Selling to Buy: Asset Sales and Merger Waves

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This version: December 14, 2016

ABSTRACT

This study provides evidence that merger waves occur as part of asset restructuring, in which asset sale proceeds are associated with increased acquisition probability. Economically, asset sale waves increase the probability of merger waves by 14.80%. Our results are consistent with the notion that asset sales enhance firm- and/or industry-specific capital liquidity, and that cash proceeds from asset sales can be used as a funding source for acquisitions. They are also in line with the "modified" neoclassical theory which suggests an increase in capital liquidity is associated with higher likelihood of merger waves. Finally, we show that firms conducting acquisitions after sales of unrelated assets are more likely to experience improvement in long-run operating efficiency, and are more likely to use cash to finance the deal.

JEL Classification: G14; G32; G34

Keywords: Mergers and acquisitions; Asset sales; Restructuring; Merger and asset sale waves; Operating efficiency; Method of payment

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1. Introduction

Mergers and acquisitions (M&A) tend to occur in waves with periods of peak merger activity comprising substantially more acquisition transactions than during other periods.[1] The two prominent theories explaining merger waves are the neoclassical theory, which suggests merger waves occur as a result of industry shocks, such as economic, technological, or regulatory shocks;[2] and alternatively, the behavioral theory, which posits that merger waves coincide with high stock market valuations.[3] Harford (2005) provides support of a "modified" model of the neoclassical theory in which increases in industry capital liquidity, in conjunction with industry shocks, lead to a higher likelihood of industry merger waves. However, the source of capital liquidity that drives merger waves still remains an open question.

In this study, based on Harford's (2005) findings, we revisit the sources of the drivers of M&A waves by looking into the importance of asset sales as a source of capital liquidity. At the firm-level, asset sales can provide individual firms with substantial *firm-specific* capital liquidity, relative to firms that do not sell assets, which could facilitate corporate restructuring via acquisitions.[4] In fact, the importance of asset sales as a means of corporate restructuring has been highlighted by existing research on divestitures showing that asset sale proceeds can become a

[1] For example, the peak of the 5th merger wave (i.e., 1999-2000) involved 82,743 acquisitions, while the trough leading up to this wave (i.e., 1990-1991) included only 36,004 acquisitions (Source: Thomson Financial SDC).

[2] Gort (1969), Mitchell and Mulherin (1996), Harford (2005), Ovtchinnikov (2010), and Garfinkel and Hankins (2011) provide support for the neoclassical model. Goel and Thakor (2010) show that envy among CEOs, in conjunction with neoclassical shocks, can lead to merger waves.

[3] Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004) find evidence in support of the behavioral model and show that merger waves and high stock market valuations are closely correlated. Harford (2005) points out that the relation between high stock market valuations and merger waves, as suggested by the behavioral theory, is driven by the higher capital liquidity along with economic shocks to the industry.

[4] Indeed, anecdotal evidence suggests that firms sell assets with the intent to pursue M&A deals. For instance in 2011, Boston Scientific sold its stroke-treating neurovascular business for $1.5 billion with the intent of using a large part of the after-tax proceeds for acquisitions. Following the completion of the deal, Boston Scientific acquired three firms using $490 million of cash proceeds derived from the asset sale (Source: The Wall Street Journal, "Stryker to Buy Boston Scientific Unit", October 28, 2010, and Thomson Financial SDC).

significant source of allocable capital for firms, with proceeds frequently used to fund corporate investments.[5, 6] Additionally, Mulherin and Boone (2000) and Brauer and Wiersema (2012) establish the existence of significant clustering of asset sales by industry (i.e., industry asset sale waves). As asset sales lead to increases in firm-level capital liquidity, industry asset sale waves can similarly increase industry-level capital liquidity. Therefore, starting with the premise that asset sales increase firm-specific capital liquidity, the main objective of this study is to empirically examine the effect of industry asset sale waves, with the resulting increase in industry capital liquidity, on the likelihood of industry merger waves.

