Valuation Waves and Merger Activity: The Empirical Evidence[1]

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ABSTRACT

Merger intensity spikes in times of high market valuations (i.e., when average M/B ratios are at their highest). This is especially true for stock-based mergers, supporting recent theories by Rhodes-Kropf and Viswanathan (2002) and Shleifer and Vishny (2003). To explore whether this is the result of correlated valuation errors or behavioral mispricing we decompose M/B into three components: firm-specific deviation from short-run industry valuations; short-run industry deviations from long-run values, and long-run value to book. The fact that high M/B buys lower M/B is driven mostly by firm-specific deviations from short-run industry average pricing. However, both targets and acquires are priced above their long-run industry average. When we find differences between bidders and targets in long-run value-to-book, we find that *low* buys *high*. We also find that the industry-specific component of M/B is highly positively correlated with merger intensity, and correlated with the use of stock. However, long-run value-to-book is uncorrelated with cash merger intensity and negatively correlated with stock merger intensity, leading to little overall correlation between long-run value-to-book and merger activity. One interpretation for these findings is as follows: relatively over-valued firms buy relatively under-valued firms in times when the industries of both firms are over-valued; stock acquisition intensity increases with the over-valuation of the industry, while cash merger intensity does not; and finally, mergers involve cash when high Q buys lower Q but industry over-valuation leads to mergers in which low Q buys high Q. These findings support recent theories but also provide new findings that current theories are unable to explain.

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I. Introduction

An old and widely espoused idea in corporate finance is that firms use stock as an acquisition currency in mergers when they think their stock is overvalued. This idea is rooted in asymmetric information arguments such as Myers and Majluf (1984), and is the basis for a series of papers examining long-run post-acquisition under-performance.[1]

While this view is consistent with a body of empirical work relating method of payment to subsequent under- or over-performance, it is inconsistent with a broader equilibrium that endogenizes the target's response to the offer. To put it simply, why is the target fooled? Why would a value-maximizing target knowingly accept over-valued currency in a takeover offer? Should the target not adjust its expectations of the value of the acquirer's offer downward until the acquirer is indifferent between offering stock or cash?

Two recent theoretical models offer some answers to this question, and thus to the larger question of the role that valuation waves play in merger activity. Rhodes-Kropf and Viswanathan (2002, henceforth RKV) propose a rational theory based on correlated misinformation. In the RKV world, errors in valuing potential takeover synergies are correlated with overall valuation error. Shleifer and Vishny (2003, henceforth SV) propose a theory based on an irrational stock market and self-interested target managers who can cash out quickly. SV answer the questions posed above by assuming that target managers do not maximize long-term shareholder value: they instead maximize their own short-run, private gain.

Motivated by these theories, this paper explores the importance of valuation for merger activity and method of payment. Two basic facts about merger activity give us a point of departure: first, mergers cluster in times when aggregate valuations are high; and second, high market-to-book (M/B) firms buy low M/B firms. The basic result that mergers occur in times of high M/B has been shown elsewhere in the literature (Jovanovic and Rousseau

[1] Loughran and Vijh (1997) argue that method of payment signals valuation. See also Rau and Vermaelen (1998). A number of other papers have examined long-run performance. These include Franks, Harris, and Titman (1991), and Agrawal, Jaffe, and Mandelker (1992); see Agrawal and Jaffe (2000) for a review.

(2002), Dong, Hirshleifer, Richardson, and Teoh (2002), and a number of others), and seems consistent, at least superficially, with the five great merger waves of the last 125 years of US business history (Jovanovic and Rousseau 2001). For example, the merger wave of the latter part of the 19th century that created industrial giants such as GE, DuPont, Standard Oil, and US Steel ended with the stock market crash of 1903-1904. Likewise, the stock market boom of the 1920s coincided with a wave of oligopolistic mergers, which ended with the crash of 1929. The wave of conglomerate acquisitions in the 1950s and 1960s also rose and fell with market valuations, as did the most recent merger wave, as well as the one ending in 1991. Thus, history provides evidence that episodes of high valuations coincide with episodes of high merger activity.

These findings are subject to two opposing interpretations, one based on efficiency and the other based on mis-valuation. The efficiency view is that M/B proxies for Tobin's Q, in which case this result is evidence that assets are being redeployed towards more productive uses (see Servaes (1991) and Lang, Stulz, and Walkling (1989) for market reaction evidence in favor of this view). In contrast, if financial markets value firms incorrectly, M/B will be contaminated by mispricing, confounding attempts to use M/B as a measure of Tobin's Q.[2] Thus, the result can be interpreted as evidence that acquisition frenzies are driven by overvaluation, not favorable asset redeployment. Indeed, the fact that each of the five merger waves described above ended with a precipitous decline in equity prices is suggestive of the over-valuation hypothesis.

Of course, both of these effects could be at work in the data. Our goal is to disentangle these competing explanations. This involves two steps. First, a simple algebraic identity allows us to decompose the market-to-book ratio into two parts:

$$\mathrm{Market-to-Book} \equiv \mathrm{Market-to-Value} \times \mathrm{Value-to-Book}. \tag{1}$$

[2]Throughout the paper we use Tobin's Q and M/B interchangeably. This is an abuse of terminology, since Tobin's Q refers to asset values, while M/B measures equity values. Nevertheless, since we are generally forced to use book values of debt to arrive at the total market value of the firm, and our remarks are about the components of market valuation, we hope that our meaning is clear from the shorthand.

Lee, Myers, and Swaminathan (1999) use similar logic to explore the intrinsic value of the Dow. Armed with an appropriate measure of value, we can assign interpretations to each of the two pieces on the right-hand side of Equation 1. The first piece measures the discrepancy between price and fundamentals, and thus coincides to the difference between actual and 'true value.' Some will naturally refer to this piece as the behavioral or irrational component to market-to-book; others may prefer to think of this difference as owing to asymmetric information between informed insiders and the rest of the market. In either case, the second piece captures fundamental value to book, which is a measure of Tobin's Q that is unadulterated by these concerns.

Since this decomposition is an algebraic tautology, these interpretations rest critically on a particular measure of 'true value.' Thus, our second step is to generate one such measure. Our approach is to perform industry-level, cross-sectional regressions of firm-level market equities on accounting measures each year in order to generate a measure of value based on accounting fundamentals. Average R^2 values indicate that this approach explains between 80% and 94% of intra-industry variation in firm-level market values at a point in time. (This approach is closely related to a large literature in accounting that studies valuation and the value relevance of accounting measures, although our approach differs considerably from prior literature. See Francis and Schipper (1999), Barth, Beaver, and Landsman (2001), Penman (1998), or Collins, Maydew, and Weiss (1997) for examples.) The resulting regression coefficients have natural interpretations as accounting multiples. Unlike standard multiples, however, our conditional regression multiples approach allows us to break down value changes into firm-specific and industry-specific components. Thus, by exploiting the panel structure of our data, we can break M/B into the following components: (1) firm-specific deviations from valuations implied by time-t industry multiples; (2) differences that arise when time-t industry multiples differ from long-run valuation multiples; and (3) long-run value to book.

Using this breakdown of M/B we can reexamine the characteristics of targets and acquirers, as well as the relation between merger activity and fundamental measures of value to book. The conventional wisdom that high M/B buy low M/B firms is only partly correct: we show that, indeed, high M/B buys lower M/B firms, but merger targets have significantly higher M/B than the average COMPUSTAT firm. This result is driven largely by stock transactions. Decomposing M/B, we find that this difference between bidders and targets is driven by firm-specific deviations from short-run average value, not from fundamental differences between targets' and acquirers' 'true' or 'long-run Q.' Targets and acquirers both come from industries that are priced relatively high in the short-run. Furthermore, acquirers tend to be above short-run industry valuations, while targets are below theirs. This finding supports the central prediction of both models: overvalued firms use stock to buy relatively undervalued firms when both firms are in overvalued sectors.

If this effect is truly a function of sector mis-valuation then changes in sector mis-valuation should affect both merger intensity and the method of payment. We use our breakdown of M/B to examine how merger intensity changes over time with changes in the components of M/B. We find a surprising level of support for the predictions from the theories that relate to merger intensity. Increasing the mis-valuation of a sector increases the merger activity in that sector and increases the use of stock.

One of the most striking results comes from comparing M/B to long-run value to book. We show that bidders with *low* long-run value to book acquire *high* long-run value to book targets. Thus, while high M/B bidders acquire lower M/B targets, so much of this is driven by short-run valuation dynamics that the long-run value to book measures contradict the received wisdom about mergers and Tobin's Q. This finding has important implications for questions relating to mergers, corporate governance, and overall economic efficiency.

Our results also indicate that short-run and long-run valuation components determine merger activity. Thus, not only is it the case that firm- and industry-specific valuation errors are high conditional on merger activity, but merger activity is more likely conditional on having high valuation error. Our decompositions of M/B have far more explanatory power than M/B alone. In fact, year fixed effects typically drive away the explanatory power of M/B in simple probit regressions. On the other hand, each piece of our M/B decomposition has a strong effect on merger intensity, even controlling for time fixed effects.

These findings are subject to three interpretations. Under an efficient markets interpretation, merger activity spikes when firm-specific discount rates are low, or equivalently, when expected growth opportunities are high. However, these growth opportunities appear transient, and seem to contradict underlying long-run fundamentals. Under an asymmetric information interpretation, managers time their merger transactions to occur when their stock is at short-term peaks. The fact that targets are also relatively overvalued in the short-run keeps this equilibrium from unravelling. Finally, under an irrational markets interpretation, our results indicate that misvaluation drives merger activity. The joint hypothesis problem prevents us from cleanly distinguishing between these alternatives; the truth is probably somewhere in between.

This paper is related to a number of distinct literatures. It adds to a large empirical literature examining trends in merger and acquisition activity (for recent surveys, see Holmstrom and Kaplan (2001), Andrade, Mitchell, and Stafford (2002).) Our approach to decomposing the market-to-book ratio builds on recent work by Lee, Myers, and Swaminathan (1999). Finally, our technique for calculating the pieces of our decomposition draws heavily on the value relevance literature in accounting (see Barth, Beaver, and Landsman (2001), Penman (1998) for recent examples.)

The remainder of the paper is organized as follows. In section II, we review current theories relating valuation waves to merger waves and determine our testable predictions. In section III, we describe the data. Section IV and V describe the conditional regression multiples approach in detail, and compare it to alternative specifications for value. Sections VI and VII present our findings. Section VIII concludes.

II. Theoretical Background and Testable Implications

Our empirical work is motivated by two recent theoretical papers exploring the relation between mis-valuation and merger activity, Rhodes-Kropf and Viswanathan (2002, RKV) and Shleifer and Vishny (2003, SV). In this section, we review the main features of these theories, explore their empirical implications, and relate them to other explanations for merger waves that have been put forward elsewhere in the literature.

Figure 1 illustrates the empirical motivation for these theories. It shows that valuation waves (periods of high M/B) are correlated with merger waves. This fact alone is consistent with a variety of interpretations—M/B could proxy for mis-valuation or growth opportunities, either of which can be linked to increases in merger activity. The third line on Figure 1 plots the total stock transaction value (in dollar terms) as a ratio of total transaction size, and thus shows that when valuations spike, the incidence of stock as an acquisition currency also spikes. This alerts us to a possible explanation along the lines of Myers and Majluf (1984), in which knowledgeable insiders use over-valued currency when they go on acquisition sprees. SV and RKV attempt to place this intuition into an equilibrium setting.

