The Existence of and Explanations for the Private Company Discount

Gus De Franco
Joseph L. Rotman School of Management
University of Toronto
gus.defranco@rotman.utoronto.ca

Ilanit Gavious
School of Management
Ben-Gurion University
madaril@bgu.ac.il

Justin Jin
Joseph L. Rotman School of Management
University of Toronto
yiqiang.jin03@rotman.utoronto.ca

Gordon D. Richardson
Joseph L. Rotman School of Management
University of Toronto
gordon.richardson@rotman.utoronto.ca

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Abstract: In this study, we seek to establish the existence and examine explanations for the private company discount applied by investors when they value the controlling interest in a private firm. Our four main findings are summarized as follows. First, we show the existence and estimate the magnitude of the PCD actually applied by investors when they acquire a private company. Employing both a univariate and a multivariate approach that controls for differences in industry, time, firm size and growth our results suggest a range of PCD estimates between 34% and 38%. Second, we find greater income-increasing accruals for private as opposed to public firms in the most recent annual fiscal period prior to their acquisition, consistent with private firms engaging in greater earnings management. Third, we present evidence that price multiples are weakly related to whether the financial statements have been audited by a Big5 auditor, which provides modest but more direct support for the link between information risk and the private company discount. Last, we find that in regressions of purchase price paid on net income, book value and other fundamentals, the coefficient on net income is significantly lower for private firms. This result provides triangulating evidence consistent with the notion that earnings quality is indeed lower for private firms.

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The Existence and Explanations for the Private Company Discount*

1. Introduction

In this study, we seek to establish the existence and examine explanations for the private company discount (PCD) applied by investors when they value the controlling interest in a private firm. While the market prices of public companies are readily available, pricing information about private firms is scarce (i.e., private firms are private!). The method of comparables along with estimates of the PCD are routinely used by investors and valuation practitioners either as the primary valuation methodology or as a secondary check on the estimated firm value, even if the initial valuation employed a direct valuation approach such as discounted cash flows. A typical starting point in the method of comparables is to identify comparable public firms and determine an appropriate public-firm price multiple of an accounting fundamental (e.g., 10×EBITDA). This multiple is then modified by applying a PCD to account for the fact that the firm is actually private. The value of the private firm equals the modified price multiple times the private firm's accounting fundamental. Estimates of the PCD also potentially inform judges and experts involved in estate and gift tax cases (see Beatty, Riffe and Thompson 1999). We emphasize at the very outset that the PCD is a broader concept than a simple lack-of-marketability discount and captures other reasons for a discount such as information risk (see Easley and O'Hara 2004). This study explores the following four related research questions.

1. Is there a PCD?
2. Is earnings quality lower for acquired private companies relative to that of acquired public companies?
3. Is higher information risk a partial explanation for the PCD?
4. As an implication of lower earnings quality for private firms, is the relation between net income and the purchase price for acquired private firms weaker than that for acquired public firms?

We now elaborate. First, we show the existence and estimate the magnitude of the PCD actually applied by investors when they acquire a private company. Employing both a univariate and a multivariate approach that controls for differences in industry, time, firm size and growth our results suggest a range

of PCD estimates between 34% and 38%. Our inferences primarily rely on the use of Enterprise-Value-to-EBITDA (EV/EBITDA) multiples, the primary valuation multiple used in practice. While the specific PCD estimates vary, the existence and approximate economic magnitude of the PCD is robust to using alternative accounting fundamentals such as EBIT, earnings and sales. The sample underlying this and the other analyses in the paper consists of 2,329 public and 713 private firm U.S. controlling-interest transactions for the period 1995 to 2004. Our source of data is a new large-scale database, *Pratt's Stats™ Private Transaction Database* (*Pratt's Stats*), created and routinely used by private-firm valuation practitioners, such as accounting firms, investment banks and business brokers that represent buyers or sellers in private-firm transactions. We augment it with additional financial statement data hand-collected from the SEC filings of the acquirers. This sample represents the largest set of private firms with both price and comprehensive financial statement information studied in the academic and practitioner literature.

Our second research question explores the quality of private firm's earnings, which we hypothesize to be lower because of the decreased demand for financial statement information by users other than the acquiring company. Given the typical high ownership concentration and the increased likelihood of owners being managers in private firms, contracts are more likely to be based on private information as opposed to financial statements. As well, private firms experience minimal enforcement and monitoring. U.S. private firms do not submit financial statements to regulators and rarely undergo scrutiny by the media or sell-side analysts. Less demand leads to weaker internal controls and lower audit quality, all of which increases the unintentional errors in private-firm earnings.[1] The opportunity for earnings manipulation will also be higher for private as opposed to public acquisition targets, although the management of both private and public firms will have incentives to increase earnings in the year prior to selling.

[1] The current version of the paper focuses on whether earnings are managed upwards. Future versions will also include examinations of more general measures of earnings quality.

We test for and find greater income-increasing accruals for private as opposed to public firms in the most recent annual fiscal period prior to their acquisition. We employ the Kothari, Leone, and Wasley (2005) ROA performance-matching procedures in order to measure discretionary accruals. We observe average performance-matched discretionary accruals for private firms of 3.9 percent of lagged assets. The corresponding estimate for public acquisition targets is -0.8 percent. Private versus public firm differences in earnings management are more pronounced for firms that are smaller in size (a proxy for weak internal controls), have less interest expense (a proxy for monitoring by debt holders), and are not audited by a Big5 auditor (a proxy for audit quality).

There is strong theoretical support for lower earnings quality representing at least a partial explanation for the PCD. While positive earnings management on average is expected by rational buyers, the actual amount of earnings management will vary from firm to firm and it is costly for the bidder to determine the exact bias adjustment to apply to fundamentals. Greater earnings management uncertainty combined with a higher risk of unintentional error for private firms leads to greater information risk faced by the bidder. To the extent that this information risk cannot be eliminated at a reasonable cost, through due diligence information search, acquirers will require a higher rate of return (see Easley and O'Hara 2004). Since price multiples of fundamentals such as earnings or EBITDA vary inversely with investors' required rate of return, the theoretical link between higher information risk for private firms and the existence of a PCD is immediate.

Whether lower earnings quality drives part of the PCD, however, is an empirical question and hinges on how much information risk can be reduced by the bidder through due diligence information search, which we argue is a substitute for lower earnings quality. Our third research question explores whether purchase price multiples of fundamentals vary with ex ante factors known to be determinants of earnings quality, such as audit quality. We present evidence that price multiples are weakly related to whether the financial statements have been audited by a Big5 auditor, which provides modest, but more direct, support for the link between information risk and the PCD.

Our fourth research question can be viewed as a consistency check for whether earnings quality is actually lower for private acquisition targets. An implication of lower earnings quality for private firms is that the relation between net income and the purchase price paid will be weaker for private firms, consistent with greater investor skepticism of the income statement for private acquisition targets. This setting is interesting because we examine earnings and its accrual component, as opposed to EBITDA, which is the main focus of our tests above. We find that in regressions of purchase price paid on net income, book value and other fundamentals, the coefficient on net income is significantly lower for private firms. In similar regressions, when we decompose earnings into operating cash flows and accruals, we find that private-firm coefficients on both operating cash flows and accruals are lower than the respective public firm coefficients. While such evidence constitutes triangulating evidence in support of the second research question, it does not address whether lower earnings quality is a partial explanation for the PCD. This is due to the fact that investors can always substitute "other information" (Ohlson 1995) via due diligence. Further, if the cost of this information substitution is nominal, then there should be no priced information risk associated with lower earnings quality. Thus, establishing that net income is less important in the information set used by bidder for private targets does not allow us to conclude that bidders face greater overall information risk for private relative to public targets. Nevertheless, we view our evidence related to the fourth research question to be interesting in its own right.

We contribute to the literature in a number of ways. This article presents a rigorous study of the PCD in the context of controlling interests, which is needed because, as Pratt (2001, p.173) argues, the existing analysis is neither comprehensive nor thorough enough to answer once and for all the question of whether private-firm controlling interests sell for less. While Ball and Shivakumar (2005) and Burgstahler, Hail and Leuz (2006) document the lower quality of earnings for European private firms, our setting is unique. All our sample firms prepare financial statements using U.S. GAAP and have the same incentives (i.e., to upward bias earnings). As well, the above two studies are made possible by the fact that European private firms must submit their financial statements to country regulators and hence their financial statements are, in essence, public documents. In contrast, there is no regulatory oversight of U.S. private firms and hence

our study is more about the different levels of enforcement and monitoring between private and public firms. We also relate earnings quality with the prices paid for the private firms. Last, this study demonstrates to practitioners, that the discount paid for private firms relative to public firms goes beyond a simple difference in lack of marketability.

The remainder of the paper proceeds as follows. Section 2 contains our literature review and our testable hypotheses. Section 3 describes our sample, while Section 4 describes our research methodology and results for each of the four research questions. Section 5 provides our conclusions.

