that between public and private acquirers. Thus, differences in agency problems are greater between public and private firms than within public firms, consistent with Gao et al. (2013). Second, we compare governance arrangements

[2]In addition, if targets of private bidders were more profitable, this would be reflected in higher prices paid for those assets. In fact, we find the opposite.

[3]Note that, to the extent that private firms are not subject to capital market pressures that put emphasis on short-term profitability as much as public firms are, private firms are more likely to undertake deals that result in long-term value creation at the expense of immediate effects on earnings. At the same time, public firms may be coerced into deals that result in near-term improvements in profitability. If this is the case, our analysis focusing on the first three years following the deal will not capture these long-run differences. This biases us against finding greater operating performance improvements for private bidders.

of public and private firms and investigate whether these differences can account for the private bidder effect. We take advantage of Capital IQ's coverage of antitakeover defences for both public and private firms.[4] Private bidders employ significantly fewer provisions limiting shareholder control. When we match public and private bidders on the basis of these provisions, we find that private acquirers perform similarly to public acquirers.

This paper contributes to the M&A literature by providing the first evidence on value creation by private acquirers. Our results thus complement prior research that was limited to public acquirers.[5] In doing so, we also reaffirm one of the major reasons for poor performance of acquiring firms proposed in the literature, namely the agency problem (see, e.g., Masulis et al. (2007), Moeller et al. (2004)). Moreover, our findings help interpret some of the prior results in this literature. In particular, Bargeron et al. (2008) show that private operating firms pay lower premia relative to public bidders, a result we confirm in a broader sample of deals using transaction multiples. There are two possibilities: either private firms are more disciplined due to better incentive alignment, or they simply enter deals with lower synergy gains that would naturally warrant lower prices. Our results on greater operating performance improvements suggest it is the former case, and further demonstrate that, not only private bidders pay lower prices for target firm assets, they also operate those assets more efficiently. Finally, our paper contributes to the nascent literature in corporate finance that studies the characteristics of private firms (Brav (2009), Saunders and Steffen (2011), Michaely and Roberts (2012), Gao et al. (2013), Asker, Farre-Mensa, and Ljungqvist (2015), Xiong (2015)). We expand this set of studies by providing new evidence on the effect of private ownership on takeover efficiency gains, and, by extension, on the quality of investment decisions more broadly.

[4]While titled "Takeover Defences" in Capital IQ, this variable captures limitations to shareholder control more broadly. In addition to standard antitakeover provisions such as poison pills and classified boards, this index captures such limitations/enhancements of shareholder rights as cumulative voting for board seats, causes for director removal, and limits to amend the corporate charter and bylaws, among others. While antitakeover provisions may be less relevant for a private firm given its concentrated ownership structure, the use of these provisions may convey general attitude of the firm and its management towards shareholder value maximization.

[5]The only exception is a study by Maksimovic et al. (2013) who use plant-level data for U.S. manufacturing firms to study public and private firm participation in merger waves. They show, among, others, that productivity gains (measured by total factor productivity) following plant acquisitions are greater when the buyer is public. Our results are not necessarily in conflict, because i) our sample is not limited to manufacturing firms, and ii) we measure efficiency gains as changes in overall operating profitability at the firm level, which takes account of various expenses not captured in total factor productivity.

The rest of the paper proceeds as follows. Section 2 reviews related literature. Section 3 describes our sample and measures of operating performance improvements. Main results are presented in Section 4. We investigate the agency cost channel in Section 5. Finally, Section 6 concludes.

2.2 Literature Review

There is a large literature examining takeover gains to acquiring firms, though virtually all papers are limited to studying public acquirers and use abnormal stock returns to measure takeover gains (see Betton et al. (2008) for a complete summary of the literature). In general, evidence on the ability of acquiring firms to generate value through takeovers has been mixed. Fuller et al. (2002) study abnormal returns for public firms that acquired five or more targets within a three-year period, showing that public acquirers gain when buying a private or subsidiary firm, but lose or break-even when buying a public firm. In a sample of acquisitions by public firms from 1980 to 2001, Moeller et al. (2005) show that acquiring-firm shareholders lose $25.2 million on average upon announcement. Moeller et al. (2004) show that returns to public bidders decline with the size of the bidder, a result they attribute to greater agency problems/weaker incentive alignment at larger firms. Along these lines, Masulis et al. (2007) show that poorly governed public bidders – as measured by their use of antitakeover provisions – exhibit lower returns than better governed bidders. Since private firms tend to be smaller and use fewer provisions limiting shareholder control, the classic agency view would predict that private bidders should make better M&A decisions.

In the voluminous M&A literature, only two papers have touched upon private acquirers. Bargeron et al. (2008) investigate all-cash takeovers of U.S. public targets by private and public bidders from 1990 to 2005. They find that private equity bidders pay 63% lower premiums relative to public bidders, and that private operating companies (the focus of our paper) pay 14% lower premiums relative to public firms. Our paper differs in that we study actual efficiency gains realized in takeovers by private firms, and that our sample is not limited to public targets. Maksimovic et al. (2013) study a sample of acquisitions by manufacturing firms in the U.S. using plant-level data from the Annual Survey of Manufactures. They find that productivity gains, measured by total factor productivity, are greater when the buyer is a public firm. Our sample is not limited to manufacturing firms, and our measures of efficiency gains take into account overall profitability at the firm level.

We also join a small but growing literature that studies private companies. Sheen (2012) and Asker et al. (2015) find that private firms invest more and are more responsive to investment opportunities. Gilje and Taillard (2016) examine a unique dataset of U.S. natural gas producers and show that investment by private firms react less to changes in natural gas prices. Brav (2009) and Saunders and Steffen (2011) investigate the financial policies of private and public firms in the U.K. and find that private firms face higher costs of external finance. Michaely and Roberts (2012) study dividend policies of public and private firms in the U.K. and find that private firms smooth dividends significantly less than public firms. Gao et al. (2013) shows that private firms hold, on average, about half as much cash as public firms do. If public firms acquire more to take advantage of their cash holdings rather than to realize synergies, as predicted by Jensen (1986), then we would expect that public acquirers experience lower operating profitability than private acquirers after corporate takeovers. Xiong (2015) quantifies the effects of agency and financing on large private firms using a structural estimation approach. He finds that large private firms face fewer agency problems than their public counterparts. This evidence supports the idea, on which we base our empirical strategy, that the performance of large private acquirers can serve as plausible counterfactual for public acquiring firms.

2.3 Data and Basic Statistics

2.3.1 The sample

Our primary data source is the Capital IQ database. Starting from the late-1990s, Capital IQ provides data on U.S. firms' M&A activity and financial information with a similar level of detail as provided by SDC Mergers and Acquisitions Database and Compustat for public firms. We start with U.S. public firms traded on the NYSE, Nasdaq, or Amex. A private firm is required not to have shares traded on any major stock exchange or OTC market. In Capital IQ, private firm observations mainly come from Form 10-K and from Form S-1. In U.S., firms have to file financial reports with the Securities and Exchange Commission (SEC) requires, if they have $10 million or more in total assets and 500 or more shareholders (2,000 shareholders since April 2012), or if they list their securities with the SEC, like public debt. Capital IQ collects private firms' financial data from the SEC through 10-K or S-1. In our final sample, data for most private firms (96%) come form 10-K, and the remainder (4%) comes from S-1. Most private firms in the sample are large or have access to public debt. Although they are not representative of a typical private firm, this makes them comparable to public firms in terms of size, disclosure requirements and information availability.