In RKV, private information on both sides rationally leads to a correlation between stock merger activity and market valuation. In their theory, mis-valuation has a market- or sector-wide component, as well as a firm-specific component. The target's and bidding firm's private information tells them whether they are over- or under-valued, but they cannot separately identify the sources of the misvaluation. A rational target correctly adjusts bids for potential market overvaluation, but as a Bayesian, the target puts some weight on high synergies as well. When the market-wide overvaluation is high, the estimation error associated with the synergy is high too, so the offer is more likely to be accepted. Thus, when the market is overvalued the target is more likely to overestimate the synergies because it underestimates the component of mis-valuation that it shares with the bidders.

In contrast, SV posit inefficient capital markets and differences in managerial time-horizons as the key drivers of merger activity. They hypothesize that short-run managers sell their firm for stock in a long-run manager's firm when both firms are overvalued, even though the transaction price gives the short-run manager less than he knows his firm will be worth in the long run. The short run manager then sells his stock. The market is assumed to be irrational and therefore does not react to this deception/exploitation.

Although the theories of RKV and SV are based on different ideas they yield remarkably similar predictions. Both theories guide our examination of merger intensity as a function of mis-valuation, and encourage us to examine differences between merger and non-merger firms in terms of discrepancies between prices and fundamental values. Therefore, our goal is to use these theories to establish empirically testable hypotheses in order to determine if valuation plays a fundamental roll in mergers.

A. Relative Value Predictions

In both models, overvaluation leads to mergers. Therefore, the central prediction of either theory is:

Prediction 1 *Overvalued firms use stock to buy relatively undervalued firms when both firms are overvalued.*

In SV this occurs because the overvalued short-run managers wish to sell out while their stock is overvalued. Only long-run managers whose companies are more overvalued have room in their stock price to over pay for a target that is also overvalued, and still make money in the long run.

In RKV, if the bidding firm has a large firm-specific overvaluation then it is more likely to win because the target cannot fully distinguish between a large synergy and a large firm-specific error. Furthermore, if the market or sector is overvalued then the target is more likely to overestimate the synergies *even though it can see that its own price is affected by the same overvaluation.* Although the target makes the correct adjustment for potential market or sector overvaluation, as a Bayesian updater, the target puts some weight on high synergies as well. When the market or sector-wide overvaluation is high, the estimation error associated with the synergy is high too, so any offer is more likely to be accepted.

The above logic from both papers also suggests that:

Prediction 2 *On average, firms in overvalued sectors should use stock to buy firms in relatively less overvalued sectors.*

Both theories also suggest that overall merger activity will be higher in overvalued markets. Thus, both predictions above should hold not only for stock mergers, but for other types of mergers as well. Nonetheless, the theories predict that the overvaluation component should be stronger for stock acquirers than for cash acquirers.

The theories differ only slightly in their predictions about cash mergers. SV suggest that firms should only use cash to buy an undervalued firm because there is no role for true synergies in their model. In RKV cash targets should be less overvalued than stock targets, but could still be overvalued if high synergies outweigh the overvaluation. Overall the theories suggest that cash mergers are driven by undervaluation and/or synergies, while stock valuations are driven by overvaluation. Thus, the theories suggest that:

Prediction 3 *Cash targets are more undervalued than stock targets.*

B. Merger Intensity Predictions

The first three predictions relate to levels of relative mis-valuation across types of transactions. In addition, the predictions from theory can be stated in terms of changes in mis-valuation and changes in merger activity. If the theories are correct, then merger activity should be more likely conditional on high valuation errors. Therefore, theory predicts:

Prediction 4 *1) Increasing firm specific mis-valutation increases the probability that a firm is an acquirer. 2) Increasing sector mis-valuation increases merger activity in that sector.*

In both theories the greater a firm's overvaluation the more likely it is to win the bidding for a target. However, RKV also predict that even the probability of being a *target* should increase with *sector* overvaluation. This is because in RKV, targets make mistakes evaluating synergies that are correlated with sector wide mis-valuation. Therefore, in this paper we also test whether or not sector overvaluation increases the number of targets in a sector.

In considering the method of payment both theories predict a correlation between the use of stock and overvaluation:

Prediction 5 *1) Increasing firm-specific mis-valuation increases the probability that a firm is a stock acquirer. 2) Increasing sector mis-valuation increases the total value of stock mergers and the fraction of deals completed with stock in that sector.*

While both theories support prediction 5, RKV's support is tempered by a rational market reaction. In RKV firms that have easy access to cash are not able to use their overvalued stock. As RKV state, "If managers receive a stock offer they perceive as worth accepting from a bidder who has access to cash, they will simply request a similar amount in cash and remove the lemons [problem] (those with overvalued stock)...Therefore, in equilibrium, targets will accept only cash bids from firms that have costless access to cash." Therefore, RKV have an additional prediction:

Prediction 6 *The effect of increased mis-valuation on merger activity should be lower the greater a firm's access to cash.*

RKV does not suggest that access to cash determines whether a firm uses cash—of course this is true. Instead, access to cash should interact with the presence of overvalued stock, decreasing the effect of overvalued stock on the probability of acquiring a target.

Overall, these predictions will allow us to examine the importance of valuation, and the components of valuation, in merger activity. However, it is important to note that there are a number of other prominent explanations for merger waves. For example, Holmstrom and Kaplan (2001) argues that corporate governance issues let to the merger waves of the 80s and 90s. Andrade, Mitchell, and Stafford (2002) and Mitchell and Mulherin (1996) argue that deregulation caused the 90s wave. Gorton, Kahl, and Rosen (2000) suggest that mergers are a defensive mechanism by managers. Jovanovic and Rousseau (2001), (2002) argue that technological changes caused the waves of the 1900, the 1920s, 1980s and 1990s, but not the 1960s. The SV and RKV theories do not suggest that these other factors do not also cause merger waves. Rather, SV and RKV suggest that mis-valuation impacts mergers and merger waves regardless of the underlying motivation for mergers and even if no underlying motivation exists. In the same light, we show empirically that valuation affects mergers, but we do not attempt to show that other ideas do not impact mergers, nor do we attempt to address underlying factors that may drive valuation. However, it is important to note that no other current theory about merger waves generations the set of predictions we test in this paper. For example, the outstanding theories are largely silent on the method of payment. In light of our findings, these theories may need to be expanded. An interesting question would be to examine how technological, regulatory, and governance shocks propagate through the valuation mechanism to affect merger activity. Valuation could potentially exacerbate or mitigate the initial shock; this question is ultimately beyond the scope of this paper.

III. Data and Trends in Merger Activity

Data for this study come from COMPUSTAT, CRSP, and the Securities Data Corporation (SDC) merger and acquisition database. The Compustat data provide fiscal year-end accounting data; the CRSP tapes provide stock returns and market valuations, and the SDC files allow us to identify mergers and acquisitions from 1978 to 2001.

We use the following conventions to merge data from the three sources. First, to calculate M/B, we match fiscal year-end data from Compustat with CRSP market values occurring 3-months afterward. Since firms have different fiscal year end dates, this involves compensating for Compustat's year-of-record scheme, so that the year of the data corresponds to the year in which the accounting information was filed. Then, we associate this CRSP/Compustat observation with an SDC merger announcement if the announcement occurs at least one month after the date of the CRSP market value. If a merger announcement occurs between the fiscal year-end and one month after the CRSP market value, we associate the merger announcement with the previous year's accounting information.

Table I reports the time-series of merger announcements over our sample. While the SDC data span from 1978 to 2001, our data conventions associate the earliest mergers with fiscal year 1977 and the latest with fiscal year 2000. Requiring both firms to be on CRSP/Compustat, we have announcements from 4,325 acquirers corresponding to 4,025 target firms. (The difference owes to withdrawn or failed offers in multi-bidder takeover battles.) As the table shows, in many instances the SDC data do not indicate the method of payment of the transaction: we have 799 mixed payment, 1,218 all stock, and 1,542 all cash transactions.

Using Compustat, we calculate a variety of size, performance, and leverage ratios. Market Value is CRSP market equity plus Compustat book assets (item 6) minus deferred taxes (item 74) minus total liabilities (item 181). In addition, we obtain the following size-related measures: Total Plant, Property, Equipment (item 8), Total Cash (item 1), Long-term Debt (item 9), CAPEX (item 128) and Net Income (item 172). Interest Expense (item 15). Return on assets and equity are calculated by dividing net income in year t by assets (item 6) or book equity (item 60) in year $t-1$. For leverage measures, we obtain the Current Ratio (item 4/item 5), Quick Ratio ((item 4 - item3)/item 5), market leverage (1 - market equity/market value), and book leverage (1 - book equity/total book assets). Finally, the announcement and closing dates of mergers, the method of payment (when available), and a dummy for whether the merger was withdrawn were taken from SDC and merged to the Compustat/CRSP data.

Table II provides a comparison of these summary statistics based on whether an observation is non-merger (i.e., on COMPUSTAT but not on SDC), or a merger observation, and according to whether that merger observation was a bidder or a target. Firms are flagged as merger observations in Table II in the year that a merger event is announced, therefore firms that ultimately are involved in mergers will be grouped in the non-merger category in the years in which they have no merger activity. Along virtually any conceivable size dimension, merger observations are larger than the typical non-merger firm on COMPUSTAT. However, this difference is driven by the fact that acquirers are much larger than average; target firms are about the same size, or a little smaller, than the average COMPUSTAT firm.

Merger and non-merger firms also differ considerably along performance measures. Non-merger firms have statistically higher return on assets, but insignificantly different return on equity than merger firms. We learn more when we compare bidders and targets: acquiring firms have higher-than-average ROA and ROE, whereas targets have below-average values. These differences are highly significant.

The market-to-book ratios for firms involved in mergers are considerably higher than those for non-merger firms. When we compare bidders and targets, we find that M/B is significantly higher for bidders than for targets. However, average M/B ratios for targets are statistically larger than for non-merger firms. Thus, the conventional wisdom that high M/B buys low M/B is somewhat misguided: high M/B firms buy lower M/B firms, but these targets have higher M/B ratios than the average firm. This is a first hint that mergers occur when both firms are overvalued, which is our main relative value prediction.

Finally, the leverage calculations show that merger firms have higher book leverage and lower current ratios than non-merger firms. Thus, they have more debt on their books, and their assets have a longer 'duration.' Interestingly, this is driven by the fact that acquiring firms have much lower quick ratios and current ratios than target firms, and are more highly levered. Taken together, these summary comparisons support conventional wisdom that targets have high cash balances but low returns.

In order to say more about the tendency for mergers to cluster in particular industries at a point in time (á la Andrade, Mitchell, and Stafford (2002) or Mitchell and Mulherin (1996)), we use industry classifications provided by Eugene Fama and Kenneth French.[3] These are described in Table III, which reports verbal industry descriptions along with firm-counts and aggregate valuation and merger statistics. The firm-counts indicate that industry-year level regressions, discussed in section V, do not suffer from small sample problems. At the same time, Table III shows that although certain industries provide active merger markets (computers, finance) while others do not (consumer durables, chemicals), the long-run industry averages in merger activity do not correlate with industry-average multiples.

The summary statistics from this section expand on existing results linking M/B to merger activity: high M/B firms are involved in mergers; the very highest M/B firms buy higher-than-average M/B firms. To build on these findings, we next discuss a technique for decomposing the M/B ratio that allows us to attach separate interpretations to these findings in terms of firm-specific mis-valuation, sector mis-valuation and long-run value-to-book.