2. Literature Review and Hypotheses

A limited amount of research, mainly practitioner oriented, has studied and produced mixed results about whether controlling interests in private firms sell for less than public firms. Pratt (2001, p.172) shows that the median price-earnings ratio for public firms is higher than that for private firms in most, but not all, years using data from *Mergerstat*, which collects data from SEC filings on transactions over $100 million, the very largest private companies. Koeplin, Sarin, and Shapiro (2000) employ 84 (108) matched private/public acquisitions in (outside of) the United States between 1984 and 1998 and attempt to estimate the PCD from a comparison of the multiples paid for fundamentals. However, Phillips and Freeman (1995), relying on a small sample of 51 private-firm transactions, challenge the existence of a discount and show that after controlling for size, profitability, and whether the transaction occurred in the banking industry there is no significant discount. Last, Ang and Kohers (2001) present evidence that private firms sell at a premium when using book value of equity as the accounting fundamental. In contrast to these studies, our study employs larger numbers of firms, and comprehensive financial statement data. Additionally, we introduce multivariate approaches based on the detailed financial statement information that allow us to improve inferences about the magnitude of the PCD. We expect that a private firm discount should exist because private firms are potentially different from public firms along two primary dimensions – marketability and earnings quality.

The first difference between private and public firms is the ability to trade shares on an exchange. We note here an important distinction about our setting. We study transactions of controlling interests and not minority positions. In contrast to public shares, there is practically no liquidity for small or minority amounts of shares in privately-held firms. There is empirical research conducted by and general agreement among practitioners that minority positions in private firms suffer significant liquidity constraints and hence should be discounted relative to minority positions in public firms. The existence of a marketability discount for controlling interests, however, is controversial. Given that a controlling interest is at stake and bidders are typically other companies, some practitioners question to what degree being a private as opposed to a public acquisition target translates into a smaller number of potential bidders (Pratt 2001, p.173). For example, the management of public acquisition targets likely face more pressure from minority investors to sell when an acquisition offer arrives, which is not necessarily the optimal time to sell. It is possible that private firms may be able to better time the sale of their firm, which would mitigate the potential effect of less bidder competition.

Several empirical studies provide indirect and mixed evidence of less marketability for private companies by comparing public company bidder returns at the announcement of takeover proposals for private relative to public targets. These studies expect that if controlling interests of private firms experience a lack of rival bidders then private firms will sell at a discount to their true economic value. Given the acquiring firms' public status, its assets suffer no such discount, and so part of the value realized by the acquiring public firm arises from eliminating the marketability discount associated with the private target's assets when these assets become part of the public firm's assets. For a sample of U.S. stocks between 1984 and 1995, Ang and Kohers (2001) document a positive abnormal return for bidders (the 2-day CAR ranges between 1.3 and 1.8 percent) of private targets, in contrast to the negative abnormal return for bidders of public targets. Chang (1998) and Draper and Paudyal (2006) document similar results for U.S. acquirers during 1981-1992 and U.K. acquirers during 1981-2001, respectively. Our data and tests, however, do not allow us to test a marketability explanation for the PCD. The focus of our paper is to explore "earnings quality" explanations for the PCD.

The second major difference between public and private firms relates to the quality of earnings for private firms, which we expect to be lower for private firms because of the decreased demand for financial statement information and minimal regulatory enforcement. By definition, a public firm is listed on an exchange, issues audited financial statements and fulfills regulatory and exchange requirements of public companies, such as filing prospectuses and 10-Ks. In contrast, private firms do not file comprehensive documents with regulators. If public firms report incorrect or misleading information, they could face sanctions or publicly-disclosed investigations by exchanges or regulatory agencies such as the SEC. In contrast, private firms will suffer no such consequences for such an action. Private firms also undergo minimal monitoring and information collection and processing by outside stakeholders. For example, sell-side analysts are neither analyzing nor writing reports and journalists are less likely to write media articles about these firms. Less demand for financial information leads to more primitive accounting systems and weaker internal controls, all of which increases the unintentional errors in private-firm earnings. Furthermore, given less regulatory oversight and monitoring, the opportunity for earnings manipulation will be higher for private as opposed to public acquisition targets, despite the incentives being similar for both types of firms.[2]

The empirical literature documents the lower quality of earnings for private firms. Ball and Shivakumar (2005) show U.K. private company financial reporting is of lower quality than U.K. public company financial reporting due to different market demand, regulation notwithstanding. Burgstahler, Hail and Leuz (2006) find earnings management is more pervasive in private firms across European

[2] Owners of firms (private or public) who want to sell their business have strong incentives to manage earnings upward. For example, Teoh et al. (1998a, 1998b) show that firms issuing new equity (initial public or seasoned) adapt income-increasing accruals. Marquardt and Wiedman (2004) find evidence of upward earnings management prior to equity offerings by accelerating revenue recognition. Easterwood (1998) finds some modest evidence that abnormal accruals are higher for 110 public-firm targets of tender offers prior to the initiation of the takeover attempt, which directly supports our assertion that targets have incentives to manage earnings upwards. In addition, Christie and Zimmerman (1994) provide some limited support for the idea that managers of public target firms adopt income-increasing accounting methods. Erickson and Wang (1999) find that acquiring firms manage earnings upward in the periods prior to the merger agreement.

countries.[3] Similar to these studies, our sample firms all prepare financial statements using the same standards, which in our case is U.S. GAAP. Our setting, however, is unique along other dimensions. Given that our sample firms are all being sold, the earnings management incentive (i.e., to upward bias earnings) is unique and signed. As well, the Ball and Shivakumar (2005) and Burgstahler, Hail and Leuz (2006) studies are made possible by the fact that European private firms must submit their financial statements to country regulators and hence their financial statements are, in essence, public documents. In contrast, there is no regulatory oversight of U.S. private firms and hence our study is more about the different levels of regulatory enforcement between private and public firms, and the resulting effect it has on firms' earnings quality and on the relation between earnings and transaction prices.[4]

The academic literature on the relation between private firm valuation and detailed accounting information is non-existent, with one exception. Hand (2005) finds that financial statement information is value relevant in the pre-IPO venture capital market for biotechnology firms, and becomes more value-relevant as the firm matures, consistent with financial statements capturing the intensity of assets-in-place relative to future investment options. His data is obtained from regulatory filings of biotechnology firms that filed IPO prospectuses with the SEC. These prospectuses describe the pre-IPO financing history which is the source of his private firm transactions. Our sample is representative of typical private entities as it includes firms in a broad range of industries and firms with no ambition to go public. As well, his transactions are for minority interests, typically among existing venture-capital investors who are more able to extract management's private information because of the board positions they hold and their frequent interactions with and monitoring of management. In contrast, we study transactions for controlling interests in which significant information asymmetry likely exists between buyers and management.

[3] As some examples, Beatty and Harris (1999) and Beatty et al. (2002), who focus on a regulated banking industry, find that public banks engage in more earnings management than private banks, consistent with earnings management occurring due to greater information asymmetry in public firms.

[4] While the financial statements of the firms in our sample eventually enter the public domain (which allows us to study them), at the time of the negotiations and transaction with the acquirer, the statements are private.

As mentioned above, private firms differ from public firms along the two dimensions of marketability and earnings quality, which leads to an expectation that private firms will sell at a discount to public firms. Our first hypothesis (in alternate form) is:

H1: *Ceteris paribus, purchase price multiples of accounting fundamentals are lower for private versus public acquisitions.*

Tests of H1 seek to establish the existence of a discount but not explanations for that discount. We now move to hypotheses that address the role of financial statement information. Although incentives for income increasing earnings management exist for both private and public firms that want to sell their business, given less enforcement and monitoring, we expect private firms will manage earnings upwards to a greater degree. This leads to our second hypothesis (in alternate form):

H2: *Ceteris paribus, earnings management is more positive in private firms than in public firms.*

As discussed in the introduction, our third research question explores whether lower earnings quality is at least a partial explanation for the PCD. As a point of logic, the assertions that there is a PCD and there is lower earnings quality for private acquisition targets can both be true, but this does not imply that lower earnings quality is a partial explanation for the PCD because information risk can be reduced by the bidder through due diligence information search.[5] Thus, whether lower earnings quality drives part of the PCD is an empirical question.

As we discuss in Section 4, we show that certain firm characteristics explain the unexpected abnormal accruals for our private firms: size, Big 5 auditor, and proxies for financial leverage. We argue that these "ex ante" factors are associated with the demand for monitoring of managers by firm stakeholders, and hence constitute ex ante measures of earnings quality. Prior literature has, in particular, studied the role of larger auditors. As examples, Becker, DeFond, Jiambalvo, and Subramanyam (1998) show that large auditors tend to provide higher-quality audits to reduce litigation risk and to protect their brand name reputation; Francis et al. (1999) demonstrate that Big-6-audited firms have lower amounts of estimated

[5] In equilibrium, if greater due-diligence information search for private firms is costly, these costs are imposed on the seller by the bidder through a lower purchase price. Thus, it is plausible that lower earnings quality is a partial explanation for the PCD.

discretionary accruals; and, Khurana and Raman (2004) document that a Big 4 Audit is associated with a lower ex ante cost of equity capital for U.S. firms. We also define "ex post" measures of earnings quality to be our calculated unexpected abnormal accruals. Using either measure, if one assumes that it is costly to substitute other information for poor earnings quality, information risk remains which drives higher required rates of return, hence, lower multiples of fundamentals. This leads to our third hypothesis (in alternate form):

H3: *Ceteris paribus, the purchase price multiples paid for the fundamentals of private acquisition targets will increase as ex ante (or ex post) measures of earnings quality increase.*

Our fourth research question explores the pricing implications of lower earnings quality in private firms. Accounting-based valuation models have become a prominent feature in accounting literature during the past ten years (e.g., Feltham and Ohlson 1995, 1996; Collins et al. 1997; Burgstahler and Dichev 1997; Francis and Schipper 1999; Dechow et al. 1999). In these models, market value is related, usually as a linear function, to book value of equity, current earnings and/or expected future earnings. The basic valuation model used in our study is based on Ohlson (1995), which is:

$$Price = k(\varphi Earnings - Dividends) + (1 - k)Book\ Value\ Equity + \alpha_2\ Other\ Information, \quad (1)$$

where $\varphi = (r + 1)/r$, $k = r\omega/(r + 1 - \omega)$, r is the equity cost of capital, and ω is the persistence of current abnormal earnings. Assuming dividends equals zero and placing other information in the model disturbance term, as well as adding an intercept to capture the mean effect of other information, one has a basic empirical model relating accounting attributes to value:

$$Price = \beta_0 + \beta_1\ Earnings + \beta_2 Book\ Value\ Equity + \varepsilon, \quad (2)$$

where β_1 is the estimate of $k\varphi$, and β_2 is the estimate of $1 - k$.