Prior research on the use of proceeds from asset sales as a potential source of funds in M&As is, at best, sparse. For example, Lang, Poulsen, and Stulz (1995) hint that many firms "[…] seem to sell assets while engaged in a program of acquisitions so that the asset sales provide cash for these programs […]", and Kaplan and Weisbach (1992) and John and Ofek (1995) provide brief descriptive statistics showing that some firms raise cash through asset sales to fund acquisitions. We focus on the effects of asset sale proceeds on M&A investments for three main reasons.

First, given the fact that M&As represent perhaps the most economically important corporate investment in the life of a firm,[7] it is rather surprising that the extant literature on funding sources

[5] Bates (2005) argues that asset sales increase firms' liquidity, and that cash proceeds from a sale can be reallocated to the unfunded projects of the divesting firm. In this respect, Hovakimian and Titman (2006) and Borisova and Brown (2013) provide empirical evidence that asset sale proceeds are used to fund capital expenditures and R&D investments, respectively, particularly for firms which are financially constrained. Arnold, Hackbarth, and Puhan (2015) also show that asset sales are often used as a funding source for corporate investment but find evidence that they are sensitive to business cycles.

[6] An alternative argument to asset sales increasing firm-specific capital liquidity, with the proceeds being used to fund acquisitions, is that firms could also be selling assets in anticipation of making acquisitions, because they know that antitrust rules would require them to divest certain assets before a deal can be closed. Antitrust authorities routinely make asset sales a requirement to clearing mergers. Importantly, this argument is toward the notion that asset sales most likely precede acquisitions, thereby attenuating concerns about reverse causality (i.e., for antitrust reasons, firms will sell assets before conducting acquisitions, but it is unlikely the reverse to occur for antitrust reasons).

[7] Over the period between 1990 and 2014, the U.S. takeover market has faced 396,056 deals worth almost $80 trillion (Source: Thomson Financial SDC).

for M&As is silent on the use of proceeds from asset sales, focusing only on operating cash flows, cash holdings, debt, and equity (see, e.g., Jensen, 1986; Amihud, Lev, and Travlos, 1990; Harford, 1999; Schlingemann, 2004; Martynova and Renneboog, 2009).[8] Second, M&As following asset sales represent *pure* asset restructuring events, which are not confounded by capital structure effects associated with proceeds being used for retiring corporate debt, or with payout policy implications related with distribution of cash to shareholders (i.e., dividends or stock repurchases). Third, this type of selling-to-buy asset restructuring (i.e., asset sales followed by acquisitions) can have a significant effect on firm operating efficiency; in fact, any firm that sells an asset, which is not related to its core operations, and uses the proceeds to buy an asset that improves operating efficiency, experiences a *double benefit effect*: the first benefit coming from disposing of an unwanted, inefficient operation,[9] and the second stemming from buying an asset which can further improve the operating efficiency of the firm.

Therefore, recognizing that i) asset sales increase firm-specific liquidity and that cash proceeds from an asset sale can be reallocated to the unfunded projects of the divesting firm (Bates, 2005); and ii) given that asset sales cluster in industry waves (Mulherin and Boone, 2000), resulting in increased industry capital liquidity, we hypothesize that *industry asset sale waves are positively associated with the subsequent occurrence of industry merger waves*. Furthermore, John and Ofek (1995) identify the benefits to a firm resulting from focus increasing asset sales, showing that these types of divestitures lead to an improvement in the operating performance of the seller's

[8] In prior literature, the term 'method of payment' is usually considered as synonymous to the 'sources of takeover funds' (see, e.g., Travlos, 1987; Faccio and Masulis, 2005). Nevertheless, Schlingemann (2004) and Martynova and Renneboog (2009) have reconciled the two concepts, providing evidence that the source of funds (in addition to the method of payment) plays an important role in acquisitions.