IV. Decomposing Market-to-book

This section and the next discuss the two methodological innovations that we use to study how valuation waves affect merger waves. The theories of SV and RKV both suggest that a merger is more likely when a firm's market value, M, is greater than its true value, V. Therefore,

[3]This is available on-line at <`http://mba.tuck.dartmouth.edu/ pages/faculty/ken.french/`>.

both theories implicitly suggest that a firm's market to book ratio should be broken into two components: market value to true value, M/V, and true value to book, V/B. Thus, for any measure of value, we can use the following algebraic identity to decompose the market-to-book ratio:

$$m-b \equiv m-v+v-b \tag{2}$$

where m is market value, b is book value, and v is some measure of fundamental, or 'true' value, all expressed in logarithms.[4] Inserting a measure of value into the market-to-book ratio thus allows us to separate $\log(M/B)$ into two components: a measure of price to fundamentals, $\log(M/V)$, and a measure of fundamentals to book value, $\log(V/B)$.

Assume, for the sake of argument, that a 'perfect' measure of v is available to the empiricist. Then, if markets perfectly anticipate future growth opportunities, discount rates, and cash flows, there would be no scope for pricing error to contaminate M/B, the term $m-v$ would always be equal to zero, and the term $v-b$ would be trivially equal to $\log(M/B)$ at all times.

If, on the other hand, markets potentially make mistakes in estimating discounted future cash flows or, as in RKV, markets do not have all the information known by managers, then price-to-true-value, $m-v$, captures the part of $\log(M/B)$ that is associated with mis-valuation. This may or may not correspond to an asset-pricing sense of mispricing, depending on whether the information in v is known to the market. If the market price does not reflect true value, then $\log(M/V)$ will be positive in times of overvaluation, and negative in times of under-valuation. The remainder, $\log(V/B)$, (with debt added to both V and B) will then be the true measure of Tobin's Q.

The interpretations discussed above hold only for a correct measure of v. We will, of course, only have empirical estimates of v. Clearly, since we will be estimating v, we face the same joint hypothesis problem that others face. Since we will be unable to show that $\log(M/V)$ *is* measuring mis-valuation rather than simply varying risk premia or growth rates,

[4] Throughout our discussion, we will use lower-case letters to denote values expressed in logs, and upper case letters to denote the same values expressed in standard units.

any finding will be open to more than one interpretation. However, as we show below, our approach to estimating true value relies on forward-looking information not available at time t. Thus, we are partially able to circumvent this concern. When we discuss our results, we offer interpretations from both a rational and a behavioral point of view.

A. Firm-Specific and Sector-Specific Mis-Valuation

RKV takes the breakdown of $m_{it} - b_{it}$ further to suggest that one component of $m - v$ is shared by all firms in a given sector or market, while another component of $m - v$ is firm-specific. Thus, in order to test predictions from the RKV model, we need to separate $\log(M/B)$ into three components: (1) the difference between observed price and a valuation measure that reflects time-t fundamentals; (2) the difference between valuation conditional on time-t fundamentals and a valuation that reflects long-run, forward-looking fundamentals; and (3) the difference between valuation based on long-run fundamentals and book value.

As we discuss in the next section, our approach to estimating v conceptually involves using firm-specific accounting information at a point in time, θ_{it}, and a vector of accounting multiples, α to express v as a function of these accounting values. Thus, writing $v(\theta_{it};\alpha)$ as the predicted value based on some vector of multiples α, we can re-write Equation 2 as:

$$m_{it} - b_{it} = \underbrace{m_{it} - v(\theta_{it};\alpha_{jt})}_{firm} + \underbrace{v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\alpha_j)}_{sector} + \underbrace{v(\theta_{it};\alpha_j) - b_{it}}_{long-run} \tag{3}$$

The key difference in the $v(\theta_{it})$ expressions is that time-t multiples are represented as α_{jt} while long-run multiples are represented by α_j. The first term is the difference between market value and fundamental value conditional on time t and sector j valuation effects, $m_{it} - v(\theta_{it};\alpha_{jt})$. Thus, if the market is 'overheated' at time t, this will show up in α_{jt} and therefore in $v(\theta_{it};\alpha_{jt})$. Likewise, if industry j is 'hot' relative to other industries at time t, this too will appear in α_{jt}. This means that the term $m_{it} - v(\theta_{it};\alpha_{jt})$ captures purely firm-specific deviations from fundamental value, since the v term captures all deviations common to an industry at a point in time.

The second component of $\log(M/B)$ is time-t fundamental value to long-run value, $v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\alpha_j)$. The function $v(\theta_{it};\alpha_j)$ captures industry-specific valuation that does not vary over time. In other words, when $v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\alpha_j)$ is high, the industry-specific valuation wave is near its peak. The parameters in α_j in some sense capture the long-run value of a firm in industry j. The final component is the difference between long-run value and book, $v(\theta_{it};\alpha_j) - b_{it}$.

For notational simplicity, we will suppress θ_{it} in the remainder of our analysis and simply write $v(\theta_{it};\alpha_{jt})$ or $v(\theta_{it};\alpha_j)$, where it is understood that these estimated values are obtained by applying either time-t or long-run multiples to firm-specific accounting information. Thus, $v(\theta_{it};\alpha_j)$ will vary over time at the firm level as accounting information changes (i.e., θ_{it} varies over t holding i constant), and will vary across firms within an industry as their accounting data differ (i.e., θ_{it} varies over i at a particular time t).

V. Estimating Market Value

In order to use our decomposition of M/B we must estimate the pieces of the decomposition that relate to time-t fundamental value and true value. Our general approach is similar in spirit to Lee, Myers, and Swaminathan (1999), however our estimations of value differ from theirs. This subsection describes our approach to calculating $v(\theta_{it};\alpha_{jt})$ and $v(\theta_{it};\alpha_j)$. Ideally, a measure of V would proxy for fundamental value by reflecting information that an insider would know, but that an outside market participant would not know.

Our starting point is the definition of firm value, which goes back to Marshall, that relates the market value of the firm to the book value of the assets plus the residual income generated by those assets:

$$v = Bv + \int_t^{\infty} \mathrm{e}^{-\int_t^{\tau} r(\eta)d\eta} \mathbf{RI} d\tau \tag{4}$$

where RI is residual income, defined as the excess of the economic flows arising from the assets over their opportunity cost, and $r(\eta)$ is a potentially time-varying discount rate. By defining residual income as the difference between the return on equity and the cost of capital, both multiplied by the previous period's capital stock, we can write equation 4 in discrete time as

$$\mathbf{MV}_t = \mathbf{BV}_t + \sum_{\tau=t+1}^{\infty} \frac{(ROE_\tau - r_\tau)\mathbf{BV}_{\tau-1}}{(1+r_\tau)^\tau}. \tag{5}$$

Depending on the identifying assumptions imposed, Equation 5 yields to a variety of econometric specifications. The remainder of this section discusses three possible interpretations.

A. Model I: Market Value and Book Value

The strongest identifying assumption one can impose is that perfect competition forces the return on equity equal to its opportunity cost at all points in time, $\mathbf{ROE}_t = r_t \; \forall \, t$. In that case, all the residual returns are NPV = 0 and we are left with

$$\mathbf{MV}_t = \alpha_0 + \alpha_1 \mathbf{BV}_t. \tag{6}$$

where $\alpha_0 = 0$ and $\alpha_1 = 1$. This equation also holds under the slightly less restrictive assumption that all future ROEs are expected to equal the opportunity cost of capital, but the current ROE may differ from the current cost of capital. Under that interpretation, $\alpha_0 \neq 0$ and/or $\alpha_1 \neq 1$. In this case, the α_0 and α_1 parameters will generally be proportional to discount rates (costs of capital) and growth rates.

To account for the possibility that discount rates and growth rates may vary over time and across industries, we estimate equation 6 through the following equation:

$$\textbf{Model I}: \textbf{Market Value}_{\mathbf{t}} = \alpha_{0jt} + \alpha_{1jt}\textbf{Book Value}_{\mathbf{it}} + \varepsilon_{it} \tag{7}$$

This is estimated in logs to account for the right-skewness in the accounting data. To implement Equation 7, we group firms according to the 12 Fama-French industries and perform annual, cross-sectional regressions for each industry in question. Estimating separate equations for each industry-year addresses concerns about time-varying risk premia and expected growth opportunities raised by Ang and Liu (2001) and Feltham and Ohlson (1999), since the α_{1jt} are allowed to vary over time.

The industry classifications used for these regressions are discussed in Table III. To interpret Equation 7, consider an industry average M/B multiple from Table III. Equation 7 breaks this multiple into two pieces. The constant term, α_{0jt}, captures the amount of market value attributed to all firms on average, in a given industry at a point in time, regardless of their book value relative to other firms in their industry. This can be interpreted as the value of intangibles priced into the industry-average firm at a point in time. Since the equation is estimated in logs, α_{0jt} has an equivalent interpretation as the average market value associated with a firm with \$1 MM book equity in industry j, year t. The coefficient on book, α_{1jt}, then measures the multiple associated with incremental book equity.

It is important to note that equation 7 is not an asset-pricing equation—it does not relate expected returns to a particular set of priced risk factors in the economy. Nevertheless, since multiples reflect discount rates and expected growth rates, the α coefficients naturally embody risk characteristics of the average firm in the industry.

In order to generate estimates of $v(\theta_{it};\alpha_{jt})$ and $v(\theta_{it};\alpha_{j})$ we simply use fitted values from Equation 7 above:

$$v(\mathbf{BV}_{it};\hat{\alpha}_{0jt},\hat{\alpha}_{1jt}) = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt}\mathbf{BV}_{it} \tag{8}$$

for each firm. To obtain $v(\theta_{it};\overline{\alpha}_j)$, we simply average over time to obtain $\frac{1}{T}\sum\hat{\alpha}_{jt} = \overline{\alpha}_j$ for each set of parameters $\{\alpha\}$, then calculate

$$v(\mathbf{BV}_{it};\overline{\alpha}_{0j},\overline{\alpha}_{1j}) = \overline{\alpha}_{0j} + \overline{\alpha}_{1j}\mathbf{BV}_{it}. \tag{9}$$

The time-series averages from Model I are presented in the upper panel of Table IV. The variable $\overline{\alpha}_{0j}$ is recorded as $E_t(\hat{\alpha}_0)$, and varies considerably across industries. Moreover, the magnitudes of $E_t(\hat{\alpha}_0)$ are consistent with interpretations as capitalized intangible value, given the industry descriptions. For example, Utilities and Consumer non-durables have the lowest values of $E_t(\hat{\alpha}_0)$, while Telephone & TV, computers, and medicine have the highest values of intangibles according to our estimation scheme. Moreover, the values of $\overline{\alpha}_j$ are generally the highest in the same industries in which the constant terms are the lowest, suggesting that in these industries tangible book assets is most highly correlated with value. Finally, the average R^2 values are high across all industries, even in a simple model of log market value on log book value.

B. Model II: Market Value, Book Value, and Net Income

Examining the value-relevance of various accounting measures via equations similar in spirit to Equation 7 has a long tradition in the accounting literature. That literature is far too large to discuss fully here (Holthausen and Watts (2001), Kothari and Zimmerman (1995), Kothari (2001), and Barth, Beaver, and Landsman (2001) contain excellent surveys of this literature and debates about the conclusions that can be drawn from it). A number of authors (for example Amir and Lev (1996), Lev (1997)) have argued that the value relevance of accounting has declined, in part because of the rise in importance of intangible assets that are not captured in book equity. Collins, Maydew, and Weiss (1997) counter that accounting information continues to be important in the face of intangibles, pointing instead to the increasing importance of net income for explaining cross-sectional variation in market value.