In the above price levels regression setting, we explore the extent to which earnings have weaker relations to the purchase price paid for private relative to public acquisition targets. Earnings are hypothesized to be of lower quality for private targets for several reasons. First, due to weaker internal control and lower audit quality, the risk of unintentional error in earnings is higher for private firms. In addition, many private firms have a short history of audited financial statements. If so, investors will be

more skeptical of audited acquisition-year income statement accruals (e.g., cost of goods sold and related gross margins) than of balance sheet accruals (e.g., inventory) because a time-series benchmark is more important in understanding the income statement.[6] A third explanation discussed above, is that the opportunity for earnings manipulation will be higher for a private as opposed to a public acquisition target, due to less regulatory oversight and lower audit quality, although both types will have incentives for income increasing accruals in the most recent year prior to selling. Since discretionary current accruals tend to reverse in the next year, the accruals of private firms are less persistent compared to public firms. Greater investor skepticism of private company reported income implies more weight on the balance sheet and less on income, in a price level regression where the purchase price is the dependent variable. It can be shown using equation (1) above that the relative weight on earnings versus book value of equity (i.e., β_1/β_2) is $\omega/(1-\omega)$. The relative weight is increasing in current abnormal earnings persistence that proxies for earnings quality (see Francis, LaFond, Olsson and Schipper 2004). In explaining the purchase price paid, we expect that net income of private companies will receive a lower weight relative to that of public companies. Our fourth and final hypothesis (in alternate form) is as follows:

H4: *Ceteris paribus, earnings will have a weaker relation to the price paid for private relative to public firms.*

We view this prediction as a consistency check on whether earnings quality is actually lower, for private relative to public acquisition targets, as implied by H2.

3. Data Sources and Sample Selection

The source of our private-firm valuation data is *Pratt's Stats* published by *Business Valuation Resources* (*BVR*). It includes financial statement and transactional details on the sale of privately-held firms from the period 1994-2005. This database is routinely used by intermediaries, such as accounting firms, investment banks and business brokers that represent buyers or sellers in these transactions. The data itself is collected from two sources in about even proportions. First, the same intermediaries that use

[6] We are grateful to Roger Grabowski, Managing Director of Duff & Phelps LLC for this explanation.

the data also contribute details of completed transactions to the database. Second, data is collected from SEC filings, in which public firms acquiring private firms disclose these transactions in regulatory filings such as 8Ks.

The available data in *Pratt's Stats* include: the firm's identity (e.g., company name, industry classification, country location); summary information from the firm's most recent financial statements (e.g., net sales, cost of goods sold, interest expense, taxes, net income, trade receivable, inventory, fixed assets, total assets, current liabilities, total liabilities, income statement date, and balance sheet date); and, details about the acquisition transaction (e.g., buyer company name, equity price, enterprise value, detailed sale terms, sale date, stock versus asset sale). We restrict our sample to those firms sold as stock sales. We exclude asset sales because in these transactions it is not clear exactly which assets or liabilities (if any) were included in the transaction. For parsimony, given that only a small number of observations are for non-U.S. firms, we limit our sample to U.S. private firms.

Although *BVR* provides a comprehensive set of selected financial information to satisfy the needs of practitioners, we manually collect private firms' financial statement data from the SEC filings of the U.S. acquirers because *BVR* does not collect all the information required for this study. For example, *BVR* collects no information from the cash flow statement but we require operating cash flow (in particular, to calculate the derived accruals measure) for our earnings management and pricing tests. As another example, we require the name of the auditor to determine auditor quality. Furthermore, *BVR*'s income statement information is for the most recent annual fiscal period but balance sheet information is provided for the most recent fiscal quarter prior to the acquisition, which may not be the fourth fiscal quarter. In order to fairly evaluate income and balance sheet information in our tests, we require the balance sheet at the end of the annual fiscal period. Last, our tests require us to calculate changes in some annual measures, and so we require not only the most recent annual financial statements but also the financial statements for the prior year.

U.S. acquirers normally file 8K or 8K/A forms with the SEC within 15 days of an acquisition, and the date of the filing is recorded by *BVR*. The *Pratt's Stats* database also includes the buyer Central Index

Key (CIK), which is the unique number that the SEC's computer system assigns to corporations who file disclosure documents with the SEC. The CIK, along with the recorded date enables us to quickly and precisely access the 8K or 8K/A filings of the public acquirers on the SEC's EDGAR website for each private-firm observation. For a small number of firms we cannot locate the appropriate SEC filing or the filing simply does not contain the financial statement data we require. We exclude these firms from the analysis. A number of variables we collect are already provided in the *Pratt's Stats* dataset. Given the novelty of the *Pratt's Stats* dataset and the absence of previous academic research using the data, we manually collect this data from the SEC filings of the acquirer in order to check the integrity of *BVR*'s SEC-data collection process. With few exceptions, all data in *Pratt's Stats* match with our hand-collected data. If there is a difference, we reexamine the source SEC filing and discuss the difference with representatives from *BVR*. For those cases in which the error was our fault we adjust our data set. There is no systematic pattern to the errors. Given this checking and reconciliation process, we are confident that both *Pratt's Stats* SEC data and our hand-collected data is of high-quality. This manual process restricts our sample of private firms to those purchased by public U.S. firms, and those with financial statement data for the two fiscal years prior to the acquisition.

Our complementary sample of public transactions is taken from the *Thomson Financial SDC* database of mergers and acquisitions.[7] The sample includes U.S. public firm targets acquired by other U.S. public firms for the same time period of our private-firm sample. We limit our analysis to *SDC* firms in which the buyer acquires 100% controlling interest after the transaction. This data is directly comparable to the private firm transactions, which also represent the purchase of 100% controlling interests. Our focus on controlling interests allows us to abstract from any issues of minority interest discounts. While the *SDC* dataset does include some financial statement data, it does not contain all the data we need for our tests. We use a combination of programming and manual processes to match the *SDC* data with *Compustat*,

[7] While *SDC* will include some information on the acquisition of private firms, it rarely includes financial statement information at a comparable level with its public acquisitions. As well, because *Thomson Financial* does not indicate the source of its information, it is extremely difficult for us to verify the integrity of this data.

using firms' ticker symbol, name and fiscal year, and obtain all financial statement data from *Compustat*. Public firms with insufficient *Compustat* data are excluded from the analysis.

Last, we combine the private firms of *Pratts' Stats* and the public firms of *SDC* into one dataset. We restrict our sample to firms with positive book value of equity and sales. We exclude financial institutions from our sample to avoid the confounding effects of these highly-regulated industries.[8] After applying all the restrictions discussed above, our sample consists of 3,042 companies, of which 713 are private and 2,329 are public. Some tests require additional restrictions and these are discussed in the appropriate sections.

Table 1 contains descriptive statistics for our sample of private and public firms. The two samples are different along a number of dimensions. As expected, private firms are smaller. The median private (public) firm size, measured by total assets, is $8.5 ($131.1) million. Private firms have greater growth prospects. The median private (public) *Sales Growth*, measured as percentage change in annual sales, is 18 (12) percent. Private firms also have lower leverage, and greater profitability as measured by ROA and ROE. In addition, 60 (93) percent of private (public) firms, respectively, are audited by a Big5 auditor. We recognize the dilemma posed by differing firm characteristics, such as firm growth, and the importance of maintaining the spirit of the ceteris paribus assumption in our analyses. We describe our empirical approach next.

4. Research Methodology and Results

The four sub sections that follow correspond to our four research questions, respectively. In each section, we first present our test methodology and then discuss the results.

4.1. Estimating the Private Company Discount

4.1.1. Tests. To answer our first research question, what is the discount of private firms, Appendix A describes the need to employ a multivariate regression methodology. Central to our approach is an

[8] According to Burgstahler and Eames (2003) financial firms are subject to earnings-management incentives that are more complex due to regulation and other factors. See also, e.g., Burgstahler and Dichev (1997) and Rosner (2003).

attempt to control for those valuation differences unrelated to whether the firm is private or public. Consistent with classical valuation theory, we view the firm as a function of the current level, expected growth and risk of cash flows. We rely on the ability of selected financial accounting information to proxy for these valuation dimensions.