[9] Daley, Mehrotra, and Sivakumar (1997) show evidence that focusing through asset sales improves operating performance and makes the firm's remaining segments more efficient.

remaining assets.[10] Adding to this understanding, we predict that *acquisitions following focus increasing asset sales should lead to improved operating efficiency resulting from the double benefit effect*. Additionally, Clayton and Reisel (2013) show that payments from asset sales are almost entirely made in cash, with 81% of asset sales involving 100% cash transactions, thus implying that *asset sales will lead firms to use cash method of payment in the acquisitions that follow*.

To identify industry merger waves, we use a broad sample of US acquisitions over the period from 1990 to 2014, which includes the 5th, 6th, and the emerging 7th merger waves. Since the same transaction classified as a divestiture by one firm could actually represent an acquisition for another firm, we ensure that any deals in our M&A sample that are also found in our asset sale sample are eliminated to avoid them being counted as both an asset sale and an acquisition transaction. Interestingly, we initially uncover that industry characteristics differ across time, suggesting that merger waves can develop because of various underlying characteristics, including key economic shock variables.

Most importantly, we find strong empirical support for our hypotheses. As a first step, we provide evidence of a positive relation between an individual firm's asset sales and the probability of the asset seller making a subsequent takeover bid. Further, our main finding shows that asset sale activity does indeed occur in industry waves, which drive industry merger waves. Economically, industry asset sale waves are associated with a 14.80% increase in the probability of an industry merger wave in the following year.

Additionally, we report evidence of the double benefit effect from this type of firm restructuring, showing a 1.77% increase in the three-year operating performance for firms that sell

[10] Schlingemann, Stulz, and Walkling (2002) also find that firms often prefer to dispose of assets or operations which are not related to the firm's core industry.

an unrelated asset and use the proceeds for a subsequent acquisition, relative to those that do not make an acquisition. This result is driven by focus increasing acquisitions. Further, we identify a significantly positive relation between asset sales and the choice of cash as the method of payment in acquisitions. We find that firms that finance acquisitions through asset sales are approximately 25.06% more likely to use cash as the method of payment in M&A deals.

Our results hold with alternative measures of asset sales and irrespective of the time period in question. In addition, they are robust after controlling for potential endogeneity bias arising either from reverse causality or from the choice of asset sales being correlated with potentially omitted variables.[11] We also provide an exhaustive set of additional checks to confirm the robustness of our main findings.

This study makes several important contributions to the source of funds, asset sale, M&A, merger and asset sale waves, restructuring, and method of payment literature. First, it provides empirical evidence that proceeds from asset sales are likely to be used as a funding source in the most important corporate investment that a firm can undertake, i.e., M&As. Second, it documents that industry asset sale waves are important sources of capital liquidity which drive industry merger waves. Third, it contributes to our understanding of the operating efficiency derived beyond asset sale restructuring solely, i.e., from the joint restructuring transactions of both selling and buying assets. Fourth, it adds to the literature on the determinants of method of payment in M&As, offering an economically important omitted variable and particularly underlining the relation between asset sales and the use of cash as a means of payment in acquisitions. Fifth, it provides the first empirical evidence of the emergence of the 7th merger wave. Sixth, it highlights

[11] Our results remain strong over the period from 2001 to 2014, in which our descriptive statistics show that no asset sale waves are preceded by merger waves, further enhancing the view that our results are not affected by reverse causality bias.

that the sources of capital liquidity, as identified by the prior literature as the main driver of merger waves, are not persistent over time, contrary to asset sale waves, the main variable of this study.

Our study is related to the work on merger wave determinants by Gort (1969), Mitchell and Mulherin (1996), Harford (2005), and Garfinkel and Hankins (2011), who support the neoclassical theory. The first three studies find that merger waves are caused by industry shocks, with Harford (2005) also providing evidence that capital liquidity is an important catalyst in conjunction with industry shocks. Garfinkel and Hankins (2011) examine the effect of risk management on merger waves and show that increases in cash flow uncertainty encourage firms to vertically integrate resulting in merger waves. We provide evidence in support of the findings of the above studies and show that asset sales are related with merger waves.