We collect the sample of U.S. mergers and acquisitions from Capital IQ. M&A data from Capital IQ, in particular, data on leveraged buyouts, have been used in a recent study by Axelson, Jenkinson, Stromberg, and Wesibach (2013). Following the literature, we collect all completed transactions for the period 1997 to 2010 (to allow for 3 years worth of post-acquisition performance data) in which the acquirer owns 100% of the shares of the target after the deal. We exclude all deals with non-operating targets, with missing deal values, and where the bidder is a group of investors. We further remove all regulated or financial bidders with SIC code between 4900 and 4999 or between 6000 and 6999. Since our main variable of interest requires the operating performance before the deal to be available, we require all acquirers to have financial data in the year prior to the deal. The resulting sample consists of 8,760 deals involving a public bidder and 1,176 deals by private bidders.

Since a private bidder does not have publicly traded equity to offer, it is not surprising that most acquisitions by private bidders are cash deals. In the initial sample, more than 90% of acquisitions by private bidders are all-cash deals. In contrast, about 40% of public bidders use all-stock payment or mixed offers. To obtain a sample where deals are most comparable between public and private acquirers, we exclude all non-cash deals. Excluding non-cash deals results in a final sample of 6,345 deals where 5,313 deals involve a public bidder and 1,032 deals by private bidders.

Table 2.2 reports the distribution of the number and the aggregate value of the transactions measured in 2009 purchasing power through time. In total, public firms participate more than private firms as buyers of assets in mergers and acquisitions. Among all deals, 83% of the deals involve a public bidder, with 17% deals involving a private bidder. In contrast, most target firms are private. The fraction of acquisitions each year made by private firms is highest from 2005 to 2007. The aggregate deal values by private bidders are much larger in 2000, 2004, and 2009 compared to any other year.

2.3.2 Summary statistics

We collect all financial performance measures and deal characteristics from Capital IQ. We focus on bidder and deal characteristics that both empirical and theoretical literature have found to be important. Panel A of Table 2.3 compares bidder characteristics between public and private acquirers for one year before the deal completion.[6] The first two variables are total assets and operating income measured in CPI-adjusted 2009 dollars. It is not surprising that public bidders are larger than their private counterparts in total assets and operating income. We next consider a measure of leverage equal to the ratio of the book value of debt to total assets. We find that private acquirers are much more levered than public acquirers. Consistent with Gao et al. (2013), we also find that public bidders hold, on average, about 50% more cash than private bidders do. As suggested by Jensen (1986), companies with substantial cash flows and low leverage ratio are prone to agency problems of free cash flow, and thus managers of firms with large free cash flows are more likely to undertake inefficient or even value-destroying corporate takeovers.

Private bidders tend to be younger firms, with significantly lower firm age compared to public bidders. Private bidders also have fewer industry segments than public bidders. On average, a private bidder has 1.81 industry segments, whereas an average public bidder has 3.43 segments. There is no significant difference in the ratios of tangible assets to total assets (Tangibility), capital expenditure (CAPEX/Total assets), and one year percentage change in total revenue (Sales growth) between public and private bidders. However, the average

[6]It is interesting to also compare the characteristics of target firms. However, financial information for target firms is limited, because most targets are relatively small private that are not required to disclose to the SEC. Nevertheless, below we will investigate target firm profitability in a subsample of deals.

public bidder spends 3.2% of capital on R&D, substantially higher than 1.2% of the average private bidder.

Panel B of Table 2.3 reports several deal characteristics, which are also obtained from Capital IQ. We find no statistical difference in the mean dollar value of the deals measured in CPI-adjusted 2009 dollars for public acquiring firms relative to private acquiring firms. In other words, the transaction sizes are similar across public and private bidders. The proportion of hostile acquisitions is greater when a bidder is public than when a bidder is private, although the difference is not statistically significant. Public bidders are less likely to be involved in solicited deals than private bidders. A large fraction of targets consist of firms with a two-digit SIC code other than that of the bidder, but that fraction is similar when bidders are public or private.

Finally, we compare our sample bidders to the full population of firms in Capital IQ (public and private, respectively). We remove observations with missing SIC codes, zero or negative total assets and gross capital stock. Following the literature, we also exclude all financial or regulated firms with SIC codes between 4900-4999 and between 6000-6999. These screens result in a final sample of 23,286 firm-year observations for 2,189 public firms and 9,920 firm-year observations for 3,283 private firms, over the period from 1997 to 2010. Table 2.4 reports mean values for firm characteristics for bidders and the full population. For both public and private companies, almost every firm characteristics is significantly different between bidders and the average firms. On average, a bidder is a much larger firm in terms of total assets and operating income. Typically, a bidder firm tends to be older and have more industry segments than the average firm. We also find that the average firm holds more cash, owns more net property, plant and equipment, invests more, and spends more on its research and development than bidding firms do. However, private bidders rely less on debt compared to all private firms, while public bidders rely slightly more on debt relative to all public

2.4 Main Results

In this section, we investigate the differences in post-acquisition operating performance improvements between public and private acquiring firms. We focus on operating performance during the first three years after the deal for all bidding firms with post-deal financial information, since market-based valuations for private firms are not available. We first explore these characteristics at the univariate level and then continue with regression analysis.

2.4.1 Univariate comparisons across bidder types

Our main measure of operating performance is return on assets (ROA): operating income before depreciation divided by total assets. Operating income captures the cashflows of the underlying business and is not affected by differences in capital structure, taxes, and depreciation policy. Scaling by total assets partially controls for divestitures and differences in growth and size. In a loose sense, ROA can be interpreted as measuring the efficiency with which the acquiring firms use a given amount of assets, and changes in ROA can be interpreted as improvements in this efficiency. As an additional measure of efficiency, we look at asset turnover (ATO), defined as sales divided by total assets. This ratio captures the efficiency with which the firm is using its assets to generate revenue, and the post-takeover changes measure improvements in productive asset utilization. We will also examine return on sales (ROS) in our later analysis.

Following Kaplan (1989) and Maksimovic et al. (2013), we examine operating performance during the first three years after corporate takeovers. We measure the annual percentage changes in the variables in the first three years after the deal completion (years +1, +2, +3) relative to the last year before the deal completion (year −1).[7] Results for year 0, when the deal is completed, are not presented because they are difficult to interpret as pre- or post-deal performance. Furthermore, accounting variables in year 0 maybe inaccurate or biased due to deal-related fees and asset write-ups.

[7] We use percentage changes in our performance measures to facilitate interpretation and to make economic magnitude of the results readily apparent. This is consistent with literature focusing on operating performance improvements following buyouts (e.g. Kaplan (1989) and Guo, Hotchkiss, and Song (2011)). Our conclusions are the same when using percentage point (unscaled) changes in ROA and ATO. These results are available upon request.