As a starting point, we frame this analysis in terms of price multiples of accounting fundamentals, which implicitly controls for differences in the current level of cashflow. For reasons explained in Appendix A, our focus is on the ratio of enterprise value to earnings before interest, taxes, depreciation and amortization (*EV/EBITDA*). Enterprise value is defined as the sale price of the firms' equity plus total liabilities less current liabilities and hence this multiplier models the value of the entire firm (the asset value) as opposed to just the value for equity holders. This multiplier is the one most widely used by practitioners to value private firms. This multiplier also has a number of advantages over other potential ratios, and hence we view it as yielding our most reliable estimate of the PCD. We consider and tabulate results for other income statement mutipliers, but consider these more of a robustness check. The enterprise value to earnings before interest and taxes ratio (*EV/EBIT*) is inferior for our purposes, since *EBIT* is after deducting depreciation. Either one has to assume capital purchases and depreciation policies are the same across public versus private firms, or one has to model these differences. The sale price of the firms' equity to net income before extraordinary items (*P/E*) model suffers from similar problems, plus the need to assume comparable tax policies and on- and off-balance-sheet financial leverage decisions, or again to model these items. Last, in the case of *EV/Sales*, the role of the profitability of sales (i.e., profit margin), must be taken into account.

In our regressions, we use *EBITDA/EV* as the dependent variable, the inverse of the *EV/EBITDA* multiplier. Beatty et al. (1999) discuss the advantage of the former relative to the latter when using the method of comparables. Basically, the accounting variable is considered a noisy measure for the expected cash flow, and if placed in the denominator (numerator) leads to estimated coefficients that are positively biased (unbiased).

The multivariate model that we employ with *EBITDA/EV* as the dependent variable is as follows:

$$iEBITDA/EV = \alpha_o + \alpha_1 Private + \alpha_2 iSize + \alpha_3 iSales\ Growth + \varepsilon. \quad (3)$$

Private is an indicator variable that equals 1 if the firm is privately held and 0 otherwise, *Size* is the log of total assets, and *Sales Growth* is the percentage change in annual sales. This multivariate analysis is conducted on an intra-industry-year level in order to control for industry and year effects and facilitate pooling across our sample. For each two-digit SIC industry and year, we use *Compustat* data to calculate the median value of dependent and independent variables, and subtract the respective median from the raw value. To indicate this industry-year adjustment we add the prefix *i* to the variable name. [9, 10] *Size* and *Sales Growth* serve as proxies for risk and growth, respectively, and their inclusion as covariates should assist in controlling for these important dimensions of firm value. To the extent that part of a firms' growth and risk is associated with its industry membership, our industry adjustment also assists in controlling for risk and growth. The coefficient on the *Private* indicator variable captures the mean difference in the multiple between private and public firms, which we expect to be positive, consistent with the *EV/EBITDA* multiple (i.e., the inverse of our dependent variable used in the tests but our actual variable of interest) to be lower for private firms.

The other multiplier regressions we estimate, in which the inverse ratios are used as the dependent variables, are as follows:

$$iEBIT/EV = \alpha_o + \alpha_1 Private + \alpha_2 iSize + \alpha_3 iSales\ Growth + \varepsilon, \quad (4)$$

$$iE/P = \alpha_o + \alpha_1 Private + \alpha_2 iSize + \alpha_3 iSales\ Growth + \alpha_4 iLeverage + \varepsilon, \text{ and} \quad (5)$$

$$iSales/EV = \alpha_o + \alpha_1 Private + \alpha_2 iSize + \alpha_3 iSales\ Growth + \alpha_4 iR\&D\% + \alpha_5 iProfit\ Margin + \varepsilon. \quad (6)$$

[9] Industry-year medians for the valuation multiple estimated using *Compustat* data use exchange-traded market prices, which reflect the value of minority interest in that firm. Hence, these medians disregard any valuation premium for control. This source of "noise," however, is the same for both our private and public sample firms and should be neutral to the analysis.

[10] Our results are robust to alternative specifications that control for industry effects. For example, in untabulated analysis we do not industry-adjust any variables but include the industry-year median multiplier as a separate explanatory. As another example, in untabulated analysis we estimate separate industry and year fixed effects. Estimated coefficients on the *Private* variable remain similar.

Leverage is the ratio of total liabilities less current liabilities to total assets, *R&D%* is research & development expense divided by sales, and *Profit Margin* is EBITDA divided by sales.[11] For the analyses in this section, consistent with other multiplier research (e.g., Koeplin et al. 2000; Beatty, Riffe and Thompson 1999), we restrict the sample to observations in which *EBITDA*, *EBIT*, *E* (net income), and *SALES*, is positive when estimating the respective equations, in order to make meaningful comparisons across private and public multipliers. We delete 0.5 percent (winsorize 1 percent) of the very smallest and very largest values of the multipliers (independent variables) calculated separately for the private and public samples.

An alternative method that we consider but do not employ is matching public firms with private firms as Koeplin et al. (2000) do. Sample size decreases considerably when requiring a matching public firm for each private firm. For example, Koeplin et al. (2000) base their inferences on 84 (108) private/public pairs of U.S. (non-U.S.) firms matched on industry, year and size. Instead of matching we rely on linear multivariate models to remove the effects of differences in size and growth. But even with matching, restoring homogeneity in firm value drivers is extremely difficult. A perfect match is not possible, and by matching on one dimension, researchers typically ignore other dimensions. Consider Koeplin et al.'s study again. When matching, they minimize the difference in size between private and public firms, but their public firms remain significantly larger than their private firms. Their analysis also ignores any differences in growth. Similar to our sample, their sample of U.S. private firms is growing significantly faster than their public firms.

4.1.2. Results. Before we proceed to the results of our multivariate tests, we first examine univariate differences, which are presented in Panel A of Table 2. Focusing initially on *EBITDA/EV* in the first column, the mean multipliers are 0.137 and 0.090, for private and public companies, respectively. The mean difference in multiples across the two samples is 0.047, which is positive as expected and consistent with a private firm discount. Panel B of Table 2 presents the results of our multivariate tests. Although the

[11] We do not control for R&D%, an additional proxy for growth besides Sales Growth, in models (4) and (5) because of mechanical relation between R&D expense and lower earnings.

coefficient on *Size* is not significant, the coefficient on *Sales Growth* is significantly negative (coefficient = -0.016), suggesting that the *EV/EBITDA* multiplier is increasing in growth as expected. After partialling out the effects of these value drivers on the multiple, and hence facilitating the ceteris paribus assumption, we focus on the *Private* indicator variable. The estimated coefficient on *Private* is 0.056, which is of a comparable magnitude to the univariate-estimated difference.

To assess the economic interpretation of these differences, in Panel C we calculate the actual PCD using the inverted mean multipliers and the following equation (explained in Appendix):

$$\text{PCD} = \frac{(EV/EBITDA_{Public} - EV/EBITDA_{Private})}{EV/EBITDA_{Public}} \quad (7)$$

where $EV/EBITDA_{Public}$ ($EV/EBITDA_{Private}$) is the inverse of the mean public (private) firm *EBITDA/EV* multiplier. In the case of the univariate difference, $EV/EBITDA_{Public}$ is 11.11 (=1/0.090) and $EV/EBITDA_{Private}$ is 7.30 (=1/0.137), resulting in a PCD equal to 34.3%. For the multivariate analysis, we assume the $EV/EBITDA_{Public}$ is the same as in the univariate analysis (i.e., 11.11) and calculate the implied $EV/EBITDA_{Private}$ using the estimated *Private* coefficient from equation (3), which represents the mean difference between private and public firms in a multivariate setting. Given the univariate mean public *EBITDA/EV* multiplier of 0.090 and the *Private* coefficient of 0.056, the implied multivariate mean private *EBITDA/EV* multiplier is 0.146 (= 0.090+0.056) and the multivariate version of $EV/EBITDA_{Private}$ is 6.85 (=1/0.146). Hence, the multivariate analysis produces an estimated PCD of 38.3%.

We view this 34-38% estimate of the PCD to be reasonable. It is greater than that calculated by Koeplin et al. (2000), who estimated an *EV/EBITDA*-based PCD of 20.39% for U.S. firms. But, we believe the Koeplin et al. PCD is biased downward because they calculate means based on *EV/EBITDA*. As mentioned above, the mean of this ratio is biased upward because of noise in the *EBITDA* denominator. We expect that private firms' *EBITDA* is noisier than that of public firms' *EBITDA*, which implies that private firms' mean *EV/EBITDA* is relatively more upward biased than that of public firms, hence generating a smaller PCD. We also emphasize that our sample is more comprehensive (2,354 firms whereas they employ only 84 matched pairs), and they do not control for private firms' systematically

higher growth rates. Our results also contrast with Beatty, Riffe and Thompson (1999), who document the existence of a private firm discount, which they label lack of marketability, for tax valuations of private companies, as applied by the courts. For the 31 estate and gift-tax cases they examine, the mean discount assessed as appropriate by the judges is 25 percent. We differ from Beatty et al. (1999) in that we infer the private company discount actually applied by firms who acquire private as opposed to public companies. Taken at face value, our results suggest that the courts should be applying a higher discount than they currently do.

The remaining columns in Table 2 show similar estimations of univariate differences, multivariate regressions and PCD calculations for the *EBIT/EV*, *E/P* and *Sales/EV* multiples. The corresponding univariate (multivariate) PCD estimates, are 43.1% (43.6%), 50.0% (48.9%), and 31.9% (20.4%), respectively, which are different than but still comparable to our estimated PCD using the *EBITDA/EV* multiple. In the next section, we describe our test of whether private firms manage earnings upwards to a greater degree than public firms, which is a potential earnings-quality-based explanation for the apparent discount applied by buyers when purchasing private companies.