Additionally, our analysis is in line with the work of Mulherin and Boone (2000) and Brauer and Wiersema (2012), who find evidence of asset sale clustering and waves. We also identify asset sale waves in our sample period and show that they are positively associated with the subsequent occurrence of merger waves.

Further, our study is related to the work on the uses of asset sale proceeds by Bates (2005), Hovakimian and Titman (2006), and Borisova and Brown (2013). Bates (2005) identifies distributions to debt or equity holders, retention of proceeds by management, and financing of capital expenditure as potential uses of asset sales. Hovakimian and Titman (2006) and Borisova and Brown (2013) also show that asset sale proceeds are deployed to finance capital expenditure investments and R&D, respectively, especially for financially constrained firms. We provide evidence that financing acquisitions is another use of asset sale proceeds.

Moreover, our work is related with studies which provide associations between increases in firms' cash liquidity and acquisition bids, such as Jensen (1986) with free cash flows, Blanchard,

Lopez-de-Silanes, and Shleifer (1994) with cash windfalls, and Harford (1999) with cash holdings. Particularly, our study shows that proceeds from asset sales, which increase firms' liquidity, lead to a higher probability of takeover bids.

In addition, we expand the work on asset restructuring and firm focus by John and Ofek (1995) and Daley et al. (1997), who study the performance of firms with asset sales (without also examining acquisitions), by illustrating an additional advantage to simply selling unrelated assets, as identified by the double benefit effect of disposing of unrelated assets and using the proceeds to acquire a firm that would improve operating efficiency.

Finally, we extend the work on determinants of the choice of payment method in acquisitions by Amihud et al. (1990), Faccio and Masulis (2005), Harford, Klasa, and Walcott (2009), Chemmanur, Paeglis, and Simonyan (2009), and Karampatsas, Petmezas, and Travlos (2014), highlighting the importance of asset sales as an overlooked determinant of method of payment in acquisitions.

The remainder of this study will be presented as follows: Section 2 identifies our sample and data. Our main empirical findings are presented in Section 3. We control for potential endogeneity in Section 4, and provide key implications of this type of asset restructuring in Section 5. Additional auxiliary tests to further substantiate the robustness of our results are presented in Section 6. Finally, Section 7 concludes the study.

2. Sample and data

Our initial sample consists of all NYSE, Amex, and Nasdaq firms listed on the Compustat annual industrial file from 1989 through 2013. Our sample is composed of 32,033 firms for a total of 330,106 firm/year observations. Our acquisition sample consists of deals announced between

January 1, 1990 and December 31, 2014, and is obtained from the Thomson Financial SDC Mergers and Acquisitions Database (SDC). There is a one-year lag between the sample period of the overall sample and the M&A sample because we associate acquisition-related dependent variables in a specific year to the firm's asset sales and other control variables at the end of the previous year. Bidders are US public firms, and targets are public, private, or subsidiary firms domiciled both in and outside of the US. We eliminate transactions valued at less than $1 million.[12] We further require that bidders must own less than 10% of the target's shares prior to the announcement and must be seeking to acquire more than 50% of the target's shares after the acquisition. We exclude all privatizations, leveraged buyouts, spin-offs, recapitalizations, self-tender offers, repurchases, sales of a minority interest, liquidations, restructurings, reverse takeovers, bankruptcy acquisitions, going private transactions, exchange offers, acquisitions of partial interest, and buybacks. After matching the two samples, we find that 6,212 bidders (14,883 firm-year observations) conducted 29,379 acquisitions over the period 1990 to 2014, out of which 27,506 are completed transactions.