Table 2.5 summarizes the percentage changes in ROA and ATO. During the first three years, ROAs of public bidders on average grow by 1.69%, 2.52%, and 2.62%, while ROAs of private bidders improve by 15.85%, 18.12%, and 19.24%. Turning to ATO, mean increases for public bidders are 1.13%, 1.91%, and 2.49%, in years +1, +2, +3 in comparison with year −1. These increases are significantly greater for private bidders: 9.49%, 13.98%, and 13.53% for years +1, +2, +3, respectively. The differences between public and private firm improvements in ROA and ATO are large and statistically significant at the 1% level across all years. Private bidders exhibit incremental 14-16% improvements in ROA, and additional 8-11% increases in ATO. One may argue that private bidders could simply by going after more profitable targets, thereby resulting in higher combined firm profitability. However, this is likely to be offset by the higher asset base of the combined firm due to higher prices paid for more profitable assets. Moreover, we will show later that, for a subsample of deals where the target firm financials are available, firms targeted by private bidders are not more profitable that those targeted by public bidders.

We also investigate whether private firms in general exhibit higher levels of ROA and ATO growth than public firms do. For this analysis, we focus on the entire population of private firms in Capital IQ and use both the full sample and a matched sample of public firms. Following the literature such as Gao et al. (2013) and Asker et al. (2015), we match private and public firms with replacement based on size and industry. For each private firm, we match a public firm closest in size (total assets) and in the same industry (defined by 3 digit SIC code). If no match is found, we discard the observation from the sample. After matching, the sample contains 9,490 observations for 2,189 public firms and an equal number of observations for 3,283 private firms. We have a sample of all public firms collected from Capital IQ and a sample of matched public firms. Then we compare growth in operating performance between private and public firms one, two, and three years in the future. Table 2.6 presents these results. ROA growth is actually lower private firms than for public firms in Capital IQ. There is no significant differences between private and public firms in terms of percentage changes in ATO, except for year +3 when the entire population of public firms is used. Thus, when looking at the entire population, we do not find consistent evidence of inferior operating performance of public firms relative to private firms. Hence, our results on the higher changes in operating performance for private bidders can be more readily attributed to acquisitions.

2.4.2 Baseline regressions

The univariate comparisons provide evidence that private acquiring firms are more successful in generating cash flows than their public counterparts after acquisitions. To investigate whether firm's listing status indeed accounts for these differences between public and private acquirers we conduct regression analysis that controls for main observable differences in deal types and bidder attributes. We first estimate a regression of the changes in ROA on the private bidder indicator and a set of controls. We run the following regression model:

$$\begin{aligned} \Delta ROA(-1,+j) = \alpha + \beta_1 PrivateBidder + \beta_2 ROA + \beta_3 Log(revenue) + \beta X' \\ + IndustryFEs + YearFE,\ j = 1,2,3 \end{aligned} \tag{2.1}$$

The dependent variables are percentage changes in ROA for acquirers using three windows, $(-1,+1)$, $(-1,+2)$, and $(-1,+3)$, with year 0 being the transaction year. $ROA(-1,+1)$ is the percentage changes in return on assets from $t-1$ to $t+1$. Similarly, $\Delta ROA(-1,+2)$ and $\Delta ROA(-1,+3)$ measure the percentage changes in return on assets from $t-1$ to $t+2$ and from $t-1$ to $t+3$. The variable $PrivateBidder$ is an indicator variable which is equal to one if the bidder is a private firm, and zero otherwise. Variables ROA and $Log(revenue)$ are return on assets and the natural logarithm of total revenue for acquiring firms in $t-1$ that control for the starting level of performance and the size effect. Vector X' contains additional bidder and deal characteristics found important by prior literature. Industry (based on three-digit SIC) fixed effects (FEs) and year FEs are included to control for the effect of time-invariant industry effects or year-specific variation in operating performance changes. The coefficient on $PrivateBidder$, β_1, is of interest.

Table 2.7 shows that on average private acquiring firms experience higher growth in future profitability than public acquiring firms in terms of ROA. The coefficient on $PrivateBidder$, the indicator for whether the bidder is private, is positive and significant at the 1% level for all three post-takeover years. Private acquirers realize an incremental 16.0% increase in ROA during the year after the acquisition, 18.1% two years after the acquisition, and

16.2% three years after the acquisition compared to public acquirers. We also find that the coefficients on ROA and $Log(revenue)$ are significant at the 1% level in all columns, suggesting a negative impact of the bidder's pre-deal level of operating performance and size on subsequent improvements. The negative effect of size on post-takeover performance is consistent with evidence in Moeller et al. (2004) based on announcement period returns.

Table 2.7 also reports the regression estimates for Δ ATO as the measure of operating performance improvement. Again, we find that private acquirers realize greater improvements in ATO than public acquirers. The coefficients on $PrivateBidder$ are positive and statistically significant at the 1% level in years +1 and +2, and at the 5% level in year +3. The incremental improvements in ATO are on the order of 8-11%. The coefficients on ATO and $Log(revenue)$ are negative and significant in all of our specifications, consistent with the regression estimates using ROA as the performance measure.

Overall, there is strong evidence that acquiring firm ownership type strongly affects post-takeover performance. This results holds after controlling for numerous potential confounding effects, such as differences in growth opportunities (firm age), deal size (relative size), and target type (private targets). So far our results are consistent with the notion that private bidders make better acquisition decisions, as predicted by classic agency theory. In the following sections we will explore robustness of this finding, possible mechanical explanations, as well as the hypothesized agency channel behind this association.

2.4.3 Possible explanations

So far we find higher improvements in ROA and ATO for private bidders following takeovers. One possible explanation is that private acquirers simply pick targets with higher levels of operating performance. Note that we compare pre-deal operating results of the bidder with the post-deal operating results of the combined firm assets. That is, private bidders go after target firms with higher levels or growth in ROA or ATO than target firms acquired by public firms. To investigate this concern, we examine target firms' pre-deal performance. However, this analysis is limited to a subsample of target firms with financial information available from Capital IQ, because most target firms are private and small. We measure the level as the well as the percentage changes of the target firm's ROA and ATO in the last fiscal year prior to deal completion (relative to two years prior in the case of changes). Table 2.8 reports target's pre-deal performance. We find that public acquirers pick target firms that have higher somewhat lower levels (Panel A) and growth rates (Panel B) in ROA, although the differences are not statistically significant. This suggests that, if anything, our results are biased against finding greater performance improvements for private bidders. There are no discernible differences in levels and growth rates of ATO. Another way to assess whether targets of private bidders are more profitable is to examine prices paid for those assets. If targets acquired by private bidders are more profitable, one would expect higher prices paid for those assets. Panel C examines mean and median transaction multiples paid by public and private bidders. We use deal value to total assets, deal value to sales, and deal value to operating income before depreciation. These multiples approximate price-to-book, EV/Sales and EV/EBITDA valuation multiples. We find that private bidders consistently pay lower prices for their targets: all transaction multiples are significantly lower for targets acquired by private firms. This result confirms the findings of Bargeron et al. (2008) who find that private bidders pay lower bid premiums for comparable public targets. Overall, there is no evidence that targets of private bidders are more profitable, ruling out this as a possible explanation for better post-takeover performance of private firms.