4.2. Tests of Earnings Management

4.2.1. Tests. In this section, we examine the discretionary accruals of our sample firms to determine whether private firms' discretionary accruals are more positive than those of public firms, consistent with greater earnings management in private firms. We follow Kothari et al. (2005) to estimate performance-matched discretionary accruals for our sample firms and then compare the private and public firms' mean values for evidence of a difference. Matching on performance is important in our research setting because, as Table 1 indicates, private firms' economic performance (i.e., ROA) is greater than that of public firms. Performance-matching procedure reduces the risk of a false rejection of the null of no difference in earnings management across the private and public acquisition samples.

We first estimate the cross-sectional version of the modified Jones (1991) model for each two-digit SIC industry and year. We trim one-half percent of the data based on the distribution of the dependent

variable, total accruals scaled by lagged total assets and delete these observations. For the remaining observations, we winsorize the right-hand-side independent variables at the 1st and 99th percentiles and then estimate the following cross-sectional regression for each two-digit SIC industry and year, using *Compustat* data:

$$\frac{Accruals_{i,t}}{Assets_{i,t\text{-}1}} = \gamma_0 + \gamma_1 \frac{1}{Assets_{i,t\text{-}1}} + \gamma_2 \frac{(\Delta Sales_{i,t} - \Delta AR_{i,t})}{Assets_{i,t\text{-}1}} + \gamma_3 \frac{PPE_{i,t}}{Assets_{i,t\text{-}1}} + \varepsilon_{i,t}, \quad (8)$$

where, *Accruals* is earnings before extraordinary items and discontinued operations less operating cash flows, Δ*Sales* is annual sales less previous year's sales, Δ*AR* is accounts receivable less previous year's accounts receivable, *PPE* is property, plant and equipment, and *i* and *t* subscripts indicate the firm and year, respectively. The industry-year-specific coefficient estimates from equation (8) are used to estimate expected accruals as a percentage of lagged total assets, i.e., non-discretionary accruals (*NDA*). Discretionary accruals (*DA*) are accruals (scaled by lagged total assets) less non-discretionary accruals. These values are calculated for both public and private firms in our sample.

In order to calculate performance-matched discretionary accruals (*PMDA*), following Kothari et al. (2005), we obtain the closest ROA matching *Compustat* firm in the same industry and year for each of our private and public acquisition targets. We then calculate discretionary accruals for the matched firms in the manner described above and calculate performance-matched discretionary accruals for the sample firms as the difference between the discretionary accruals of each sample firm and that of its ROA-matched firm.

We then develop and test a number of cross-sectional predictions. Following Butler, Leone and Willenborg (2004), we regress (signed) *PMDA* on firm characteristics thought to be related to earnings management. We estimate:

$$PMDA = \alpha_o + \alpha_1 Size + \alpha_2 Big5\ Auditor + \alpha_3 Interest + \alpha_4 Sales\ Growth + \varepsilon, \quad (9)$$

where *Big5 Auditor* equals 1 if the auditor is a Big 5 audit firm and 0 otherwise, and *Interest* is interest expense scaled by assets.

Firm size is correlated with the sophistication of firm's accounting computer and internal control systems, which increases the difficulty of strategically managing the underlying estimates and accounting choices. We expect that financial statements that have been audited by one of the larger prestigious auditing firms will be of higher quality. Third-party creditors (such as banks) prefer financial statements with high-quality accruals and are more likely to transact with firms with higher-quality accounting systems, all else equal. Creditors may also be monitoring the firm and its accrual process, which leads to the idea that firms with more debt outstanding are more likely to have higher-quality accruals. We use interest expense scaled by assets instead of total liabilities scaled by assets (i.e., leverage) as our proxy for bank loans because private firms in particular often have non-interest bearing liabilities (e.g., loans from owners or other insiders), which do not represent the effect of third-party activities in the spirit of our construct.[12] Based on these factors, we predict that *PMDA* is decreasing in *Size*, *Big5 Auditor* and *Interest*.

Given that private firms endure no regulatory enforcement, a factor limiting earnings management, we conjecture that other factors associated with curbing earnings management activities will have stronger effects on private firms' earnings management. Hence we predict that the relation between *PMDA* and *Size*, *Big5 Auditor* and *Interest* will be more negative for private firms. We include percentage sales growth as a "second pass" control, given that the ROA-matching procedure used by Kothari et al. (2005) may not perfectly control for the effects of growth on measured discretionary accruals.

4.2.2. Results. Panel A of Table 3 contains our evidence of income increasing performance-matched discretionary accruals for public versus private acquisition targets. The mean *PMDA* for public and private firms is -0.008 and 0.036, respectively. This suggests that private targets have (as a percentage of lagged total assets) 3.6 percent discretionary accruals, an estimate that is close to the 4 percent discretionary current accruals for IPO's calculated by Teoh, Welch, and Wong (1998).[13] Given that public

[12] Our inferences are robust to the use of the variable *Leverage* (instead of *Interest*) as a proxy for monitoring by creditors.

[13] Teoh et al. (1998) do not directly use ROA performance-matched discretionary accruals but they do indirectly explore the sensitivity of their inferences to industry economic performance.

companies face greater regulatory and financial intermediary scrutiny, the close to zero mean PMDA for that group is not surprising. The mean difference in *PMDA* across the private and public firms in the full sample is -0.044, which is statistically significant at the 0.01 level.

Panel B of Table 3 indicates that *PMDA* for private acquisition targets, as expected, decreases in *Size* (coefficient estimate is -0.032) and *Interest* (coefficient estimate is -1.44). For the public acquisition targets, also as expected, *PMDA* is decreasing in *Size* (coefficient estimate is -0.006). Although the positive relation between *PMDA* and *Big5 Auditor* is not what we expected, the coefficient is only weakly significant. Sales growth is insignificant in regressions for both samples, which suggest that in our setting, the Kothari et al. procedure does remove the effects of growth. In the private company regression, the estimated intercept of 0.152 indicates that estimated earnings management is more pronounced for private firms that are very small and undergo little creditor scrutiny. Overall, our univariate and multivariate results in Table 3 are consistent with our second hypothesis, that earnings management is more positive in private firms than public firms.

In the next section, we examine the effects of lower earnings quality on the purchase price paid as a multiple of the accounting fundamentals.

4.3. Relation between Information Risk and the Private Company Discount

4.3.1. Tests. In this section we present evidence as to whether greater information risk is a partial explanation for the PCD. We test whether the multiple paid for a dollar of *EBITDA* fundamentals declines as our measures of information risk increase. We estimate an equation similar to equation (3) that includes a set of explanatory variables augmented with our information risk measures. For example, we continue to control for size and sales growth since these are well known determinants of this multiple and their inclusion helps reduce problems related to correlated omitted variables. The dependent variable (i.e., the multiplier) and the control variables are measured on an intra-industry basis. Our first measure of information risk is the same discretionary accrual measure used as the dependent variable in our section

4.2 earnings management tests, which is already computed on an intra-industry basis. We estimate the following equation separately for the private- and public-firm samples:

$$iEBITDA/EV = \alpha_o + \alpha_1\, iSize + \alpha_2\, iSales\ Growth + \alpha_3\, PMDA + \varepsilon. \quad (10)$$

Given our dependent variable is *EBITDA/EV*, we predict a positive association between *EBITDA/EV* and discretionary accruals. We repeat the tests using our second measure of information risk, namely observable firm characteristics that are ex ante determinants of earnings quality and information risk more generally. In this case, we use the variables *Big5 Auditor* and *Leverage*. These variables indicate higher monitoring that constrains earnings management and hence increases information quality. These variables were used as explanatory variables in the section 4.2 tests. For consistency, we measure leverage on an intra-industry basis. We estimate:

$$iEBITDA/EV = \alpha_o + \alpha_1\, iSize + \alpha_2\, iSales\ Growth + \alpha_3\, Big5\ Auditor + \alpha_4\, iLeverage + \varepsilon. \quad (11)$$

We predict that both *Big5 Auditor* and *Leverage* will be negatively correlated with *EBITDA/EV*.

4.3.2. Results. Panel A of table 4 summarizes the results of estimating equation (10). The coefficients on discretionary accruals are insignificantly different from zero for both the public and private samples. This result provides no support for our third hypothesis. Panel B presents the results when we include the ex ante information risk measures. For the public sample, the coefficient of -0.009 on *Big5 Auditor* is weakly significant at the 0.10 level (one-tailed). For the private sample, the corresponding coefficient of -0.021 is significant at the 0.10 level (two-tailed). In the case of *Leverage*, the results are not supportive for the public sample – the *Leverage* coefficient is significant and positive, the opposite to our prediction. We conjecture that firms with greater *EBITDA/EV* have greater ability to pay interest (in a times interest earned sense), and, hence, borrow more, increasing their leverage. This situation is consistent with a positive relation between *EBITDA/EV* and *Leverage*, which works against our prediction. Despite this bias, the *Leverage* coefficient is -0.038 for the private-firm sample, which is negative as predicted and weakly significant at the 0.10 level (one-tailed). Our result shows that creditors play a significantly bigger role in monitoring earnings management behaviors of managers in private firms than in public firms.