In order to develop a valuation model that includes net income as well as book value, one can impose less restrictive assumptions on Equation 5. For example, by assuming that the firm is in steady state, and book value and net income are growing at constant rates, we can re-write Equation 5 following Penman (1998) as

$$\mathbf{MV}_t = \alpha_0 + \alpha_1 \mathbf{BV}_t + \alpha_2 \mathbf{NI}_t. \tag{10}$$

In order to deal with the fact that net income is sometimes negative, we estimate the following equation:

$$\textbf{Model II}: \quad \mathbf{MV_t} = \alpha_{0jt} + \alpha_{1jt}\mathbf{BV_{it}} + \alpha_{2jt}\mathbf{NI^+_{it}} + \alpha_{3jt} I_{(<0)} \mathbf{NI^+_{it}} + \varepsilon_{it} \tag{11}$$

where $\mathbf{NI}^+$ stands for the absolute value of net income and $I_{<0}$ is an indicator function for negative net income observations. Since this equation is estimated in logs, and net income is often negative, this setup allows for net income to enter into the estimation without discarding all the firms with negative net income at a point in time. By estimating separate sets of parameters $\{\alpha_2\}$ and $\{\alpha_3\}$ for positive and negative net income, we allow negative net income observations to enter into the estimation without contaminating the 'earnings multiple' interpretation of α_2. Thus, if firms in a given industry are penalized for having negative net income in a given year, the α_{3jt} parameter will be negative.

To obtain $v(\theta_{it}; \hat{\alpha}_{jt})$ and $v(\theta_{it}; \hat{\alpha}_j)$ using Equation 11, we perform calculations analogous to Equation 8:

$$v(\mathbf{BV}_{it}, \mathbf{NI}_{it}; \hat{\alpha}_{0j}, \hat{\alpha}_{1j}, \hat{\alpha}_{2j}, \hat{\alpha}_{3j}) = \hat{\alpha}_{0j} + \hat{\alpha}_{1j}\mathbf{BV}_{it} + \hat{\alpha}_{2j}\mathbf{NI}^+_{it} + \hat{\alpha}_{3j} I_{(<0)} \mathbf{NI}^+_{it}. \tag{12}$$

for each firm. To obtain $v(\theta_{it}; \alpha_j)$ under Model II, we simply average over time to obtain $\frac{1}{T}\sum \alpha_{jt} = \overline{\alpha}_j$ for α_k, $k = 0, 1, 2, 3$, then calculate

$$v(\mathbf{BV}_{it}, \mathbf{NI}_{it}; \overline{\alpha}_{0j}, \overline{\alpha}_{1j}, \overline{\alpha}_{2j}, \overline{\alpha}_{3j}) = \overline{\alpha}_{0j} + \overline{\alpha}_{1j}\mathbf{BV}_{it} + \overline{\alpha}_{2j}\mathbf{NI}^+_{it} + \overline{\alpha}_{3j} I_{(<0)} \mathbf{NI}^+_{it}. \tag{13}$$

The second panel of Table IV reports time-series average values of the $\{\alpha_j\}$ for each industry. The cross-industry comparisons match Model I, except that the addition of net income to the model uniformly increases average R^2 values. In addition, the interpretations of the loadings on the income variables make intuitive sense: the loading on net income for positive net income realizations is positive and about the same order of magnitude as the loading on the absolute value of the negative net income observations. The other noteworthy feature of this model is that including net income reduces the loading on book value; presumably this is arising from the time-series properties of net income.

C. Model III: Market Value, Book Value, Net Income and Leverage

Models I and II implicitly impose the restriction that firms be priced against the average multiples for firms in that industry-year. To account for the fact that within-industry differences in leverage could potentially influence this, we estimate a third model in which leverage also appears. Accounting for leverage allows for the fact that firms with higher (lower) than industry-average leverage will have higher (lower) costs of capital, forcing them to differ from industry average multiples. Thus:

$$\textbf{Model III}: \quad \mathbf{MV_t} = \alpha_{0jt} + \alpha_{1jt}\mathbf{BV_{it}} + \alpha_{2jt}\mathbf{NI^{+}_{it}} + \alpha_{3jt}\mathrm{I}_{(<0)}\mathbf{NI^{+}_{it}} + \alpha_{4jt}\mathbf{LEV} + \varepsilon_{it} \tag{14}$$

where LEV is the ratio of the book value of debt to the market value of assets. As in models I and II, this regression is estimated cross-sectionally in each industry-year, allowing the α_k, $k = 0, \ldots, 4$ to vary both over time and across industries. Cross-sectional and time-series variation in the parameters, in particular, captures the fact that some industries may be able to sustain high debt loads, while in other industries the optimal capital structure may be more tilted towards equity.

The third panel of Table IV presents summary statistics for the Model III. Not surprisingly, the loading on leverage is negative and highly significant (Fama-Macbeth standard errors are reported below point estimates). Moreover, the value of intangibles rises when we account for cross-sectional differences in leverage. Finally, the average R^2 values range between 80% and 94%, indicating that accounting information and leverage alone explain the vast majority of cross-sectional variation in market values within a given industry at a point in time.

Looking across the three models reported in Table IV, it is generally easy to reject the null hypothesis that the average $\alpha_0 = 0$. There is less time-series volatility in the loadings on accounting variables for each industry than on the α_0 terms, however, which suggests that while discount rates and growth rates vary a great deal across industries, they are less variable within industries over time.

D. Discussion

The accounting multiples that are summarized in Table IV are used with firm-specific accounting information to yield estimates of $v(\theta_{it};\alpha_{jt})$. Using the time-series averages that are tabulated in Table IV result in the $v(\theta_{it};\alpha_j)$ that are used in our analysis below. Since the accounting multiples are applied to time- and firm-specific accounting information, the resulting values all vary at the firm-year level. However, the different constructions of value place different multiples on these accounting variables. The long-run multiples use information not available at time t to form a value that reflects multiples that *will* hold in a long-run average sense. To summarize, Table V provides an exact interpretation of each of these components based on our decomposition methodology.

Based on these interpretations, we can assign meaning to $m_{it} - v(\theta_{it};\hat{\alpha}_{jt})$, $v(\theta_{it};\hat{\alpha}_{jt}) - v(\theta_{it};\alpha_j)$, and $v(\theta_{it};\alpha_j) - b_{it}$ in the context of our regression framework. The term $m_{it} - v(\theta_{it};\alpha_{jt})$ is simply regression error—this is the deviation between a firm's actual market value and its predicted market value based on an industry average multiple calculated cross-sectionally at time t. Firms with positive $m_{it} - v(\theta_{it};\alpha_{jt})$ are ones with firm-specific growth opportunities that exceed those of their industry, ones with lower firm-specific discount rates than their industry, or ones that are overpriced. RKV and SV predict that mergers should occur between $m_{it} - v(\theta_{it}; \hat{\alpha}_{jt}) > 0$ acquirers and targets with $m_{it} - v(\theta_{it}; \hat{\alpha}_{jt})$ less than the acquirer.

The term $v(\theta_{it}; \hat{\alpha}_{jt}) - v(\theta_{it}; \hat{\alpha}_j)$ represents short-run mis-valuation arising from industry-wide deviations from long-run industry means. This is an inherently backward-looking calculation, since we are using ex-post knowledge about prices to look back and discover when prices were high. There is no way that this information could be incorporated into prices at time t—it was not in investors' information sets at time t, unless we assume a particular form of stationarity in asset prices. Thus, accepting the interpretation that this measure proxies for mis-valuation does not require the reader to believe that assets were mispriced in an asset-pricing sense. It does not rest on the inability of market participants to make full use of available information. This measure could proxy for knowledge held by the management that was unknown to the market at the time. Thus, this form of 'mis-valuation' could be a part of a completely rational model, as it is in RKV. Of course, this measure could proxy for any form of irrational mispricing as well. The large amount of time-series variation in the α parameters, as evidenced by the large Fama-Macbeth standard errors reported in the appendix, ensures that there is plenty of variation over time in $v(\theta_{it}; \hat{\alpha}_{jt}) - v(\theta_{it}; \hat{\alpha}_j)$.

Finally, $v(\theta_{it}; \hat{\alpha}_j) - b_{it}$ represents a long-run measure of Tobin's Q when the value of debt is added to $v(\theta_{it}; \hat{\alpha}_j)$ and b_{it}, since it reflects the ratio of time t accounting information valued at long-run multiples to book value. This measure will vary over time and across firms within an industry, since it involves some combination of time t accounting information, minus time t book value.

VI. Testing Relative Value Predictions

In this section we make use of the decomposition provided in Sections IV and V to explore how the individual components of M/B vary between targets and bidders, and by method of payment. This allows us to test the relative value predictions, which are briefly restated here for convenience:

- Firms involved in merger activity are more overvalued than non-merger firms.
- Bidders are more overvalued than targets.
- Cash targets are undervalued, while stock targets are over-valued.

The first row of Table VI reports differences in $m_{it} - b_{it}$ ratios by target, acquirer, and method of payment. From this we see that it is not the case that high M/B buys low M/B, but rather high M/B targets are bought by even higher M/B acquirers. Interestingly, this finding is driven by the characteristics of targets in stock transactions. In this group, both bidder and target have significantly higher M/B ratios than in other method of payment categories. When we examine cash-only or mixed payment transactions, we find no difference in M/B between target firms and non-merger firms.[5]

The remainder of Table VI reports the results of using the fitted values from Models I, II and III to break market to book into its three components: $m_{it} - v(\theta_{it};\widehat{\alpha}_{jt})$ firm specific deviations from industry pricing, $v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$ industry valuation to long run valuation, and $v(\theta_{it};\overline{\alpha}_j) - b_{it}$ long run valuation to book. Since the table is in logs, the three components of M/B for each model add to the M/B ratio reported in the top row. Table VI reports values for all mergers (4,025 mergers), but also breaks the sample into cash transactions (1,899 mergers), stock transactions (1,436 mergers) and mixed transactions (968 mergers). (SDC does not report the method of payment for many mergers.) Within each group, Table VI reports whether the difference between the target and the acquirer is significant.

Looking across models, we can compare how they attribute total M/B to its various components. For example, merger targets in cash acquisitions have an $m_{it} - b_{it}$ of 0.61. Model I, using just book values attributes 0.59 of this to $v(\theta_{it};\overline{\alpha}_j) - b_{it}$, 0.13 of this to $v(\theta_{it};\hat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$, and the remaining -0.11 to $m_{it} - v(\theta_{it};\hat{\alpha}_{jt})$. By comparison, Models II and III

[5]t-statistics for the differences are not reported but are significant and insignificant corresponding to the discussion.

attribute 0.58 and 0.62 to $v(\theta_{it};\overline{\alpha}_j) - b_{it}$, a slightly smaller 0.12 and 0.06 to $v(\theta_{it};\hat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$, and a slightly larger -0.09 and -0.08 to $m_{it} - v(\theta_{it};\hat{\alpha}_{jt})$. Overall the breakdown of M/B across the three models is remarkably consistent. Since the results are robust to different models, in what follows we will discuss the results only for Model III.