Another potential explanation has to do with merger accounting. Under U.S. Generally Accepted Accounting Principles (GAAP),the bidder has to account for the entire purchase price on its balance sheet. Any value in excess of the (stepped-up) value of identifiable assets is recognized as goodwill.[8] If public bidders pay higher prices (as we have shown above), then more accounting goodwill is created, resulting in a higher accounting asset base for the combined firm. Since we measure ROA as the ratio to total assets, this can potentially explain why public acquirers have smaller post-deal ROA and the associated change. To mitigate this measurement concern, we use return on sales (ROS), as in Custodio (2014) study of the diversification discount. As for ROA, we measure the annual percentage changes in ROS in the first three years following deal completion (years +1, +2, +3) relative to the

[8] This is also the case under International Financial Reporting Standards (IFRS).

most recent fiscal year prior the deal completion (year -1). Panel A of Table 2.9 reports univariate analysis, and Panel B the results of regressions analysis this alternative measure of performance improvements. Our results continue hold. Univariate differences in ROS improvements are significant at the 1% level for all windows. Similarly, the coefficients on the $PrivateBidder$ indicator are positive and significant at the 1% level for windows $(-1, +1)$ and $(-1, +2)$, and at the 5% level for window $(-1, +3)$. The magnitude of the effect is large, with 7-10% greater improvements in profit margins for private bidders. Therefore, merger accounting effects cannot be the explanation behind better ROA and ATO for private bidders.

Successful acquirers may change their listing status after the acquisition. For example, a successful private acquirer may go public after the deal. If so, higher future profitability of private acquirers may benefit from IPO and subsequent infusion of capital to fund growth, not from mergers and acquisitions. In the sample, only 127 (10.8%) private acquirers go public within 3 years after the deal, and no public acquirer goes private within 3 years after the deal. We eliminate these bidders from the sample and rerun the regressions. The results are shown in Panel A of Table 2.10.[9] The coefficients on $PrivateBidder$ remain positive and significant at the 1% level across all specifications, with magnitudes comparable to those in prior analysis.

We further examine the organizational form of private bidders in our sample. First, we distinguish between independent private firms and those whose ultimate parent is a listed firm. We find that 25% of private bidders in our sample have public firms as their ultimate parents. We then examine whether these bidders perform any differently to independent private firms (one prediction could be that private firms whose ultimate parents are public may suffer from similar agency conflicts as their parents). Panel B of Table 2.10 reports the coefficient estimates. The indicator $PublicParent$ takes the value of one if the bidders is private and its ultimate parent is public, and zero otherwise. It should therefore be interpreted as interaction effect. Somewhat surprisingly, the coefficient on this variable is statistically insignificant, suggesting that private firms with public parents do not perform any differently to independent private firms.

[9] We report only the coefficients of interest. The specifications are otherwise identical to those in Table 2.7.

Second, we also investigate whether the private bidder effect is driven by the private equity ownership model. Capital IQ provides information on whether the firm has received private equity sponsorship at any point in time. Similar to the public parent analysis, we define an indicator variable $Non - PEBacked$ that takes the value of one if the bidder is private and has never received private equity investment, and zero otherwise. Panel C of Table 2.10 reports the estimation results. We find that private bidders that are not currently under private equity equity ownership and have never received private equity backing experience the same levels of operating performance improvements as independently owned private bidders. Overall, the private bidder effect is common to the private ownership model more broadly.

2.4.4 Endogeneity

Being public or private is, of course, an endogenous decision. The listing status can be correlated with firm's financing or investment decisions,[10] thus affecting firms' operating performance. Of particular concern is a variable that is positively correlated with the propensity to stay private and, at the same time, positively affects post-takeover operating performance improvements.[11] To mitigate the concern of selection on observables, we employ a propensity score matching procedure to reduce the potential selection bias. The matching technique we use is a one-to-one nearest neighbour matching with replacement (Heckman, Ichimura, and Todd (1998)). We start with a probit regression with the private bidder indicator variable as the dependent variable, using as explanatory variables the logarithm of total assets, ATO or ROA one year before the deal, and industry fixed effects. We then use the results from the first-stage probit regression to calculate an acquiring firm's propensity scores (i.e., the probability that an acquirer is private, given the set of observable characteristics). We match each private acquirer with a public acquirer by minimizing the absolute value of the differences between their propensity scores. The matched sample shrinks to 1,032 private acquirers firm-year observations and an equal number of public acquirers firm-year observations.

Table 2.11 presents the results based on our matching procedure. Panel A shows differ-

[10]See, for example, Brav 2009; Asker et al. 2015; Gao et al. 2013.

[11]Note that if the omitted variable correlated with the propensity to stay private negatively affects post-takeover value creation, this would bias our results downward, working against our finding of a positive private bidder effect.

ences in the performance percentage changes after the deal between private acquirers and their propensity-score-matched public acquirers. We find that private acquirers improve significantly more in terms of post-deal ROA and ATO than their matched public acquirers. After matching between samples, we find that differences are of comparable magnitude to those in the unmatched sample. Panel B of Table 2.11 shows the regression results for the matched sample. We use the same explanatory variables as before. The coefficient on the *PrivateBidder* indicator is positive and significant at the 1% level for both ROA and ATO across all windows.

It appears that selection on observable characteristics does not bias our results. Of course, it is still possible that there is an unobserved characteristic that is positively correlated with both private firm status and post-takeover performance. In the absence of a source of exogenous variation in the firms' listing status, we stop short of making strong causal statements. Nevertheless, note that the typical narrative, whereby high quality firms/assets select into public status, would bias our results downward - to the extent that asset quality is positively related to gains in takeovers, public firms would be expected to do better than private firms.

2.5 The Agency Cost Channel

Our results suggest that post-deal operating results of private acquirers are better than public acquirers. We have examined several possible explanations, such as more profitable target firms, merger accounting, or benefits of subsequent IPOs.

Why do private acquirers outperform? We have argued that public ownership comes with greater agency conflicts relative to the more concentrated private ownership. We now investigate directly whether agency costs are, indeed, behind the private bidder effect.

2.5.1 Evidence for public acquirers

We first examine how, within public firms, different qualities of corporate governance affect the operating performance after the deal. We use the sample of public acquirers from Capital

IQ with available information on insider ownership. Insider ownership is defined as the percentage equity ownership of all executive officers and directors. Following Gao et al. (2013), we use this variable as a possible proxy for corporate governance and agency problems. We sort the sample of public acquirers based on insider ownership.[12]

Table 2.12 compares between the subsample with insider ownership in the top quartile and the subsample with insider ownership in the bottom quartile. Table 2.12 presents percentage changes in ROA or ATO after the deal across public acquirers with different insider ownership. We find evidence that public acquirers with insider ownership in the top quartile realize higher gains in operating profitability after the deal than the public acquirers with insider ownership in the bottom quartile. For example, the percentage changes in ROA using three windows are 4.70%, 3.79%, and 3.77% in the top quartile, versus 0.21%, 1.35%, and -1.01% in bottom quartile. The differences are statistically significant. Thus, acquiring firms with higher insider ownership (potentially better-governed firms) achieve better operating results after deals relative to acquiring firms with lower insider ownership (potentially poorly-governed firms). Note that the difference within public acquirers of different insider ownership (between 2.5% and 4.8%) is smaller than the difference between public and private acquirers (between 14% and 16%). This may suggest that agency problems are greater between public and private acquirers than within public acquirers, consistent with Gao et al. (2013). The results for ATO follow a similar pattern, so we do not discuss them.

2.5.2 Controlling for takeover defenses

Antitakeover provisions reduce the probability of a successful takeover (Field and Karpoff (2002); Bebchuk, Coates IV, and Subramanian (2007)) and the conflicts between managers and shareholders are more severe at firms with more antitakeover provisions. Masulis et al. (2007) support ATP value destruction hypothesis that "Managers protected by more antitakeover provisions are more likely to indulge in value-destroying acquisitions since they are less likely to be disciplined for taking such actions by the market for corporate control".