A simple economic interpretation of the coefficients on *Big5 Auditor* is as follows. For the private sample, the average *EBITDA/EV* ratio reported in Table 2 is 0.137, which when inverted implies an average *EV/EBITDA* multiple of 7.3 times. Ignoring other covariates, the *Big5 Auditor* intercept shift of -0.021 implies that the average *EBITDA/EV* ratio declines to 0.116 (0.137-0.021), which when inverted implies an average *EV/EBITDA* multiple of 8.6 times for firms with Big5 auditors. Since the average *EBITDA* for our private sample is $2.4 million, a swing of multipliers from 8.6 to 7.3 due to not having a Big5 auditor costs the firm $3.1 million ((8.6-7.3)*$2.4). A corresponding analysis could be performed for the public acquisition targets. However, as indicated in Table 1, 93 percent of public targets have a Big5 auditor compared to only 60 percent for private acquisition targets. So, while a lack of Big5 auditor effect is operating in both groups, it is applied to a much larger percentage of private firms, suggesting that a lack of Big5 auditor is a partial reason for the overall PCD.

Taken together, we interpret our Table 4 results as weak evidence that information risk is a partial explanation for the PCD. The patterns are not implausible. On one hand, the results suggest that Jones model discretionary accruals are viewed by investors as noisy measures of the actual earnings manipulation that has occured for a particular target firm. On the other hand, ex ante characteristics such as the existence of a Big5 Auditor are measured with considerably less noise and are likely viewed by investors as correlated with firm information risk. The Big5 Auditor results suggest that information risk is priced in economically meaningful amounts.

4.4. The Ability of Earnings versus Book Value in Explaining the Purchase Price

4.4.1. Tests. As discussed in Section 2, we begin with the basic empirical Ohlson model represented by equation (2) and estimated by Collins et al. (1997). Following Core, Guay and Buskirk (2003), we augment this model to include the following proxies for "other information" (see equation (1)): R&D expense, sales growth and controls for negative earnings.[14] We estimate:

[14] Unlike Core et al. (2003), we do not incorporate advertising and capital expenditure as additional growth proxies because this data is not readily available for our target private companies.

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, Earnings + \alpha_3 \, Loss \times Earnings + \alpha_4 \, \Delta Sales + \alpha_5 \, R\&D\ Expense + \varepsilon. \quad (12)$$

where all amounts are in millions of dollars, *Price* is the sale price of the firm's equity, *Loss* is an indicator variable that equals 1 if income before extraordinary items is less than zero and 0 otherwise, and *R&D Expense* is research & development expense.

Following Easton and Sommers (2003) and Beatty et al. (1999), we scale all variables in equation (12) by *Price*. We employ weighted least squares in order to estimate the equation (12) coefficients. We estimate annual regressions for each year 1995-2004, with separate estimates for private and public firms. To facilitate inference, we follow Core et al. (2003) and present mean and statistical significance based on the distribution of the ten annual coefficients as in Fama and MacBeth (1973).

4.4.2. Results. The first two columns of Table 5 contain our price regression tests of whether the relation between earnings and the price paid is weaker for private relative to public firms. After partialling out proxies for other information, the mean coefficient on earnings and book value of equity for public firms is 5.16 and 0.76, respectively, compared to 1.97 and 0.68, respectively, for private firms. Untabulated tests shows that the difference between the private and public earnings coefficients is statistically significant (*t*-statistic = 2.68) while the difference in book value of equity coefficients is not (*t*-statistic = 0.48).[15] The corresponding ratio of the coefficient on earnings to that on book value of equity is 6.79 and 2.90, for public and private firms, respectively, and the difference between these ratios is statistically significant (*t*-statistic = 1.78). Thus, the results are consistent with our fourth hypothesis: the relation between earnings and prices is lower for private firms. These results are also consistent with the underlying idea that the acquiring firms are more skeptical of reported net income for private companies and rationally price this lower earnings quality.

4.5. The Ability of Accruals versus Cash Flows in Explaining the Purchase Price

[15] In order to test statistical significance for the results in this section, the difference in coefficients (or ratios of coefficients) is calculated for each of the ten years and then a *t*-statistic is calculated based on the average difference using the Fama-MacBeth procedures.

4.5.1. Tests. In our earlier section, we document more positive performance-matched discretionary accruals for private firms, relative to public firms. If investors are skeptical of private firm income statements accruals, due either to deliberate earnings management, or unintentional error, one might observe a lower valuation weight on accruals versus cash flows, for private relative to public firms. We re-estimate our basic price regression model, equation (12), first by allowing the coefficient on accruals to differ from the coefficient on operating cash flows and second by further decomposing accruals into those that are discretionary and non-discretionary. We estimate the following two equations:

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, Accruals + \alpha_3 \, OCF + \alpha_4 \, Loss \times Accruals + \alpha_5 \, Loss \times OCF + \alpha_6 \, \Delta Sales + \alpha_7 \, R\&D\ Expense + \varepsilon, \text{ and} \quad (13)$$

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, NDA + \alpha_3 \, DA + \alpha_4 \, OCF + \alpha_5 \, Loss \times NDA + \alpha_6 \, Loss \times DA + \alpha_7 \, Loss \times OCF + \alpha_8 \, \Delta Sales + \alpha_9 \, R\&D\ Expense + \varepsilon. \quad (14)$$

These equations are estimated in an identical manner to how equation (12) is estimated (e.g., scaling by price, using WLS, presenting mean coefficients from 10 annual regressions). We interact the indicator Loss variable with the decomposed-earnings variables. Including these interactive variables allow us to isolate the coefficient on accruals versus operating cash flows for profit firm years, the focus of our tests.

4.5.2. Results. The last four columns of Table 5 contain the results of estimating these regressions. For public firms, the mean coefficient on accruals and operating cash flows for profit firm years in equation (13) is 4.48 and 5.49, respectively. The untabulated Fama-MacBeth *t*-statistic on the difference in these coefficients is significant at the 0.10 level (two-tailed). For private firms, the corresponding mean coefficient on accruals and operating cash flows is 1.38 and 2.65, respectively. Once again, the untabulated Fama-MacBeth *t*-statistic on the difference in these coefficients is significant at the 0.10 level. Thus, for both public and private firms, bidders place a higher weight on operating cash flows relative to accruals.

Comparing across public and private firms, in Table 5, it is apparent that the greater investor skepticism of the income statement suggested by model 1 extends to components of net income. In model 2, the mean coefficient on accruals for public targets, 4.48, exceeds that for private targets, 1.38. Untabulated tests shows that the difference is statistically significant (*t*-statistic = 1.92). Similarly, the

mean coefficient on operating cash flows for public targets is 5.49, which exceeds the private targets coefficient of 2.65, and the untabulated difference is statistically significant (*t*-statistic = 2.06). These results suggest that investors attach lower quality to both cash and accrual components of net income for private firms than for public firms, possibly due to weaker internal controls and a greater risk of unintentional error for private firms. For equation (14), for both private and public firms, the coefficients on discretionary and non-discretionary accruals are practically identical, which provides no support that these elements are priced differently. Given the admitted noise in the discretionary accrual measure, we are hesitant to form any conclusions about the lack of difference.

5. Conclusion

In this study, we seek to establish the existence and examine explanations for the private company discount applied by investors when they value the controlling interest in a private firm. Our four main findings are summarized as follows. First, we show the existence and estimate the magnitude of the PCD actually applied by investors when they acquire a private company. Employing both a univariate and a multivariate approach that controls for differences in industry, time, firm size and growth our results suggest a range of PCD estimates between 34% and 38%. Second, we find greater income-increasing accruals for private as opposed to public firms in the most recent annual fiscal period prior to their acquisition, consistent with private firms engaging in greater earnings management. Third, we present evidence that price multiples are weakly related to whether the financial statements have been audited by a Big 5 auditor, which provides modest but more direct support for the link between information risk and the private company discount. Last, we find that in regressions of purchase price paid on net income, book value and other fundamentals, the coefficient on net income is significantly lower for private firms. This result provides triangulating evidence consistent with the notion that earnings quality is indeed lower for private firms.

Our results should be of interest to practitioners, academics and accounting standard setters. For valuation practitioners, the PCD estimate is useful when public companies and the method of

comparables is used to arrive at or support a purchase price for a private company. A subtle point (see Appendix A) is that the 34-38% discount is applied to the firm value and does not depend on which accounting fundamental is being priced (EBITDA, EBIT, earnings or book value). Furthermore, the appropriate PCD does not depend on the target company's attributes such as industry or firm size, since such attributes have been controlled for in our estimates of the discount. The 34-38% PCD estimate may also be useful to judges and experts involved in estate and gift tax cases and exceeds the 25% discount commonly used in the courts to reflect "lack of marketability". Our results suggest that the PCD actually applied by investors reflects factors beyond lack of marketability and incorporates greater information risk when the target company is private as opposed to public.

To the extent that information risk is at least a partial explanation for the PCD, our results add to a growing academic literature suggesting a link between information risk and the cost of capital. Furthermore, our results imply that the PCD can be reduced through proactive attempts by target private companies to reduce information risk (e.g., by hiring a Big 5 auditor). This implication is consistent with the IPO literature.

Given global GAAP convergence, an issue of considerable interest to standard sellers in many countries is whether private companies should be exempted from some of the accounting and disclosure standards required for public companies. To the extent that such exemptions further increase the information risk facing the buyer of a private company, our results imply that "little GAAP" for private firms could be costly to shareholders if they decide to sell.