Table VI allows us to test the first three predictions from the theory. The first prediction says that overvalued firms buy relatively undervalued firms,

$$\underbrace{m_{it} - v(\theta_{it};\widehat{\alpha}_{jt})}_{target} < \underbrace{m_{it} - v(\theta_{it};\widehat{\alpha}_{jt})}_{acquirer}$$

but both firms must be overvalued,

$$\underbrace{m_{it} - v(\theta_{it};\widehat{\alpha}_{jt}) + v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)}_{target\ or\ acquirer} > \underbrace{m_{it} - v(\theta_{it};\widehat{\alpha}_{jt}) + v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)}_{\text{non-merger}}.$$

This result should hold for the entire sample and particularly for the stock acquisitions. Furthermore, stock acquirers should be more overvalued than the firms in cash mergers. We find support in the data for each of these predictions. Focusing on Model III, we see that acquirers are more overvalued than targets for the whole sample (0.32 for acquirers, but only 0.03 for targets) and for the stock mergers (0.44 for acquirers, but only 0.05 for targets). We also find both components for overvaluation are greater for firms involved in mergers than those not in mergers (0.18 firm-specific error in model III is greater than the -0.01 for non-merger firms, and the sector-specific 0.10 for merger-firms exceeds the 0.03 for non-merger firms).

In addition, stock acquirers are more overvalued than cash acquirers. From Model III, the stock acquirer firm-specific deviation is 0.44, while the cash acquirer firm-specific error is only 0.29, and sector-specific error of 0.17 for stock acquirers exceeds the 0.14 for cash acquirers. Although the theory does not discuss mixed payment acquisitions, by extension it would seem that all stock acquirers should be more overvalued than mixed payment acquirers, which is supported by the data (0.44 (stock) versus 0.29 (mixed) for firm-specific, and 0.17 (stock) versus 0.12 (mixed) for sector-specific). All reported inequalities are statistically significant.

The second prediction is that acquirers should come from sectors that are more overvalued than targets. Thus, $v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$ for acquirers should be greater than $v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$ for targets. This effect holds for each of the three models, and across each type of method of payment. For example, in model III we see that the sector-specific error for mixed payment acquirers is 0.12, while it is only 0.08 for mixed payment targets. For stock transactions, acquirers have an average sector-specific deviation of 0.17, while targets have an average of only 0.12. This relationship also holds for cash transactions.

The last prediction that can be tested with Table VI is that cash targets are more undervalued than stock targets. This also holds for all models. For example, in model III we see that the firm-specific deviation for stock targets (0.05) is larger than that of cash targets (-0.08). The same is true of sector-specific misvaluation for stock and cash targets (0.12 sector specific for stock targets is greater than the 0.06 sector-specific misvaluation for cash targets).

Thus, based on Table VI, we find strong support for the central predictions of the theory. In general, we find that acquirers with high short-term, firm-specific excess valuation components purchase targets with lower relative short-term, firm-specific excess valuation components, and that this occurs when both targets and bidders market-to-book ratios are high due to short-term, industry-specific excess valuation components.

In addition, Table VI contains new findings not predicted by the theory. One of the most striking results of Table VI comes from comparing M/B to long-run value to book. The table shows that *low* long-run value to book buys *high* long run value to book. While high M/B bidders acquire lower M/B targets, so much of this is driven by short-run valuation dynamics that the long-run value to book measures contradict the received wisdom about mergers and Tobin's q. This has important implications for questions relating to mergers, corporate governance, and economic efficiency—it partly suggests that firms with low growth prospects use acquisitions as a way of buying growth. This is a finding that currently theories are not well equipped to handle.

To summarize, Table VI shows that merger firms are more over-valued than non-merger firms, that bidders are more over-valued than targets, and that method of payment determines whether a target is over- or under-valued. In cash acquisitions, targets are under-valued on average. In stock acquisitions, targets are over-valued. These latter findings support the idea that correlated misvaluation leads overvalued targets to accept takeover bids from overvalued bidders precisely because they over-estimate the expected synergies.

A. Robustness Checks and Extensions

Table VI contains striking evidence in support of the idea that temporary firm-specific and industry-specific fluctuations in value drive acquisition activity. However, a number of potential alternative explanations could be clouding the results in Table VI. Tables VII and VIII provide robustness checks and further extensions to our primary relative value predictions.

One concern with the preceding analysis is that the results are being driven by the late 1990s, when (1) valuations were high, and (2) our long-run value calculations are the most backward-looking. To see why late-1990s mergers might be a problem for our analysis, consider a typical merger occurring in 1999. During this period, valuations were at all-time highs. Thus, $m_{it} - b_{it}$ is likely to be large, and α_{jt} values are likely to be above their long-term values, which towards the end of the sample are mostly backward looking (an $\overline{\alpha}$ contains only two years of forward-looking data in 1999). Moreover, since this period was a time of intense merger activity, such mergers may make up a disproportionate fraction of our sample.

To control for this possibility, Table VII repeats Table VI except that only mergers occurring prior to 1996 are included. Thus, while $\overline{\alpha}$ is calculated using data out to 2001, the latest merger is in 1996, meaning that every merger in Table VII has at least five years of forward-looking data built into $\overline{\alpha}$. The results are virtually unchanged. The main difference is that the long-run value to book measures are uniformly higher in Table VII than in VI for Models I and II. (That this does not hold for Model III is evidence that leverage was valued differently in the late 1990s.) This shows that our results are not being solely driven by events in the late 1990s, when our long-run multiples are the most backward-looking.[6]

Table VIII provides additional robustness checks by showing that our results hold across all transaction size. This table reports our breakdown of $m_{it} - b_{it}$ according to transaction quintiles. Q1 are the smallest transactions; these deals involve small targets and are most often straight cash deals. As we move rightward in the table, towards Q5, deal size and the size of the target increases. In addition, the relative fraction of straight cash deals drops.

As transaction size increases, a number of distinct effects appear. Among the quintile of largest transactions (Q5), it is no longer the case that the $m_{it} - b_{it}$ of the acquirer is statistically larger than that of the target. However, in spite of the fact that the M/B values are roughly equal, it is still the case that the misvaluation differences between acquirers and targets are large and statistically significant. Moreover, it is still the case that low long-run value to book firms acquire higher long-run value to book firms.

Another striking feature of Table VIII is the pronounced change in the target's firm-specific misvaluation as we move from Q1 to Q5. For the smallest transactions (groups Q1 and Q2), target firm-specific misvaluation is negative and very large. Moving towards Q5, the firm-specific misvaluation of the target increases, growing positive between Q3 and Q4. The long-run value-to-book measures move in the opposite direction.[7]

[6] To guard against the possibility that isolated industries are influencing our decompositions, we summarized the breakdown of $m_{it} - b_{it}$ into $m_{it} - v(\theta_{it};\alpha_{jt})$, $v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\overline{\alpha})$, and $v(\theta_{it};\overline{\alpha}) - b_{it}$ industry-by-industry. Performing the means tests industry-by-industry also has the feature that since the sample sizes are much smaller, the t-statistics will not be overstated by assumptions about independence. None of t-statistics become insignificant.

[7] This table raises the possible concern that our valuation model is failing to price large firms well. In unreported robustness tests, we have repeated Table VI for models that include squared and cubic terms for book value to capture non-linearities in size. All of our results go through under these non-linear valuation models as well. In addition, the correlation between book value and firm-specific error is zero, which indicates that our regressions are well-specified and that large firms are not systematically mispriced.

Finally, this table reports a row that adds together the sector-specific and long-run values into a single number. This is presented in order to guard against the possible criticism that we our long-run value measure is inappropriate, since it uses forward-looking data. Even if we attribute all sector-specific valuation to long-run value, we still find that low value-to-book firms acquire high value-to-book firms.

In summary, this table shows that our decomposition results are not being driven by extreme transactions. The results hold across all transaction sizes. In addition, the table removes the possibility that the decomposition results follow mechanically from differences in $m_{it} - b_{it}$ across targets and bidders. The results hold when differences in $m_{it} - b_{it}$ are large or small.

VII. Overvaluation and Takeover Intensity

The previous section studied valuation conditional on merger activity. In this section we regress our measures of merger activity on measures of overvaluation. This allows us to test predictions 4-6, which deal with the intensity of merger activity conditional on misvaluation.

A. Firm-Level Intensity Regressions

Table IX presents tests of the probability that a firm is involved in a merger as a function of its valuation characteristics. Column (1) shows that firms are more likely to be in mergers when their $m_{it} - b_{it}$ value is high, corroborating widely cited evidence linking valuation levels to merger intensity. However, column (2) shows the effect of introducing year fixed effects into this regression: the loading on $m_{it} - b_{it}$ diminishes, indicating that mostly the $m_{it} - b_{it}$ variable is picking up time trends in overall valuation levels.

Columns (3)-(8) repeat the analysis of columns (1) and (2) but replace $m_{it} - b_{it}$ with our decomposition. In each model, we see that firm-specific and sector-specific has a positive and statistically significant effect on the probability that a firm is involved in a merger, while long-run value to book has a negative, significant effect. Introducing year fixed effects drives away the significance of the industry effect, but neither the firm-specific valuation error or the long-run value to book is affected. These findings hold across each of the three models.

These findings show that firm-level misvaluation increases the probability that a firm is involved in a merger. Now we turn to testing an additional prediction that comes out of the RKV framework. In the RKV theory, firms that have easy access to cash are not able to use their overvalued stock. Therefore, RKV predict that the effect of increased sector misvaluation on merger activity is lower the greater the sectors access to cash (prediction 6).[8]

Table X tests this prediction. This table reports results from probit regressions of the probability of that a merger is financed with 100% stock on $m_{it} - b_{it}$, our decomposition variables, variables that proxy for access to cash, and interaction terms. In Column (1) we see that the stock dummy loads positively and significantly on $m_{it} - b_{it}$. Column (2) replaces $m_{it} - b_{it}$ with our decomposition based on model I, from which we see that increasing each of the pieces of the breakdown raises the probability that a firm is involved in a stock, as opposed to cash merger. This is unsurprising, as it largely echoes the results from previous tables. However, more interesting are the cash availability variables and interaction terms. To measure a firm's access to cash, we use the amount of cash on the firm's balance sheet, as well as the ratio of fixed to total assets. Our measures of cash availability demonstrate that firms are less likely to finance transactions with stock when cash is easier to obtain.

When we interact these terms with firm-level value deviation, we see that access to cash lowers the sensitivity of stock intensity to misvaluation. This is support for prediction 6. These interaction effects hold across all three models.

[8] RKV does not suggest that access to cash determines whether a firm uses cash—of course this is true. Instead, access to cash should interact with the presence of overvalued stock, decreasing the effect of overvalued stock on the probability of acquiring a target.

B. Industry Intensity Regressions

Total merger intensity is measured in two ways. First, we take the number of transactions in an industry during the year and divide it by the number of firms in the industry (# Deals). Second we take the total dollar value of merger transaction in an industry and divide it by the total market capitalization of the industry (Total $ Value). We also construct similar measures of cash and stock intensity. We take the total dollar value paid in cash (or stock) in all transactions, over the dollar value of all transactions. We call this measure the cash or stock fraction ($ Frac). We also take the total dollar value paid in cash or stock over the market capitalization of the industry. This is a measure of the value paid in particular currency (Cash or Stock $ Value).

With these six dependent variables we run OLS regressions with industry fixed effects and either industry average $m_{it} - b_{it}$ at a point in time on the right hand side or our measure of industry average misvaluation, $v(\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$, and average $v(\theta_{it};\overline{\alpha}_j) - b_{it}$ at a point in time. Table XI reports the results and allows us to test predictions 4 and 5. These predictions suggest that increasing sector misvaluation increases merger activity particularly stock merger activity. We find that a higher average M/B is only correlated with an increase in the number of deals. Thus, by itself average M/B does not tell us anything about the total value of deals or the use of stock or cash. However, if we examine average $v(\theta_{it};\widehat{\alpha}_{jt}) - v(\theta_{it};\overline{\alpha}_j)$ and average $v(\theta_{it};\overline{\alpha}_j) - b_{it}$ we see that average $v(\theta_{it};\overline{\alpha}_j) - b_{it}$ almost always insignificant and negative when significant. However, average mis-valuation increases with both measures of total deal intensity and both measures of stock intensity for all three models. The evidence suggests that dollar-weighted stock merger intensity spikes in times of high overvaluation, whereas dollar-weighted cash merger intensity does not (or increases to a much less extent). Thus, we find strong support for the prediction that increasing overvaluation causes increased stock merger activity, although we, of course, have not shown the causality predicted by the theory.