Capital IQ covers 24 unique antitakeover and corporate governance provisions, from which

[12] We do not conduct a similar analysis on private acquirers, since Capital IQ discloses limited information about insider ownership for private companies.

it constructs a Takeover Defense Score. This score is a number between 0 and 1 that represents the ability of a manager protected by antitakeover provisions (ATP) to resist a takeover, where a higher score indicates stronger takeover defenses. This score can also represent managerial attitude towards shareholder value maximization more broadly. It is computed by assigning a weight to each provision, and then averaging together the weights of provisions. This Takeover Defense Score is similar to Corporate Governance Indices computed in Gompers, Ishii, and Metrick (2003) and Masulis et al. (2007). We use Takeover Defense Score as another possible proxy for agency problems in corporate takeovers. Note that most private acquirers in the sample have more than 500 shareholders. Thus, there exists agency problems in these larger private firms due to the separation of ownership and control. Acquiring firms with similar scores would be expected to face similar agency problems. If agency is the channel through which private acquirers outperform public acquirers, we should find no significant differences in the post-takeover performance of public and private acquirers with similar governance scores.

We collect all acquiring firms with available Takeover Defense Score from Capital IQ. The sample consists of 911 private and 4,988 public acquirers. Table 2.13 presents the distributions of these scores between public and private bidders. In the full sample, the average score of public bidders is higher than that of private bidders, consistent with that takeover defenses destroy acquisition value in Masulis et al. (2007). The scores of public and private bidders intersect within the range from 0.15 to 0.51. In the range from 0.15 to 0.51, we employ a matching procedure with replacement based on Takeover Defense Score and industry to control agency problems between public and private acquirers. In the sample, for each private acquirer, we match a public acquirer closest in Takeover Defense Score and in the same industry (defined by 3 digit SIC code). If no match is found, we discard the observation and look for a match in the following year. After matching, the sample contains 644 firm-year observations for private acquirers and an equal number of firm-year observations for public acquirers. Table 2.13 also shows that takeover defense scores distribute similarly across public and private acquirers after matching.

We conduct similar analysis on our matched sample. Panel A of Table 2.14 shows the differences in performance percentage changes after the deal between private acquirers and their matched public acquirers based on Takeover Defense Score. Panel B presents the estimates of our baseline regressions on the matched sample. Again, we use the same explanatory variables as before. Consistent with our predictions, we find no significant differences in percentage changes in ROA and ATO between private acquirers and their matched public acquirers. Thus, after controlling for one dimension of agency conflict/incentive alignment, the operating performance improvements after takeover deals are similar for public and private acquirers. These results suggest that agency problems are, indeed, one channel through which private acquirers outperform public acquirers.

2.6 Conclusions

Using a dataset covering large U.S. private acquiring firms, we examine the effect of public versus private ownership on real post-takeover operational improvements. This comparison allows us to study the effect of incentive alignment on takeover efficiency gains. Besides, private acquirers are of great interest in their own right, since all existing evidence on value creation from acquisitions is limited to public bidders.

Our evidence supports the agency view that private firms should make better investment decisions. We find that, on average, private acquirers experience 16-20 per cent greater operating performance improvements following takeovers. This effect is not driven by differences in target types, merger accounting effects, private equity ownership, or benefits of subsequent listing. Further tests suggest that incentive alignment can, indeed, account for the private bidder effect. Within public acquirers, firms with higher insider ownership (potentially better-governed firms) realize higher gains in operating profitability than those with lower insider ownership (potentially poorly-governed firms). Across public and private bidders, differences in operating performance improvements disappear in a subsample of public and private firms with similar antitakeover provisions.

Finally, our findings help interpret some of the existing results in the literature. Private bidders are known to pay lower premiums in acquisitions of public firms (Bargeron et al.

(2008)), and we confirm this result in a broader sample of deals using transaction multiples. This could be due to discipline coming from stronger incentive alignment in private firms, but lower prices could also be due to private firms engaging in deals with lower overall synergy gains (perhaps because they cannot compete for better deals with less financially constrained public bidders). Our results of greater operating performance improvements (i.e. operating synergies) for private bidders suggest it is the former effect at play. Overall, not only do private firms pay lower prices for target firm assets, they also operate those assets more efficiently. This can be due to better target selection and/or exerting more effort on post-merger integration and subsequent running of the firm.

Table 2.1: **Variable Definitions**

Variable	Definition
Total assets	Capital IQ item Total Assets, reported in CPI-adjusted 2009 millions of dollars
Operating income	Total Revenue less Cost of Goods Sold and Selling General & Admin Exp, reported in CPI-adjusted 2009 millions of dollars
Book leverage	Total Debt scaled by total Assets
Cash	Total Cash & ST Investments scaled by total Assets
Age	Firm's age since the year founded
Segment	Number of business segments
Tangibility	Net property, plant & Equipment scaled by total assets
CAPEX	Capital expenditure scaled by total assets
R&D	R&D expenditure scaled by total assets
Relative size	Deal value scaled by total assets of the bidder
Sale growth	Annual increase in total revenue scaled by beginning-of-year Total Revenue
Deal value	Total transaction value, reported in CPI-adjusted 2009 millions of dollars
Return on assets (ROA)	Operating income scaled by total assets
Asset turnover (ATO)	Total revenue scaled by total assets
Return on sales (ROS)	Operating income scaled by total revenue

Table 2.2: **Sample Distribution by Bidder Type**

The sample includes all Capital IQ completed cash-only mergers and acquisitions announced between 1997 and 2010 that result in 100% ownership by the bidder. The aggregate deal value is in CPI-adjusted 2009 millions of dollars. The sample contains 5,313 deals involving public bidders and 1,032 deals involving private bidders.

	All deals		Public bidders		Private bidders		Private percentage	
Year	n	Deal value ($m)	n	Deal value ($m)	n	Deal value ($m)	Private bidders	Private targets
1997	48	11,013	23	5,528	25	5,451	0.52	0.73
1998	152	54,733	110	39,244	42	14,624	0.28	0.76
1999	200	94,380	138	74,019	62	19,154	0.31	0.69
2000	303	142,163	239	107,839	64	33,084	0.21	0.85
2001	351	121,848	278	103,947	73	17,366	0.21	0.86
2002	340	52,589	284	49,186	56	2,807	0.16	0.91
2003	426	63,361	344	51,070	82	11,862	0.19	0.90
2004	517	142,570	442	68,532	75	67,520	0.15	0.94
2005	638	140,931	522	115,597	116	21,553	0.18	0.92
2006	694	190,187	587	166,632	107	21,251	0.15	0.92
2007	766	197,152	647	185,585	119	8,434	0.16	0.90
2008	706	128,918	633	112,484	73	14,464	0.10	0.92
2009	459	102,550	404	69,250	55	31,253	0.12	0.95
2010	745	125,339	662	119,259	83	5,509	0.11	0.92
Total	6,345	1,567,734	5313	1,268,172	1,032	274,332	0.16	0.90

Table 2.3: **Summary Statistics on Bidder and Deal Characteristics**

The sample includes all Capital IQ completed cash-only mergers and acquisitions announced between 1997 and 2010 that result in 100% ownership by the bidder. The sample contains 5,313 deals involving public bidders and 1,032 deals involving private bidders. Panel A reports mean values for bidder characteristics one year before the announcement date. All variables are from Capital IQ. Total assets and operating income are in CPI-adjusted 2009 millions of dollars. Book leverage is total debt scaled by total assets. Tangibility is calculated as net property, plant & equipment divided by total assets. Age is the number of years since the firm has been founded. Segment is the number of business segments reported on Capital IQ. R&D is the expense on research and development scaled by total assets. Sale growth is the change in total revenue from $t-2$ to $t-1$ with t being the year when the deal is announced. In panel B, mean values are reported for deal characteristics. The deal value (Deal value) is the total value of consideration paid by the acquirer (in CPI-adjusted 2009 millions of dollars). Relative size is deal value scaled by total assets of the bidder. Hostile, Solicited, and Diversifying are indicator variables equal to one if the deal is hostile, solicited, or involves a target with a two-digit SIC code other than that of the bidder, respectively.