APPENDIX

Companies A and B are two recently acquired companies that differ in scale but are otherwise identical in terms of value drivers characteristics that drive *P/E* valuation multiples; A is a private company while B is public. Further, suppose that the buyer uses a *P/E* valuation model and the method of comparables to obtain the valuation multiplier, *k*. And *k* is thus the same for both firms. We assume that the valuation of the private company, *V*, is reduced by a private company discount (PCD). PCD is the percentage discount that captures lack of marketability and other factors (information risk, etc.). Thus, we have the following purchase price for all of the shares of Company A and B, where *V', V, P', P, E',* and *E* represent the valuation, purchase price and earnings in dollars for A and B and *k', k* denote the *P/E* multipliers that are observable, respectively:

Private Company A	Public Company B
$P' = (1 - PCD)(V') = (1 - PCD)(k)(E') = (k')(E')$	$P = V = (k)(E)$

Suppose the practitioner or researcher can observe the purchase price and the fundamentals and wants to "reverse engineer" an estimate of the percentage private company discount implicit in the data. The PCD cannot be recovered by calculating 1–(*P'/P*), since the two companies differ in scale.

As pointed out by Koeplin, Sarin and Shapiro (1996) (hereafter "KSS"), the PCD can, given the above simplifying assumptions, be recovered from a comparison of the observed multiples paid per dollar of earnings, as follows:

$$1 - k'/k = 1 - [(1 - PCD)(k)]/k = PCD \qquad \text{(A1)}$$

Now, suppose that the ceteris paribus assumption does not hold and the two firms differ in firm characteristics (e.g., risk, growth) that drive *P/E* valuation multiples. Assume that the buyer applies the method of comparables and uses multipliers *k** and *k* for companies A and B, respectively. As recognized by Koeplin et al. (2000), the above simple procedure for reverse engineering the PCD no longer recovers the PCD, as we now illustrate:

$1 - k'/k = 1 - [(1 - PCD)(k^*)]/k$, which does not equal PCD (A2)

As we will elaborate upon below, the researcher or practitioner must now use matching or multivariate techniques to remove the influences of firm characteristics that drive *P/E* multiples, other than the public/private distinction, so that the difference in the observable multipliers due to the private company discount can be inferred.

A very subtle point is that the reverse engineering procedure does not recover the PCD when the researcher or practitioner imposes on the data a valuation model that investors do not (at least typically) use when establishing the purchase price. We will illustrate the point with the *P/B* valuation model but the point also applies to the enterprise value/total assets model (*EV/TA*), one that KSS use in conjunction with equation (1) to infer the PCD.

To keep the illustration as simple as possible, suppose that the above assumptions hold: the two companies differ in scale and ROE but are otherwise identical in firm characteristics that drive *P/E* multiples; the k multiples are the same for both companies; and, the valuation model used by investors is the *P/E* valuation model as described above. The *P/B* multiples observed by researcher are as follows:

Private Company A	Public Company B
$P'/B' = (1 - PCD)(k)(E')/B'$	$P/B = (k)(E)/B$

The KSS procedure for reverse engineering the PCD no longer recovers the PCD, as we now illustrate:

$$1 - \frac{P'/B'}{P/B} = 1 - \frac{(1 - PCD)(k)(E')/B'}{(k)(E)/B} = 1 - \frac{(1 - PCD)E'/B'}{E/B} \quad \text{(A3)}$$

It is apparent from equation (A3) that the KSS procedure is no longer successful in recovering 1–PCD unless the researcher also knows and incorporates the book ROE (i.e., *E/B*) for each respective company. Without incorporating the book ROE, the PCD cannot be recovered using a simple univariate comparison of *P/B* multipliers. The simple intuition is that the *P/B* ratio depends on the goodwill and goodwill is driven by ROE differences across firms, something not captured in *B*. In a survey of valuations of 21

private companies involved in estate and gift tax cases, Beatty and Thompson (1999) report that the *P/E* (*P/B*) valuation is used in conjunction with the method of comparables in 85% (48%) of the valuations.

The inability to recover the PCD from a univariate comparison of *P/B* multipliers is apparently overlooked in the literature. For example, Ang and Kohers (2001, p.730) compare the *P/B* ratios for private and public targets and document no difference in premiums for the 1984-1988 period, but a positive premium for private relative to public targets for the 1989-1995 period. The univariate premium cannot yield reliable inferences unless the book ROE and other differences in value drivers are controlled for.

It can be shown that reverse engineering the PCD using equation (1) is also problematic using a univariate approach and $EV/Sales$ multiples, if the two companies differ in their gross margin, a well-known driver of such multiples. KSS match on industry and size but not gross margin, so their univariate inferences using $EV/Sales$ are confounded.

With appropriate control for value drivers, multivariable procedures should in principle be able to recover consistent estimates of the PCD across a variety of multiples comparison: *P/E*, *P/B*, *EV/EBITDA*, *EV/TA* and *EV/Sales*. However, we view our most reliable evidence on the PCD to arise from multivariate procedures used in conjunction with the *EV/EBITDA* model. This model is widely used by investors and comes closest to satisfying the ceteris paribus assumptions required by equation (A1). As recognized by KSS, the *P/E* model is relative to *EV/EBITDA* less reliable for reverse engineering the PCD. The *P/E* model requires controls for financial leverage so the researcher is typically in a setting of equation (A2) rather than equation (A1) with this model. This is problematic, since companies have off balance sheet financial leverage (due to leases, for example) which renders proxies for financial leverage to be quite noisy, a problem that also confounds the *P/B* model. In this paper, we place emphasis on PCD inference using the *EV/EBITDA* model but also report, for comparison purposes, PCD inference using the *P/E* and *EV/Sales* model.

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TABLE 1
Descriptive Statistics on Sample Firms

This table reports descriptive statistics for our sample of 3,042 (2,329 public and 713 private) firms. The source of data for private firms is *Pratt's Stats* and manually-collected financial statement data from the acquirer's SEC filings. The source of data for public firms is from *Thomson Financial SDC* and *Compustat*. All financial statement data is for the most recent annual fiscal period ending prior to the date of the sale transaction and are measured in $millions. *Assets* is total assets, *Book Value Equity* is total assets less total liabilities, *Sales Growth* is the percentage change in annual sales, *R&D%* is research & development expense divided by sales, *Leverage* is the ratio of total liabilities less current liabilities to total assets, *Profit Margin* is earnings before interest, taxes and depreciation & amortization (*EBITDA*) divided by sales, *Return on Assets* is *EBITDA* divided by total assets, *Return on Equity* is income before extraordinary items divided by book value of equity, *Loss* is an indicator variable that equals 1 if income before extraordinary items is less than zero and 0 otherwise, *Big5 Auditor* equals 1 if the auditor is a Big-5 audit firm and 0 otherwise, *Size* is the log of total assets, *Equity Price* is the sale price of the firm's equity, and *Enterprise Value* is the equity price plus total liabilities less current liabilities. Extreme values (top and bottom 1%) of continuous variables are winsorized. ***, **, and * denotes significance at the 1%, 5% and 10% (two-tailed) levels, respectively.

	Public Firms		Private Firms		Difference	
Variable	Mean	Median	Mean	Median	Mean	Median
Assets	782.7	131.1	22.9	8.5	759.8***	122.7***
EBITDA	87.2	12.6	2.4	1.4	84.8***	11.2***
Book Value Equity	282.8	67.2	10.2	3.3	272.6***	63.91***
Sales Growth	0.33	0.12	0.62	0.18	-0.29***	-0.06***
R&D%	0.13	0.00	0.12	0.00	0.01	0.00
Leverage	0.23	0.16	0.12	0.04	0.11***	0.12***
Profit Margin	-0.09	0.10	-0.24	0.09	0.15***	0.01
Return on Assets	0.04	0.11	0.12	0.19	-0.07***	-0.08***
Return on Equity	-0.13	0.06	-0.05	0.18	-0.08*	-0.12***
Loss	0.37	0.00	0.28	0.00	0.08***	0.00
Big5 Auditor	0.93	1.00	0.60	1.00	0.33***	0.00

TABLE 2
Analysis of Price to Accounting Fundamental Multiples
(Table description follows)

	Pred. Sign	Valuation Multiple *EBITDA/EV*	*EBIT/EV*	*E/P*	*Sales/EV*
Panel A: Univariate Analysis					
Public Firms					
Mean		0.090	0.062	0.046	0.919
Median		0.080	0.057	0.037	0.543
Number of Observations		1,769	1,601	1,457	2,305
Private Firms					
Mean		0.137	0.109	0.092	1.350
Median		0.106	0.088	0.064	0.858
Number of Observations		573	540	503	705
Difference					
Mean	+	0.047***	0.047***	0.046***	0.431***
		(11.33)	(13.75)	(12.85)	(7.29)
Median	+	0.026***	0.031***	0.027***	0.315***
		(8.26)	(10.36)	(11.06)	(8.50)
Panel B: Multivariate Analysis					
Intercept		-0.011***	-0.041***	-0.009***	0.156***
		(-5.61)	(-23.64)	(-5.00)	(5.78)
Private	+	0.056***	0.048***	0.044***	0.236***
		(10.83)	(10.73)	(9.23)	(3.45)
Size	–	0.001	-0.002	-0.003***	-0.066***
		(0.78)	(-1.58)	(-2.65)	(-4.38)
Sales Growth	–	-0.016***	-0.006*	-0.007**	-0.100***
		(-4.63)	(-1.86)	(-1.92)	(-4.96)
R&D%	–				-0.455***
					(-5.82)
Leverage	+			0.017*	
				(1.78)	
Profit Margin	–				-0.069**
					(-2.14)
Adj. R^2		0.078	0.102	0.097	0.046
Number of Observations		2,333	2,132	1,952	2,999