VIII. Summary and Conclusions

The fact that M/B is correlated with merger intensity suggests that valuation levels play an important role in the decision to participate in a merger. This fact does not, however, suggest that misvaluation drives merger activity. In order to make statements about the relation between <u>mis</u>valuation and merger activity, one must address the fact that M/B contains information about growth rates, discount rates, as well as valuation errors.

This paper uses the recent theoretical models of Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2002) to explore the link between merger intensity, valuation waves, and ultimately under- and over-valuation in financial markets. We use an innovation that allows us to break M/B into differences between a firm's price, M, to the value of the firm if it were priced like other firms in the industry, $v(\theta_{it};\alpha_{jt})$, and this current industry price to the value of the firm if it were priced like the long-run average firm in the industry, $v(\theta_{it};\alpha_j)$.

To summarize our main findings, our breakdown of M/B finds the following:

- Acquirers with high firm-specific valuation error use stock to buy targets with relatively lower firm-specific error when both firms benefit from positive sector-specific valuation error.
- Cash targets are undervalued relative to stock targets.
- Merger intensity is highly positively correlated with short-run deviations in valuation from long-run trends, especially when stock is used as the method of payment.
- Access to cash dampens the sensitivity of merger intensity to firm-specific valuation error.

In addition, after controlling for firm-specific deviations from time-t industry average valuations, and time-t industry deviations from long-run values, we find our most startling result: firms with low 'true value-to-book' actually buy high 'true value-to-book' targets. Therefore, while it is generally true that higher M/B firms acquire targets with lower M/B, so much of this is driven by short-run deviations in fundamentals, both at the firm and sector level, that the results for fundamental value go in the opposite direction. In fact, the component of M/B attributable to fundamental value-to-book either has no effect or is negatively correlated with the intensity of merger activity over time.

These findings are subject to three distinct interpretations. The first is an efficient markets interpretation. Under this view, our results indicate that merger activity spikes when firm-specific discount rates are low, or equivalently, when expected growth opportunities are high. However, these growth opportunities appear transient. Moreover, the short-run changes in growth rates and/or discount rates seem to mask underlying long-run fundamentals that go in the opposite direction. In a long-run sense, firms with high discount rates or low growth opportunities acquire targets that have the opposite characteristics.

The second interpretation is based on efficient markets but introduces the possibility of asymmetric information between insiders and markets. Under an asymmetric information interpretation, managers time their merger transactions to occur when their stock is at short-term peaks. Targets are also relatively overvalued in the short-run, which keeps the merger phenomenon from unravelling as an equilibrium.

Finally, under an irrational markets interpretation, our results indicate that misvaluation drives merger activity. Under this view, wily managers outsmart inefficient markets by purchasing firms with overvalued stock. The data are consistent with each of these interpretations, but the joint hypothesis problem prevents us from distinguishing between them.

In spite of the fact that it is not possible to distinguish between these explanations, a number of directions for future research emerge from our empirical findings. Given the descriptive power of each of these theories behind our empirical tests, a fruitful next step is to test the theories formally. Since the predictions of the two theories overlap, formally testing probably requires testing the assumptions that underlie each model. Our tests of the interaction between access to cash and the sensitivity of merger intensity to misvaluation are a partial step in this direction, but future tests should probably focus on the behavior of insider trading around merger announcements, on the behavior of serial acquirers, or other empirical phenomena that speak directly to the assumptions of each model.

Regardless of which interpretation for our findings is correct, the fact that *low* long-run value firms buy *high* long-run value targets is a puzzle for most theories of merger activity. What causes this finding? One possibility is that managers who face high short-run valuations acquire targets with high long-run value in order to substantiate the market's beliefs. Another is that value-maximizing, but low-skilled managers of low valued firms acquire managerial talent from outside, and try to adapt their organization to the newly acquired talent. Yet another possibility is that low-value managers acquire higher value targets as a way of further entrenching themselves. Sorting through these possibilities is a task for future theoretical and empirical research.

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Figure 1. The Timeseries of Valuation and Merger Intensity

Merger intensity is calculated at the market-wide level by averaging the merger intensity for each of the 12 FF industries described in Table III. Industry-level merger intensity is the total number of firms involved in mergers, divided by the total number of firms in the industry. Average market/book is the market-wide equally weighted industry average market/book ratio.

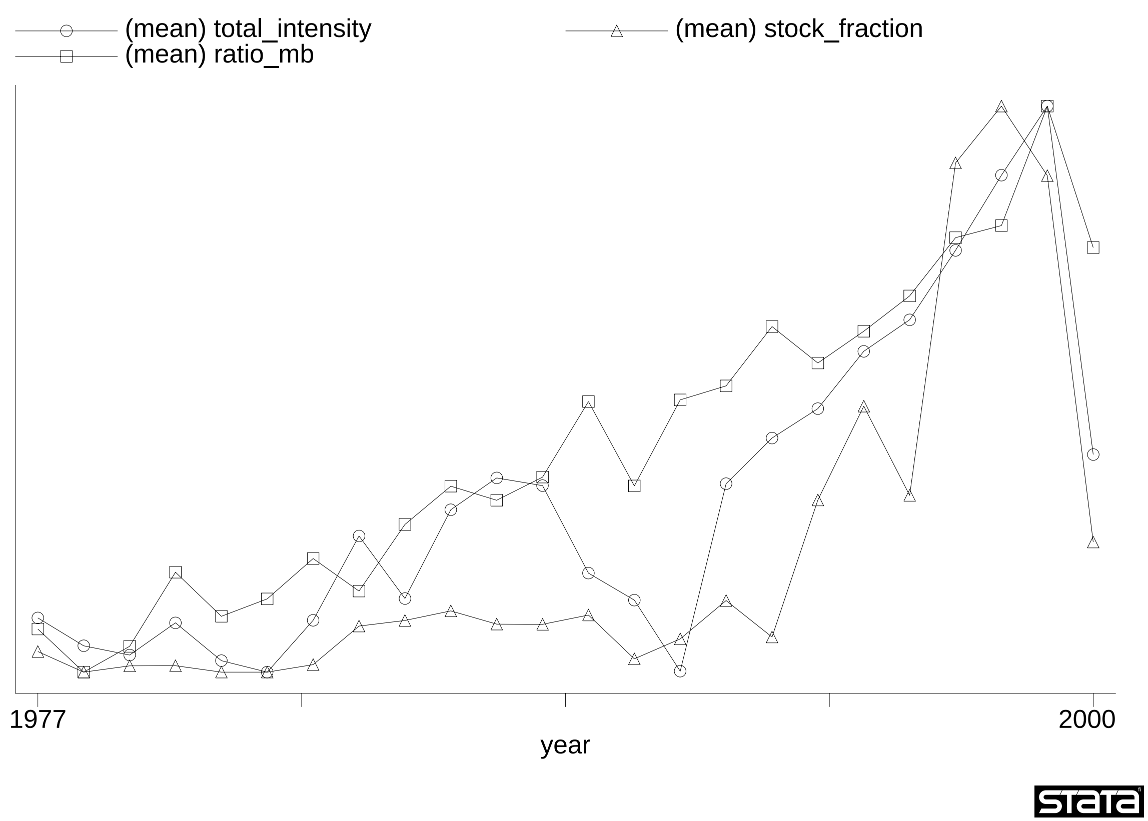

Table I
Characteristics of Merger Sample

Mergers come from SDC merger database and are required to have Acquirer and Target information on CRSP and Compustat. (Withdrawn deals are included.) Mean Size is the average transaction value in millions of US dollars as reported by SDC. All stock and all cash refer to transactions that are known to be paid in 100% stock or cash, respectively. Mixed payment transactions include combinations of stock, cash, and derivative securities. Transactions of unknown type are omitted from the method of payment columns.

Year	Acquirer	Targets	All Stock	All Cash	Mixed	Mean Size
1977	11	9	4	7	0	434.7
1978	11	11	1	4	0	88.3
1979	18	21	0	3	0	310.2
1980	61	44	1	4	0	856.5
1981	63	55	0	0	0	270.6
1982	95	94	2	9	1	307.8
1983	104	109	7	34	4	251.6
1984	113	110	17	55	16	406.2
1985	144	145	14	81	15	300.1
1986	164	168	25	95	25	273.7
1987	141	135	20	70	18	175.0
1988	141	123	28	66	15	362.6
1989	101	103	19	49	13	274.4
1990	108	90	31	32	16	233.8
1991	99	83	24	43	16	227.9
1992	170	147	51	69	27	460.4
1993	255	219	96	98	34	259.5
1994	315	284	100	124	58	568.8
1995	367	342	141	116	78	716.7
1996	413	411	157	116	103	713.4
1997	426	409	154	127	104	1840.1
1998	451	410	160	160	104	1420.9
1999	395	363	124	137	95	1665.7
2000	159	140	42	43	57	993.9
Total	4,325	4,025	1218	1542	799	839.4

Table II
Characteristics of Merger and Non-Merger Firms

Summary statistics for size, performance and leverage taken from Compustat between 1977 and 2000 to match the availability of the SDC data. 'Merger' observations are firms appearing on the SDC as either a bidder or target in the period 1977-2001. Observations are required to have book-to-market ratios below 100 and market equity larger than $10MM. Market Value of assets is market value of equity (CRSP Price * Shares Outstanding) + book assets (d6) - book debt (d60) - deferred taxes (d74). Quick ratio is (d4-d3)/d5. Current ratio is d4/d5. Leverage is debt to total assets: market leverage is 1 - mkt. equity/mkt. value; book leverage is 1 - bk. equity/bk. value. The column t(diff) reports the t-statistic for the hypothesis H(0): Non-merger - Merger = 0, or Target - Acquirer = 0, correcting for unequal variance across groups.

Variable	Non-Merger	Merger	t(diff)	Target	Acquirer	t(diff)
Sample Size:	102,527	10,670		5,335	5,335	
Size Measures:						
Mkt. Value (Assets)	2700.32	10743.50	-17.62	2425.89	18486.55	-18.66
Book Assets	2352.61	6936.98	-14.95	2017.70	11516.44	-16.44
Mkt. Equity	889.40	5421.84	-16.15	789.94	9733.78	-16.79
Book Equity	487.24	1467.56	-19.13	338.49	2518.64	-22.85
PP&E	515.42	1121.06	-12.52	319.76	1869.88	-17.06
Debt, LT	377.09	976.55	-12.65	308.85	1596.73	-14.53
Cap. Ex.	93.97	271.89	-13.02	66.67	466.12	-15.37
Net Income	53.72	223.37	-17.17	32.09	401.63	-19.90
Performance Measures:						
ROA	0.01	0.01	-0.57	-0.02	0.04	-7.83
ROE	0.01	0.09	-1.01	0.03	0.15	-6.71
Market/Book	3.24	3.58	-4.88	3.26	3.87	-4.58
Leverage Measures:						
Leverage (Book)	0.54	0.58	-14.09	0.56	0.59	-7.00
Leverage (Mkt.)	0.43	0.44	-3.16	0.44	0.44	0.08
Quick Ratio	2.46	2.21	5.25	2.42	2.00	5.43
Current Ratio	3.15	2.76	7.97	3.01	2.52	6.17

Table III
Industry Characteristics

This table describes industry classifications used in the subsequent valuation models. Definitions are taken from Fama and French. Observations describes the min, mean, and max number of observations per year in each industry. All averages are equally weighted. Merger activity is measured by the number of firms involved in mergers in a given industry.