	Public bidder	Private bidder	Public−Private	
			Difference	*p*-value
Panel A: Bidder characteristics (one year before deal)				
Total assets ($m)	6,378.230	4,428.700	1,949.530	0.000
Operating income ($m)	1,136.290	444.070	692.220	0.000
Return on assets (ROA)	0.153	0.147	0.005	0.118
Asset turnover (ATO)	0.101	0.098	0.003	0.237
Return on sales (ROS)	0.208	0.230	-0.021	0.000
Book leverage	0.190	0.367	-0.177	0.000
Cash	0.148	0.097	0.051	0.000
Age	46.090	33.970	12.120	0.000
Segment	3.432	1.812	1.620	0.000
Tangibility	0.212	0.221	-0.009	0.135
CAPEX/Total assets	0.047	0.047	0.000	0.841
R&D	0.032	0.012	0.020	0.000
Sale growth	-0.004	0.006	-0.010	0.243
Panel B: Deal characteristics				
Deal value ($m)	238.860	269.930	-31.070	0.442
Relative size	0.094	0.193	-0.098	0.000
Private target	0.897	0.910	-0.013	0.754
Hostile	0.002	0.001	0.001	0.841
Solicited	0.055	0.086	-0.031	0.000
Diversifying	0.261	0.295	-0.034	0.023

Table 2.4: **Summary Statistics on Bidders vs. All Firms**

The sample includes all Capital IQ completed cash-only mergers and acquisitions announced between 1997 and 2010 that result in 100% ownership by the bidder. The sample also contains 23,286 firm-year observations for 2,189 public firms and 9,920 firm-year observations for 3,283 private firms, collected from Capital IQ. This table compares the bidder's characteristics one year before the deal to all firms in Capital IQ. Panel A reports mean values for public companies. Panel B reports mean values for private companies. All variables are from Capital IQ.

	Bidder	All firms	bidder−all firms	
			Difference	*p*-value
Panel A: public companies				
Total assets ($m)	6,378.230	2,611.579	3,766.651	0.000
Operating income ($m)	1,136.290	252.145	884.145	0.000
Return on assets (ROA)	0.153	0.081	0.089	0.000
Asset turnover (ATO)	0.101	0.002	0.099	0.000
Return on sales (ROS)	0.208	0.086	0.122	0.000
Book leverage	0.190	0.184	0.006	0.042
Cash	0.161	0.181	-0.020	0.000
Age	46.090	43.912	2.178	0.000
Segment	3.432	2.846	0.586	0.000
Tangibility	0.212	0.257	-0.045	0.000
CAPEX/Total assets	0.047	0.069	-0.022	0.000
R&D	0.032	0.038	-0.006	0.501
Sales growth	-0.004	0.121	-0.125	0.000
Panel B: private companies				
Total assets ($m)	4,428.700	1,011.778	3416.922	0.000
Operating income ($m)	444.070	56.859	387.211	0.000
Return on assets (ROA)	0.147	0.056	0.091	0.000
Asset turnover (ATO)	0.098	0.026	0.072	0.000
Return on sales (ROS)	0.230	0.073	0.157	0.000
Book leverage	0.367	0.405	-0.038	0.002
Cash	0.097	0.134	-0.037	0.000
Age	33.970	24.905	9.065	0.000
Segment	1.812	1.409	0.403	0.000
Tangibility	0.221	0.306	-0.085	0.000
CAPEX/Total assets	0.047	0.070	-0.023	0.000
R&D	0.012	0.023	-0.011	0.000
Sales growth	0.006	0.496	-0.490	0.000

Table 2.5: **Operating Performance Improvements Following Takeovers**

This table reports operating performance improvements (percentage change in ROA and ATO) for public and private bidders over the sample period 1997–2010. Year −1 is the last fiscal year prior deal completion. Year $+i$ is the ith fiscal year after deal completion. Symbols ***, **, and * denote the significant differences at the 1%, 5% and 10% levels, repectively.

From year i year j	Private bidder	Public bidder	Test of differences
		Δ Return on assets (ROA)	
−1 to +1	15.85%	1.69%	14.16%***
−1 to +2	18.12%	2.52%	15.60%***
−1 to +3	19.24%	2.62%	16.62%***
		Δ Asset turnover (ATO)	
−1 to +1	9.49%	1.13%	8.36%***
−1 to +2	13.98%	1.91%	12.07%***
−1 to +3	13.52%	2.49%	11.03%***

Table 2.6: **Operating Performance Changes across Firm Type in the Population**

The sample contains 23,286 firm-year observations for 2,189 public firms and 9,920 firm-year observations for 3,283 private firms, collected from Capital IQ. For each private firm, we match a public firm closest in size (total assets) and in the same industry (defined by 3 digit SIC code). This table reports the differences of mean percentage changes in total revenue as a percentage of assets (Δ ATO), and in operating income as a percentage of assets (Δ ROA) between all private firms and all public firms, or between all private firms and their matched public firms. Year 0 represents current fiscal year. Year $+i$ is ith year after. Symbols ***, **, and * denote the significant differences at the 1%, 5% and 10% levels, respectively.

	From year i to year j		
Percentage changes	0 to +1	0 to +2	0 to +3
Panel A: Private firms − Public firms			
Δ Return on assets (ROA)	−4.89%***	−6.06%**	−10.64%***
Δ Asset turnover (ATO)	−0.06%	0.57%	3.16%***
Panel B: Private firms − Matched public firms			
Δ Return on assets (ROA)	−7.56%***	−9.36%***	−12.97%***
Δ Asset turnover (ATO)	−0.58%	−0.38%	2.06%

Table 2.7: **Operating Performance Improvements: Regression Analysis**

This table reports regression estimates on changes in ROA or ATO for acquirers. The dependent variables are Δ ATO(−1,+j) or Δ ROA(−1,+j) ($j = 1, 2, 3$). Private bidder is an indicator variable that equals one if the bidder is a private firm. ATO/ROA and Log(revenue) measure asset turnover, return on assets and the log of total revenue in $t - 1$. Private target indicates whether the target firm is private or not. To control for relative size of the deal, we use the deal value scaled by bidder's assets. Log(age) measures the log of bidder's age before the deal. Hostile, Solicited, and Diversifying are indicator variables equal to one if the deal respectively is hostile, is solicited, or involves a target with a two-digit SIC code other than that of the bidder. Industry (based on three-digit SIC) and year fixed effects are included. Standard errors allow for clustering at the firm level and are reported in parentheses. Coefficients denoted by *, **, or *** are significant at the 10%, 5%, or 1% level, respectively.