TABLE 2 (Continued)
Analysis of Price to Accounting Fundamental Multiples

	Pred. Sign	Valuation Multiple *EV/EBITDA*	*EV/EBIT*	*P/E*	*EV/Sales*
Panel C: Private Company Discount (PCD) Calculations					
Based on Univariate Analysis					
Mean Public Multiple		11.11	16.13	21.74	1.09
Mean Private Multiple		7.30	9.17	10.87	0.74
Difference as a % of Public Multiple	+	34.3%	43.1%	50.0%	31.9%
Based on Multivariate Analysis					
Mean Public Multiple		11.11	16.13	21.74	1.09
Mean Private Multiple		6.85	9.09	11.11	0.87
Difference as a % of Public Multiple	+	38.3%	43.6%	48.9%	20.4%

Panel A of Table 2 presents the mean and median of valuation multiples for public and private firms as well as the difference between the two means and the two medians. Panel B of Table 2 presents the results of the following four regression models. Table 1 contains a definition of each variable.

$$iEBITDA/EV = \alpha_o + \alpha_1\ Private + \alpha_2\ iSize + \alpha_3\ iSales\ Growth + \varepsilon \quad (3)$$

$$iEBIT/EV = \alpha_o + \alpha_1\ Private + \alpha_2\ iSize + \alpha_3\ iSales\ Growth + \varepsilon \quad (4)$$

$$iE/P = \alpha_o + \alpha_1\ Private + \alpha_2\ iSize + \alpha_3\ iSales\ Growth + \alpha_4\ iLeverage + \varepsilon \quad (5)$$

$$iSales/EV = \alpha_o + \alpha_1\ Private + \alpha_2\ iSize + \alpha_3\ iSales\ Growth + \alpha_4\ iR\&D\% + \alpha_5\ iProfit\ Margin + \varepsilon \quad (6)$$

Panel C of Table 2 shows the Private Company Discount (PCD) calculations based on univariate analysis (Panel A of Table 2) and on multivariate analysis (Panel B of Table 2). ***, **, and * denotes significance at the 1%, 5% and 10% (two-tailed) levels, respectively.

TABLE 3
Analysis of Earnings Management

Panel A of Table 3 compares the mean and median PMDA between public firms and private firms. Panel B of Table 3 presents the result of the following regression model.

$$PMDA = \alpha_o + \alpha_1\ Size + \alpha_2\ Big5\ Auditor + \alpha_3\ Interest + \alpha_4\ Sales\ Growth + \varepsilon, \quad (9)$$

PMDA: is the discretionary accruals derived from performance-matched modified jones model, *Size* is the log of total assets, *Big5 Auditor* equals 1 if the auditor is a Big-5 audit firm and 0 otherwise, *Interest* is interest expense scaled by assets, *Sales Growth* is the percentage change in annual sales. ***, **, and * denotes significance at the 1%, 5% and 10% (two-tailed) levels, respectively.

				Difference	
	Pred. Sign	Public	Private	Pred. Sign	Private – Public
Panel A: Univariate Analysis					
Mean *PMDA*	+	-0.008***	0.036***	+	-0.044***
		(-2.41)	(2.83)		(-4.78)
Median *PMDA*	+	-0.008*	0.014***	+	-0.022***
		(-1.89)*	(2.48)		(-3.31)
Number of Observations		2,225	664		
Panel B: Multivariate Analysis					
Intercept		0.004	0.152***	?	0.148***
		(0.26)	(5.56)		(5.74)
Size	–	-0.006***	-0.032***	–	-0.026***
		(-3.03)	(-3.49)		(-3.96)
Big5 Auditor	–	0.024*	-0.033	–	-0.057**
		(1.84)	(-1.25)		(-2.36)
Interest	–	0.002	-1.444***	–	-1.446***
		(0.01)	(-3.16)		(-4.14)
Sales Growth	?	-0.007	0.018	?	0.025**
		(-1.38)	(1.37)		(2.33)
Adj. R^2		0.004	0.043		
Number of Observations		2,225	664		

TABLE 4
Relation between Earnings Management and Price to Accounting Fundamental Multiples

Panel A of Table 4 presents the result of the following regression model.

$$iEBITDA/EV = \alpha_o + \alpha_1\, iSize + \alpha_2\, iSales\ Growth + \alpha_3\, PMDA + \varepsilon. \quad (10)$$

Panel B of Table 4 presents the result of the following regression model.

$$iEBITDA/EV = \alpha_o + \alpha_1\, iSize + \alpha_2\, iSales\ Growth + \alpha_3\, Big5\ Auditor + \alpha_4\, iLeverage + \varepsilon. \quad (11)$$

Table 1 contains a definition of each variable. All of the variables are industry-median adjusted except *PMDA* and *Big5 Auditor*. ***, **, and * denotes significance at the 1%, 5% and 10% (two-tailed) levels, respectively.

Panel A: Ex post Measures of Earnings Management

	Pred. Sign	Public	Private
Intercept		-0.011***	0.069***
		(-7.96)	(5.78)
iSize	–	-0.002**	0.010***
		(-2.18)	(2.87)
iSales Growth	–	-0.021***	0.008
		(-6.90)	(0.74)
PMDA	+	0.012	-0.006
		(1.14)	(-0.36)
Adj. R^2		0.030	0.011
Number of Observations		1,718	549

Panel B: Ex ante Measures of Earnings Management

	Pred. Sign	Public	Private
Intercept		-0.003	0.088***
		(-0.59)	(5.78)
iSize	–	-0.002**	0.013***
		(-2.13)	(3.41)
iSales Growth	–	-0.022***	0.005
		(-7.23)	(0.53)
Big5 Auditor	–	-0.009	-0.021*
		(-1.62)	(-1.83)
iLeverage	–	0.018**	-0.038
		(2.17)	(-1.28)
Adj. R^2		0.034	0.022
Number of Observations		1765	568

TABLE 5
Fama-MacBeth Pricing Regressions

Models 1-3 use the following regression models.

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, Earnings + \alpha_3 \, Loss \times Earnings + \alpha_4 \, \Delta Sales + \alpha_5 \, R\&D\ Expense + \varepsilon \quad (12)$$

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, Accruals + \alpha_3 \, OCF + \alpha_4 \, Loss \times Accruals + \alpha_5 \, Loss \times OCF + \alpha_6 \, \Delta Sales + \alpha_7 \, R\&D\ Expense + \varepsilon \quad (13)$$

$$Price = \alpha_o + \alpha_1 \, Book\ Value\ Equity + \alpha_2 \, NDA + \alpha_3 \, DA + \alpha_4 \, OCF + \alpha_5 \, Loss \times NDA + \alpha_6 \, Loss \times DA + \alpha_7 \, Loss \times OCF + \alpha_8 \, \Delta Sales + \alpha_9 \, R\&D\ Expense + \varepsilon \quad (14)$$

Price is the sale price of the firm's equity, *Loss* is an indicator variable that equals 1 if income before extraordinary items is less than zero and 0 otherwise, and *R&D Expense* is research & development expense. Table 1 contains a definition of each variable. we scale all variables in equations (12)-(14) by *Price*. We employ weighted least squares in order to estimate the coefficients. ***, **, and * denotes significance at the 1%, 5% and 10% (two-tailed) levels, respectively.

	Pred.	Model 1		Model 2		Model 3	
	Sign	Public	Private	Public	Private	Public	Private
Intercept		0.97	1.38***	0.97	1.49***	0.36	1.68***
		(0.94)	(3.50)	(1.00)	(2.96)	(0.39)	(3.07)
Book Value Equity	+	0.76***	0.68***	0.71***	0.56***	0.76***	0.50***
		(4.85)	(3.26)	(4.83)	(2.81)	(5.57)	(2.74)
Earnings	+	5.16***	1.97***				
		(4.40)	(2.69)				
Accruals	+			4.48***	1.38*		
				(3.56)	(1.70)		
NDA	+					5.11***	1.85*
						(5.35)	(1.62)
DA	+					5.15***	1.89**
						(5.09)	(1.83)
OCF	+			5.49***	2.65***	6.08***	3.10***
				(5.08)	(3.36)	(6.79)	(3.28)
Loss×Earnings	–	-5.15***	-2.07***				
		(-4.36)	(-2.45)				
Loss×Accruals	–			-4.56***	-2.31***		
				(-3.61)	(-2.22)		
Loss×NDA	–					-5.22***	-3.44***
						(-5.36)	(-2.42)
Loss×DA	–					-5.56***	-3.29***
						(-5.63)	(-2.46)
Loss×OCF	–			-4.79***	-2.31***	-5.68***	-3.06**
				(-4.38)	(-2.06)	(-6.24)	(-2.28)
ΔSales	+	0.06	0.35***	0.12***	0.29***	0.10***	0.29***
		(1.16)	(3.00)	(2.10)	(2.30)	(2.28)	(2.45)
R&D Expense	+	1.10***	2.43***	1.65***	2.84***	1.42***	2.68***
		(2.68)	(5.60)	(3.58)	(5.27)	(3.04)	(5.34)
Adj. R^2		0.47	0.37	0.49	0.43	0.51	0.44
Underlying No. of Obs.		2,305	704	2,305	704	2,227	664