	Observations per year			Average Multiples		Average	Merger Activity:		
Industry	mean	min	max	p/e	m/b	Market Equity	Total	Cash	Stock
(1) Consumer Non-durables	406	336	495	19.37	2.43	792.1	713	289	141
(2) Consumer Durables	180	142	227	15.99	2.45	1033.4	337	151	52
(3) Manufacturing	796	639	904	16.51	2.44	445.4	1295	510	272
(4) Energy	323	205	477	23.52	3.83	1454.4	520	134	126
(5) Chemicals	144	115	174	16.85	5.79	1211.7	321	145	65
(6) Computers, Software, etc.	1,037	388	1,811	19.05	5.48	780	1850	684	701
(7) Telephone & TV	165	66	333	31.53	6.96	3948.8	541	181	125
(8) Utilities	191	103	222	12.74	1.5	987.4	251	51	79
(9) Wholesale	687	532	883	22.47	2.81	430.1	905	333	227
(10) Medical	489	133	838	17.57	8.29	1205.4	992	364	367
(11) Finance	630	298	897	16.9	6.42	812.5	1905	596	661
(12) Everything Else	914	521	1,268	17.43	3.9	552.7	1349	472	351

Table IV
Conditional Regression Multiples

This table illustrates the conditional regression multiples approach. Fama-French twelve industry classifications are reported across the top. Output from valuation regressions are reported in each row. Each model is estimated cross-sectionally at the industry-year level: The subscripts j and t denote industry and year, respectively. The variable $E_t(\hat{\alpha}_0)$ is the time-series average of the constant term for each regression. Likewise, $E_t(\hat{\alpha}_i)$ is the time-series average multiple from the regression associated with the k^{th} accounting variable. Fama-Macbeth time-series standard errors are printed below average point estimates. Finally, the time-series average R^2 is reported for each industry. Regressions are run annually for each industry from 1977 to 2000. This regression uses natural logs of market (MV) and book value (BV), natural log of the absolute value of net income (NI), and an indicator interacted with log net income (NI^+) to separately estimate net income for firms with negative net income (in model 2), and leverage (Lev).

	1	2	3	4	5	6	7	8	9	10	11	12
	Model I: $\ln(\text{MV})_{ijt} = \alpha_{0jt} + \alpha_{1jt}\ln(\text{BV})_{ijt} + \varepsilon_i$											
$E_t(\hat{\alpha}_0)$	0.98	1.65	1.19	1.46	1.47	1.70	2.06	0.66	1.13	1.97	1.16	1.70
	0.06	0.11	0.06	0.08	0.09	0.07	0.12	0.10	0.07	0.05	0.07	0.05
$E_t(\hat{\alpha}_1)$	0.87	0.71	0.81	0.79	0.83	0.77	0.74	0.92	0.85	0.77	0.80	0.72
	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
R^2	0.68	0.65	0.74	0.80	0.77	0.68	0.76	0.88	0.72	0.73	0.75	0.65
	Model II: $\ln(\text{MV})_{ijt} = \alpha_{0jt} + \alpha_{1jt}\ln(\text{BV})_{ijt} + \alpha_{2jt}\ln(\text{NI})_{ijt} + \alpha_{3jt}(\ln(\text{NI})^+)_{ijt} + \varepsilon_i$											
$E_t(\hat{\alpha}_0)$	1.86	2.39	1.79	1.87	2.26	2.24	2.31	1.21	1.87	2.29	1.83	2.17
	0.06	0.13	0.05	0.08	0.06	0.07	0.07	0.09	0.06	0.06	0.05	0.05
$E_t(\hat{\alpha}_1)$	0.47	0.35	0.51	0.62	0.39	0.49	0.55	0.66	0.50	0.54	0.49	0.48
	0.02	0.03	0.02	0.02	0.03	0.03	0.03	0.04	0.02	0.02	0.02	0.01
$E_t(\hat{\alpha}_2)$	0.38	0.38	0.33	0.18	0.46	0.33	0.21	0.27	0.37	0.28	0.32	0.26
	0.02	0.02	0.02	0.02	0.04	0.02	0.05	0.04	0.02	0.02	0.01	0.01
$E_t(\hat{\alpha}_3)$	-0.35	-0.35	-0.22	-0.15	-0.23	-0.22	0.18	-0.03	-0.25	0.02	-0.14	-0.18
	0.04	0.10	0.04	0.04	0.07	0.04	0.06	0.04	0.05	0.05	0.06	0.05
R^2	0.73	0.71	0.78	0.82	0.82	0.73	0.79	0.89	0.77	0.77	0.79	0.68
	Model III: $\ln(\text{MV})_{ijt} = \alpha_{0jt} + \alpha_{1jt}\ln(\text{BV})_{ijt} + \alpha_{2jt}\ln(\text{NI})_{ijt} + \alpha_{3jt}(\ln(\text{NI})^+)_{ijt} + \alpha_{4jt}\text{Lev}_{ijt} + \varepsilon_i$											
$E_t(\hat{\alpha}_0)$	2.39	2.56	2.20	2.35	2.38	2.55	2.91	2.15	2.44	2.68	2.21	2.60
	0.04	0.11	0.05	0.06	0.11	0.05	0.10	0.13	0.05	0.04	0.04	0.05
$E_t(\hat{\alpha}_1)$	0.64	0.56	0.64	0.66	0.64	0.59	0.60	0.85	0.62	0.61	0.58	0.60
	0.01	0.02	0.01	0.02	0.05	0.02	0.03	0.03	0.01	0.02	0.01	0.01
$E_t(\hat{\alpha}_2)$	0.27	0.30	0.27	0.23	0.31	0.29	0.26	0.12	0.28	0.26	0.30	0.25
	0.01	0.02	0.01	0.02	0.04	0.01	0.04	0.03	0.01	0.01	0.01	0.01
$E_t(\hat{\alpha}_3)$	0.08	0.05	0.10	0.00	0.13	-0.03	0.27	0.17	0.01	-0.09	-0.16	0.00
	0.03	0.06	0.03	0.04	0.06	0.04	0.05	0.04	0.04	0.05	0.05	0.04
$E_t(\hat{\alpha}_4)$	-2.59	-2.36	-2.09	-2.13	-2.43	-2.55	-2.27	-2.52	-2.11	-2.42	-1.06	-2.15
	0.05	0.09	0.07	0.15	0.19	0.11	0.18	0.23	0.06	0.10	0.05	0.09
R^2	0.84	0.80	0.86	0.88	0.90	0.83	0.87	0.94	0.86	0.85	0.82	0.80

Table V
Defining the Components of the Decomposed Market-to-Book Ratio

This table is a guide to the analysis presented in the following tables. It describes the components of the M/B decomposition. In table VI, the variables below correspond to firm-level variables. In the merger intensity regression tables (Table XI), the same notation refers to annual industry average values, since the unit of observation is an intensity of merger activity in an industry-year.

$m_{it} - b_{it}$	log market-to-book ratio for firm i in industry j at time t. In Table XI, this notation refers to industry average market-to-book in year t.
$v(\theta_{it};\alpha_{jt})$	The fundamental value of the firm fitted from annual industry average regression multiples applied to firm-level accounting values. The individual time t values of the αs from Table IV are used to obtain this number. Using model II, for instance, we would have $v = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt}\mathbf{ln}(\mathbf{BV})_{ijt}$.
$v(\theta_{it};\alpha_j)$	The fundamental value of the firm fitted from long-run industry average multiples applied to firm-level accounting values. The long-run average values of α_j from Table IV are used to obtain this number. Using model II, for instance, we would have $v = \overline{\alpha}_{0j} + \overline{\alpha}_{1j}\mathbf{ln}(\mathbf{BV})_{ijt}$.
$m_{it} - v(\theta_{it};\alpha_{jt})$	The component of $m_{it} - b_{it}$ that is due to firm-specific deviations from valuations implied by industry valuation multiples calculated at time t.
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\alpha_j)$	The component of $m_{it} - b_{it}$ that is due to the deviation of ratio of valuations implied by current industry multiples to those implied by long-run multiples. In table VI, this notation refers to firm-level observations calculated by applying industry multiples to firm-specific accounting information
$\overline{v}(\alpha_{jt}) - \overline{v}(\alpha_j)$	In Table XI this notation refers to industry-average values of these variables.
$v(\theta_{it};\alpha_j) - b_{it}$	The component of $m_{it} - b_{it}$ that is due to the ratio of valuations implied by long-run multiples to current book values. In table VI, this notation refers to firm-level observations calculated by applying industry multiples to firm-specific accounting information
$\overline{v}(\alpha_{jt}) - \overline{v}(\alpha_j)$	In Table XI this notation refers to industry-average values of these variables.

Table VI
Decomposing Market-to-Book at the Firm-Level

The data comprise 102,527 non-merger firm-level observations between 1977-2000 plus 8,350 firm-level merger observations, corresponding to 4,025 merger events occurring between bidders and targets listed on CRSP, Compustat, and SDC. The column 't(diff)' reports the t-statistic for the test H(0): Non-Merger - Merger = 0, or H(0): Target - Acquirer = 0. The data include 1,899 known all-cash transactions, 968 known mixed-payment transactions, and 1,436 known all-stock transactions.
Each model regresses log market equity on accounting information in annual, cross-sectional, industry-level regressions described in table IV. Model I corresponds to $ln(ME_{it}) = \alpha_{it} + \beta_{1it} BE_{it}$; model II adds net income; model III adds leverage. The variable v is the fitted value from each model; V is the fitted value formed by averaging the coefficients for each industry over time.

	Non-	Mergers					All Cash			Mixed			All Stock		
	Merger	All	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)
$m_{it} - b_{it}$	0.59	0.76	-15.81	0.69	0.83	-6.95	0.61	0.79	-5.13	0.61	0.77	-3.29	0.87	1.12	-6.97
Model I:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.02	0.26	-26.81	0.01	0.50	-25.12	-0.11	0.49	-18.34	0.04	0.46	-9.20	0.11	0.64	-16.60
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.07	0.15	-27.70	0.13	0.18	-8.08	0.13	0.19	-6.10	0.14	0.17	-2.54	0.18	0.26	-7.09
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.54	0.34	33.64	0.54	0.16	37.91	0.59	0.11	29.61	0.43	0.14	12.95	0.58	0.23	18.97
Model II:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.01	0.22	-24.48	0.02	0.41	-22.00	-0.09	0.38	-15.45	0.04	0.39	-8.27	0.11	0.57	-15.65
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.06	0.15	-26.19	0.12	0.18	-9.11	0.12	0.19	-7.16	0.14	0.17	-2.65	0.17	0.25	-6.90
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.54	0.39	22.69	0.55	0.25	24.77	0.58	0.22	17.53	0.43	0.20	8.00	0.60	0.30	13.30
Model III:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.01	0.18	-25.21	0.03	0.32	-20.21	-0.08	0.29	-15.01	0.17	0.29	-3.46	0.05	0.44	-16.09
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.03	0.10	-24.20	0.07	0.12	-8.73	0.06	0.14	-8.40	0.08	0.12	-3.97	0.12	0.17	-5.21
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.57	0.48	10.69	0.58	0.39	12.52	0.62	0.37	9.97	0.36	0.36	0.20	0.71	0.51	6.94

Table VII
Pre-1996 Firm-Level Market-to-Book Decompositions

This table replicates the findings of table VI, except that the sample spans 1977-1996 to avoid any possible right-truncation problems associated with our long-run value measures.