	Δ ROA			Δ ATO		
	(−1,+1)	(−1,+2)	(−1,+3)	(−1,+1)	(−1,+2)	(−1,+3)
Private bidder	0.160***	0.181***	0.162***	0.090***	0.106***	0.080**
	(0.040)	(0.053)	(0.062)	(0.026)	(0.029)	(0.034)
ROA/ATO	−1.181***	−1.634***	−2.116***	−0.154***	−0.199***	−0.236***
	(0.152)	(0.219)	(0.284)	(0.012)	(0.017)	(0.017)
Log(revenue)	−0.016**	−0.025***	−0.023**	−0.010**	−0.018***	−0.018***
	(0.007)	(0.009)	(0.009)	(0.004)	(0.005)	(0.005)
Private target	−0.015	−0.005	−0.035	−0.010	−0.001	−0.001
	(0.020)	(0.025)	(0.031)	(0.012)	(0.016)	(0.017)
Relative size	−0.261***	−0.220***	−0.222**	−0.219***	−0.199***	−0.204***
	(0.046)	(0.054)	(0.088)	(0.029)	(0.031)	(0.033)
Log(age)	−0.001	0.012	−0.003	−0.005	0.003	−0.015
	(0.012)	(0.015)	(0.016)	(0.007)	(0.008)	(0.010)
Hostile	0.011	−0.007	−0.067	−0.150***	−0.190***	−0.226***
	(0.054)	(0.095)	(0.102)	(0.041)	(0.070)	(0.085)
Solicited	0.104***	0.107**	0.125**	0.036*	0.053**	0.052**
	(0.037)	(0.043)	(0.053)	(0.019)	(0.021)	(0.020)
Diversifying	−0.006	0.023	−0.027	−0.012	−0.008	−0.022*
	(0.018)	(0.024)	(0.025)	(0.010)	(0.011)	(0.012)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. Observations	5,817	5,781	5,720	5,808	5,771	5,712
Adjusted R^2	0.135	0.147	0.170	0.155	0.170	0.194

Table 2.8: **Do Private Bidders Buy More Profitable Targets?**

Panel A reports the mean ROA and ATO of target firms acquired by public and private bidders one year before the deal. Panel B reports the mean percentage changes in ROA and ATO of target firms acquired by public and private bidders from the last fiscal year prior deal completion relative to the year before. Panel C reports mean and median transaction multiples (Deal value/Assets, Deal Value/Sales, and Deal value/Operating Income) paid by public and private bidders. Tests for differences are also shown. Symbols ***, **, and * denote the significant differences at the 1%, 5% and 10% levels, respectively.

Target's characteristics	Acquired by Private firms	Acquired by Public firms	Test of differences
		Panel A: Level	
Return on asset (ROA)	1.80%	4.31%	−2.51%
Asset turnover (ATO)	14.61%	13.57%	1.04%
		Panel B: Growth	
Δ Return on asset (ROA)	14.12%	20.43%	−6.31%
Δ Asset turnover (ATO)	8.78%	8.57%	0.21%
		Panel C: Prices Paid	
Deal value/Assets			
Mean	2.30	3.10	−0.80***
Median	1.77	2.14	−0.37***
Deal value/Sales			
Mean	2.31	3.79	−1.48***
Median	1.52	1.99	−0.47***
Deal value/Operating Income			
Mean	7.49	15.34	−7.85***
Median	9.81	11.77	−1.96**

Table 2.9: **Merger Accounting? Changes in Return on Sales (ROS)**

This table reports the percentage changes and regression estimates on the percentage changes of ROS for acquirers. The dependent variables are Δ ROS(−1,+j) ($j = 1, 2, 3$). Other variables are similar to Table 2.7. Industry (based on three-digit SIC) and year fixed effects are included. Standard errors allow for clustering at the firm level and are reported in parentheses. Coefficients denoted by *, **, or *** are significant at the 10%, 5%, or 1% level, respectively.

Panel A: univariate analysis

		Δ Return on sales (ROS)	
From year i year j	Private bidder	Public bidder	Test of differences
−1 to +1	13.37%	1.53%	11.84%***
−1 to +2	11.4%	1.96%	9.44%***
−1 to +3	9.11%	2.18%	6.93%***

Panel B: regression analysis

	Δ ROS(−1,+1)	Δ ROS(−1,+2)	Δ ROS(−1,+3)
Private bidder	0.094***	0.102***	0.072**
	(0.030)	(0.036)	(0.032)
ROS	−0.819***	−1.038***	−1.218***
	(0.092)	(0.098)	(0.106)
Log(revenue)	−0.010	−0.009	−0.005
	(0.006)	(0.007)	(0.007)
Private target	−0.009	−0.006	−0.005
	(0.018)	(0.023)	(0.021)
Deal size	0.030	−0.040	−0.099**
	(0.045)	(0.047)	(0.049)
Log(age)	0.004	0.005	−0.003
	(0.011)	(0.011)	(0.013)
Hostile	0.084**	0.089	0.134
	(0.042)	(0.068)	(0.096)
Solicited	0.046	0.061*	0.055*
	(0.032)	(0.032)	(0.031)
Diversifying	0.006	0.007	−0.016
	(0.015)	(0.017)	(0.018)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
No. observations	5,466	5,415	5,356
Adjusted R^2	0.114	0.138	0.155

Table 2.10: **Robustness Checks and Further Tests**

This table reports the results of several robustness checks and additional tests. The dependent variables are Δ ROA(−1,+j) or Δ ATO(−1,+j) ($j = 1, 2, 3$). Only the coefficients of interests are shown. The specifications are otherwise identical to those in Table 2.7. Standard errors allow for clustering at the firm level and are reported in parentheses. Coefficients denoted by *, **, or *** are significant at the 10%, 5%, or 1% level, respectively.

	Δ ROA			Δ ATO		
	(−1,+1)	(−1,+2)	(−1,+3)	(−1,+1)	(−1,+2)	(−1,+3)
Panel A. Firms not Changing Listing Status Following Takeovers						
Private bidder	0.159***	0.183***	0.203***	0.112***	0.131***	0.112***
	(0.041)	(0.057)	(0.069)	(0.029)	(0.033)	(0.040)
Panel B. Public Parent Ownership						
Private bidder	0.170***	0.182***	0.160**	0.083***	0.088***	0.071**
	(0.042)	(0.055)	(0.069)	(0.030)	(0.032)	(0.038)
Public parent	−0.051	−0.005	0.011	−0.034	0.096	0.056
	(0.096)	(0.140)	(0.185)	(0.054)	(0.081)	(0.083)
Panel C. Private Equity Ownership						
Private bidder	0.131***	0.137**	0.134**	0.089***	0.108***	0.083**
	(0.042)	(0.057)	(0.067)	(0.028)	(0.032)	(0.038)
Non-PE backed	0.052	0.138	0.031	−0.065	−0.080*	−0.074
	(0.093)	(0.119)	(0.167)	(0.040)	(0.044)	(0.056)

Table 2.11: **Selection on Observables: Propensity Score Matching**

The sample consists of 6,469 deals where 5,367 deals involve a public bidder and the remaining deals have a private bidder from 1997-2010, obtained from Capital IQ. We match each deal with a private bidder to a deal with a public bidder using the nearest neighbour. The variables we use to match are Log(total assets), operating performance one year before the deal and industry fixed effects. Panel A presents differences in the percentage changes of ROA and ATO between private bidders and their propensity score matched public bidders. Symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Panel B reports regression estimates on performance changes of ROA and ATO for the matched sample. Other variables are similar to those in Table 2.7. Industry (based on three-digit SIC) and year fixed effects are included. Standard errors allow for clustering at the firm level and are reported in parentheses. Coefficients denoted by *, **, or *** are significant at the 10%, 5%, or 1% level, respectively.

Panel A. Differences in the Percentage Change

		From year i to year j	
Private bidder − Matched public bidder	−1 to +1	−1 to +2	−1 to +3
Δ Return on assets (ROA)	14.16%***	15.73%***	19.30%***
Δ Asset turnover (ATO)	8.69%***	10.21%***	10.31%***

	Δ ROA			Δ ATO		
	(−1,+1)	(−1,+2)	(−1,+3)	(−1,+1)	(−1,+2)	(−1,+3)
Private bidder	0.171***	0.197***	0.170***	0.098***	0.127***	0.106***
	(0.044)	(0.052)	(0.058)	(0.026)	(0.031)	(0.034)
ROA/ATO	−0.757***	−0.852***	−1.194***	−0.224***	−0.263***	−0.280***
	(0.131)	(0.189)	(0.278)	(0.026)	(0.034)	(0.033)
Log(revenue)	−0.038**	−0.039*	−0.033	0.003	−0.001	0.018
	(0.019)	(0.021)	(0.025)	(0.014)	(0.014)	(0.015)
Private target	−0.033	−0.016	−0.153	−0.059	−0.061	−0.072
	(0.071)	(0.077)	(0.169)	(0.042)	(0.063)	(0.054)
Relative size	−0.395***	−0.290***	−0.168	−0.217***	−0.217***	−0.187***
	(0.090)	(0.099)	(0.213)	(0.060)	(0.068)	(0.067)
Log(age)	−0.041	−0.009	−0.041	−0.014	−0.010	−0.057**
	(0.027)	(0.034)	(0.036)	(0.015)	(0.023)	(0.023)
Hostile	0.375***	0.354**	0.195	−0.128	−0.083	−0.206**
	(0.143)	(0.157)	(0.321)	(0.093)	(0.117)	(0.101)
Solicited	0.521***	0.443***	0.515*	0.137**	0.147**	0.109
	(0.122)	(0.139)	(0.263)	(0.069)	(0.068)	(0.072)
Diversifying	0.027	0.102	0.072	−0.001	0.023	−0.020
	(0.053)	(0.076)	(0.089)	(0.034)	(0.043)	(0.034)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. Observations	1,205	1,157	1,100	1,182	1,144	1,086
Adjusted R^2	0.157	0.175	0.121	0.186	0.200	0.237

Table 2.12: **Performance by Governance within Public Bidders: Insider Ownership**

This table presents the average percentages change in ROA and ATO after the deal across public acquirers with different insider ownership levels. Insider ownership is the percentage equity ownership held by all officers and directors. Symbols *, **, or *** denote statistical significance at the 10%, 5%, or 1% level, respectively.

	Insider top quartile (1)	Insider bottom quartile (2)	Test of difference (1) − (2)
Δ Return on assets (ROA)			
−1 to +1	4.70%	0.21%	4.49%**
−1 to +2	3.79%	1.35%	2.44%*
−1 to +3	3.77%	−1.01%	4.78%*
Δ Asset turnover (ATO)			
−1 to +1	4.54%	0.83%	3.71%***
−1 to +2	4.94%	0.02%	4.92%***
−1 to +3	2.71%	1.70%	1.01%

Table 2.13: **Governance across Public and Private Bidders: Takeover Defense Score**

This table presents descriptive statistics of Takeover Defense Score for the full sample of public and private acquirers and for a matched sample over 1997 to 2010. Takeover Defense Score is a number between 0 and 1 that represents the ability of a company to resist a hostile takeover. It is computed by assigning weights to 24 unique antitakeover provisions covered in Capital IQ, and then averaging together the weights of provisions.

	Full sample		Matched sample	
Statistics	Public bidders	Private bidders	Public bidders	Private bidders
Mean	0.321	0.248	0.301	0.291
Std	0.115	0.123	0.102	0.11
25%	0.23	0.15	0.21	0.21
50%	0.30	0.21	0.28	0.28
75%	0.39	0.34	0.39	0.39
99%	0.61	0.51	0.54	0.54

Table 2.14: **Controlling for Takeover Defenses**

We match each deal with a private bidder to a deal with public bidder using Takeover Defense Score. Panel A presents the differences in percentage changes of performance between private bidders and their matched public bidders. Symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Panel B reports regression estimates on percentage changes of ROA or ATO for the matched sample. Other variables are similar to those in Table 2.7. Industry (based on three-digit SIC) and year fixed effects are included. Standard errors allow for clustering at the firm level and are reported in parentheses. Coefficients denoted by *, **, or *** are significant at the 10%, 5%, or 1% level, respectively.

Panel A. Differences in the Percentage Change

	From year i to year j		
Private bidder − Matched public bidder	−1 to +1	−1 to +2	−1 to +3
Δ Return on assets (ROA)	5.91%	4.92%	1.83%
Δ Asset turnover (ATO)	0.93%	4.20%	0.13%

Panel B. Regression with Matched Sample

	Δ ROA			Δ ATO		
	(−1,+1)	(−1,+2)	(−1,+3)	(−1,+1)	(−1,+2)	(−1,+3)
Private bidder	−0.029	−0.028	−0.096	0.049	0.088*	0.074
	(0.046)	(0.056)	(0.059)	(0.033)	(0.045)	(0.045)
ROA/ATO	−2.171***	−2.897***	−3.075***	−0.091***	−0.120***	−0.107***
	(0.278)	(0.329)	(0.358)	(0.017)	(0.020)	(0.023)
Log(revenue)	−0.010	−0.026	−0.021	−0.001	−0.015	0.014
	(0.017)	(0.022)	(0.018)	(0.013)	(0.016)	(0.016)
Private target	−0.055	−0.042	−0.164*	−0.074	−0.031	−0.124*
	(0.073)	(0.079)	(0.095)	(0.049)	(0.065)	(0.064)
Relative size	−0.286***	−0.238***	−0.318***	−0.259***	−0.270***	−0.297***
	(0.075)	(0.087)	(0.093)	(0.056)	(0.076)	(0.062)
Log(age)	−0.027	−0.027	−0.049	−0.032*	0.005	−0.052**
	(0.025)	(0.033)	(0.031)	(0.019)	(0.035)	(0.023)
Solicited	0.169*	0.239*	0.231*	0.113	0.189*	−0.046
	(0.096)	(0.129)	(0.136)	(0.083)	(0.096)	(0.075)
Diversifying	−0.042	−0.010	−0.060	−0.029	−0.018	−0.016
	(0.050)	(0.066)	(0.064)	(0.037)	(0.052)	(0.046)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. Observations	893	882	848	876	862	828
Adjusted R^2	0.212	0.247	0.302	0.157	0.182	0.223

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