	Non-	Mergers					All Cash			Mixed			All Stock		
	Merger	All	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)	Tar.	Acq.	t(diff)
$m_{it} - b_{it}$	0.57	0.67	-8.81	0.60	0.73	-5.87	0.55	0.70	-3.82	0.57	0.74	-2.94	0.77	0.96	-4.81
Model I:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.01	0.21	-19.64	-0.03	0.43	-23.01	-0.13	0.44	-16.17	-0.03	0.37	-7.47	0.06	0.53	-14.38
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.02	0.08	-20.39	0.08	0.09	-1.98	0.08	0.10	-1.51	0.12	0.14	-0.91	0.11	0.15	-3.84
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.56	0.38	26.01	0.56	0.21	28.63	0.60	0.16	22.71	0.48	0.23	8.31	0.61	0.28	14.40
Model II:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.01	0.18	-18.10	-0.02	0.36	-20.07	-0.09	0.34	-13.11	-0.03	0.34	-7.20	0.06	0.48	-13.80
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.01	0.07	-18.61	0.06	0.08	-2.96	0.07	0.10	-2.54	0.13	0.13	-0.03	0.10	0.15	-4.10
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.56	0.42	18.38	0.56	0.29	18.24	0.57	0.26	12.68	0.46	0.27	5.19	0.61	0.33	10.46
Model III:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.01	0.16	-19.91	0.02	0.29	-17.30	-0.06	0.27	-12.18	0.14	0.26	-2.83	0.02	0.38	-13.62
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$	0.00	0.04	-15.57	0.04	0.05	-2.26	0.04	0.06	-3.09	0.07	0.07	-0.09	0.06	0.08	-2.59
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$	0.57	0.47	10.84	0.55	0.39	8.43	0.58	0.37	7.07	0.35	0.40	-1.15	0.69	0.49	5.58

Table VIII
Transaction Size and the Components of Market-to-Book

This table presents the same market-to-book decomposition results according to transaction size. Q1 is the quintile of smallest transactions; Q5 is the largest transactions. Approximately 800 firms of each type (acquirers, targets) are in each quintile. T-statistics assume unequal variances across groups.

	Q1			Q2			Q3			Q4			Q5		
Variable	Tar.	Acq.	t	Tar.	Acq.	t	Tar.	Acq.	t	Tar.	Acq.	t	Tar.	Acq.	t
$m_{it} - b_{it}$	0.69	0.86	-2.85	0.55	0.75	-4.19	0.54	0.82	-6.40	0.68	0.94	-6.11	0.92	0.93	-0.15
Model I:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.23	0.34	-10.72	-0.32	0.31	-15.24	-0.19	0.45	-16.99	0.07	0.65	-15.64	0.51	0.80	-6.46
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\overline{\alpha}_j)$	0.10	0.14	-2.47	0.09	0.14	-3.83	0.11	0.18	-5.24	0.14	0.20	-4.73	0.20	0.25	-3.30
$v(\theta_{it};\overline{\alpha}_j) - b_{it}$	0.82	0.39	15.81	0.78	0.30	22.00	0.62	0.19	22.14	0.47	0.09	20.11	0.21	-0.12	16.73
$v(\theta_{it};\alpha_{jt}) - b_{it}$	0.92	0.52	12.39	0.87	0.44	17.25	0.73	0.37	15.61	0.61	0.30	13.69	0.41	0.14	11.45
Model II:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.19	0.26	-9.22	-0.26	0.25	-13.81	-0.16	0.39	-16.28	0.09	0.55	-13.27	0.45	0.67	-5.17
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\overline{\alpha}_j)$	0.07	0.13	-3.30	0.08	0.14	-4.44	0.10	0.18	-5.60	0.14	0.20	-4.58	0.20	0.25	-3.55
$v(\theta_{it};\overline{\alpha}_j) - b_{it}$	0.81	0.47	9.30	0.73	0.36	12.89	0.61	0.26	13.72	0.46	0.19	11.40	0.27	0.01	10.81
$v(\theta_{it};\alpha_{jt}) - b_{it}$	0.88	0.60	7.18	0.81	0.50	10.18	0.71	0.44	9.81	0.59	0.39	7.72	0.47	0.26	7.47
Model III:															
$m_{it} - v(\theta_{it};\alpha_{jt})$	-0.18	0.19	-8.87	-0.18	0.20	-12.22	-0.09	0.31	-13.77	0.08	0.44	-12.65	0.37	0.48	-3.63
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\overline{\alpha}_j)$	0.02	0.09	-4.89	0.04	0.09	-3.68	0.06	0.12	-5.21	0.09	0.14	-4.59	0.14	0.19	-4.12
$v(\theta_{it};\overline{\alpha}_j) - b_{it}$	0.85	0.59	5.63	0.69	0.47	6.10	0.58	0.39	5.52	0.51	0.36	4.88	0.42	0.26	5.20
$v(\theta_{it};\alpha_{jt}) - b_{it}$	0.87	0.67	4.00	0.73	0.55	4.72	0.64	0.51	3.46	0.60	0.50	2.84	0.56	0.45	3.02

Table IX

Firm-Level Merger Intensity Regressions

The dependent variable is a dummy for whether the observation in question coincides with a merger. Probit regressions are estimated.

			Model I		Model II		Model III	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$m_{it} - b_{it}$	0.088	-0.034						
	(15.95)**	(1.19)						
$m_{it} - v(\theta_{it};\alpha_{jt})$			0.153	0.119	0.162	0.151	0.209	0.206
			(23.63)**	(3.26)**	(22.86)**	(3.74)**	(24.13)**	(4.02)**
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$			0.671	0.075	0.537	-0.011	0.722	-0.233
			(30.95)**	(0.72)	(27.36)**	(0.12)	(28.38)**	(1.90)
$v(\theta_{it};\bar{\alpha}_j) - b_{it}$			-0.392	-0.462	-0.174	-0.317	-0.083	-0.125
			(31.90)**	(7.32)**	(17.63)**	(5.63)**	(10.59)**	(3.28)**
Constant	-1.495	-1.504	-1.335	-1.285	-1.413	-1.361	-1.446	-1.486
	(220.01)**	(30.31)**	(161.52)**	(21.10)**	(181.77)**	(22.36)**	(202.16)**	(28.03)**
Observations	110877	110877	110877	110877	110603	110603	110603	110603
Fixed Effects?		Year		Year		Year		Year

Table X
Firm-Level Stock Intensity Regressions

The dependent variable is a dummy for whether a deal is 100% stock financed. Only merger observations are included. Probit regressions are estimated with year fixed effects.

		Model I		Model II		Model III	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$m_{it} - b_{it}$	0.179						
	(10.11)**						
$m_{it} - v(\theta_{it};\alpha_{jt})$		0.141	0.217	0.151	0.276	0.116	0.217
		(7.94)**	(7.92)**	(7.98)**	(9.73)**	(5.02)**	(7.25)**
$v(\theta_{it};\alpha_{jt}) - v(\theta_{it};\bar{\alpha}_j)$		0.404	0.339	0.374	0.328	0.373	0.407
		(6.52)**	(5.35)**	(6.81)**	(5.68)**	(5.70)**	(5.75)**
$v - b_{it}$		0.331	0.273	0.225	0.199	0.219	0.248
		(10.44)**	(7.90)**	(8.35)**	(6.93)**	(9.92)**	(9.91)**
Cash			-0.000		-0.000		-0.000
			(0.72)		(1.18)		(0.91)
Fixed/Total Assets			-1.053		-1.033		-1.041
			(14.05)**		(13.80)**		(13.87)**
$m_{it} - v(\theta_{it};\alpha_{jt})\times$ Cash			-0.000		-0.000		-0.000
			(2.15)*		(2.63)**		(2.35)*
$m_{it} - v(\theta_{it};\alpha_{jt})\times$ Fixed/Total			-0.283		-0.416		-0.345
			(3.36)**		(5.31)**		(4.80)**
Constant	-0.754	-0.730	-0.452	-0.692	-0.431	-0.676	-0.449
	(16.57)**	(27.54)**	(12.90)**	(27.27)**	(12.38)**	(28.66)**	(13.13)**
Observations	8350	8350	8124	8334	8109	8334	8109

Table XI
Valuation, Merger Intensity, and Method of Payment

These OLS regressions include fixed effects for the 12 Fama-French Industries. Under Total Intensity, the dependent variable in the '# Deals' column is the number of transactions in industry j, year t over the number of firms in the industry. In the '$ Value' column the dependent variable is the total dollar value of merger transactions involving firms in industry j year t over the total market capitalization of the industry. In the cash and stock intensity columns, '$ Frac' denotes dollar value of cash (respectively, stock) transactions over total dollar value of transactions, while '$ Value' denotes dollar value paid in cash (respectively, stock) over total market capitalization of the industry. The first column in each category regresses the dependent variable on industry average $m_{it} - b_{it}$. The second column in each category reports three sets of independent regressions, each corresponding to a model of the breakdown in industry average $m_{it} - b_{it}$ into industry-specific average deviation $(\overline{v}(\alpha_{jt}) - \overline{v}(\overline{\alpha_j}))$ and long-run $(\overline{v}(\overline{\alpha_j}) - b_{it})$ components. The Total Intensity columns contain 300 observations, the Cash and Stock # Intensity 275, and the Cash and Stock $ Intensity contain 246 observations.

	Total Intensity				Cash Intensity				Stock Intensity			
	# Deals		$ Value		$ Frac		$ Value		$ Frac		$ Value	
$m_{it} - b_{it}$	0.057		0.010		11.720		0.577		13.340		0.900	
	(7.13)		(1.38)		(1.86)		(1.31)		(2.14)		(2.13)	
R^2	0.15		0.01		0.01		0.01		0.02		0.02	
Model I:												
$\overline{v}(\alpha_{jt}) - \overline{v}(\overline{\alpha_j})$		0.091		0.035		17.364		1.510		33.316		2.710
		(9.19)		(3.77)		(2.19)		(2.69)		(4.40)		(5.25)
$\overline{v}(\overline{\alpha_j}) - b_{it}$		-0.004		-0.034		3.161		-1.042		-20.553		-2.351
		(0.31)		(2.87)		(0.32)		(1.46)		(2.19)		(3.57)
R^2		0.23		0.07		0.02		0.03		0.09		0.12
Model II:												
$\overline{v}(\alpha_{jt}) - \overline{v}(\overline{\alpha_j})$		0.085		0.031		17.519		1.479		30.554		2.349
		(8.79)		(3.46)		(2.29)		(2.74)		(4.15)		(4.66)
$\overline{v}(\overline{\alpha_j}) - b_{it}$		0.007		-0.027		3.232		-0.968		-15.818		-1.752
		(0.58)		(2.42)		(0.35)		(1.43)		(1.77)		(2.76)
R^2		0.21		0.06		0.02		0.03		0.08		0.10
Model III:												
$\overline{v}(\alpha_{jt}) - \overline{v}(\overline{\alpha_j})$		0.104		0.047		31.735		1.999		39.872		3.674
		(6.58)		(3.18)		(2.57)		(2.28)		(3.28)		(4.44)
$\overline{v}(\overline{\alpha_j}) - b_{it}$		0.028		-0.012		0.851		-0.275		-2.247		-0.823
		(2.43)		(1.17)		(0.10)		(0.44)		(0.26)		(1.39)
R^2		0.18		0.03		0.03		0.02		0.04		0.06