2.1. Asset sale measures

One challenge in observing asset sale proceeds as a funding source for M&As is that it is difficult to observe an exact correspondence between a dollar raised in time t and a dollar spent on an acquisition in time $t+\tau$ (Schlingemann, 2004). Similar to Schlingemann (2004), rather than attempting to establish a precise correspondence, we consider the cash made available to the firm through asset sales which occurred within 12 months prior to the acquisition announcement. For

[12] All dollar variable values have been adjusted to 2014 dollars using the consumer price index (CPI).

purposes of clarity, we define asset sales to include any divestitures or sell-offs of business segments, product lines, investment assets, or property, plant, and equipment.[13]

We collect asset sales data from the SDC and Compustat databases. Definitions for our asset sale measures are outlined in the Appendix. Similar to Edmans and Mann (2016), we identify asset sales from the SDC database (*SDC asset sale*) as completed M&A transactions with the form of transaction being either acquisition of assets or acquisition of certain assets, and where the acquisition technique field includes at least one out of divestiture, property acquisition, auction, or internal reorganization,[14] and none out of buyout, bankrupt, takeover, restructuring, liquidation, private, tender, unsolicited, and failed. In these transactions, the asset seller is the firm raising funds to be used in a subsequent corporate investment (i.e., acquisitions). Because some asset sales, as defined by Edmans and Mann (2016), could also be reported by the asset buyer as an acquisition, we eliminate any deals in our M&A sample that are also found in our asset sale sample to avoid them being counted as both an asset sale and an acquisition transaction.[15]

Additionally, as in Eckbo and Kisser (2016), we identify asset sales using accounting data from Compustat (*Compustat asset sale*) calculated as i) the sale of investments (siv), plus ii) the absolute value of the minimum of the *change in short-term investments* and 0 (min[ivstch,0]), plus iii) the absolute value of the minimum of the *investing activities* and 0 (min[ivaco,0]), plus iv) the sale of property, plant and equipment (sppe), according to the formula:

[13] The term divestiture has been defined in the literature as pertaining to the modification of a firm's productive assets through either sell-offs or spin-offs (Alexander, Benson, and Kampmeyer, 1984; Tehranian, Travlos, and Waegelein, 1987). Hite and Owers (1983) observe that a spin-off results in the creation of an independent firm with a corresponding reduction in the asset base of the divesting firm. Thus, spin-offs are restructuring events that do not generate proceeds for the divesting firm, nor do they create an opportunity for managers to continue the control of spun-off assets, consequently, spin-offs will not be relevant to our study. Unless specifically noted, where the term divestiture is used in this paper, it refers to sell-offs only.

[14] We deviate from Edmans and Mann (2016) by excluding *spin-offs* for purposes described in footnote 13. While spin-offs are nominally excluded, adding this restriction does not remove any observations from our asset sale subsample.

[15] A total of 10,177 overlapping deals (approximately 25%) are eliminated from the M&A sample.

$$\text{Asset sales} = \text{siv} + \min[\text{ivstch},0] + \min[\text{ivaco},0] + \text{sppe} \quad (1)$$

Using these two asset sale measures, we create our main variable of interest, which is a composite asset sale dummy variable (*asset sale*) taking the value of 1 if the asset sale is either an SDC asset sale, as in Edmans and Mann (2016), or a Compustat asset sale, as in Eckbo and Kisser (2016). Otherwise, the dummy is set to 0. This variable, which has the advantage of including all possible asset sale information, is constructed to identify whether the firm had any reported asset sales within the 12 months leading up to the announcement date.[16] Out of the 29,379 acquisition transactions in our M&A sample, 438 transactions involve bidders with an SDC asset sale, 2,702 involve bidders with a Compustat asset sale, and 2,986 involve bidders with our composite asset sale measure, which suggests that 10.16% of the deals in our sample are likely to be funded by asset sale proceeds.

2.2. Merger wave identification

To identify merger waves, we follow Harford (2005) and assign each bidder and target firm in our M&A sample to one of the 49 industry groups based on the Fama and French (1997) industry classification codes. We further split the sample into three separate time periods: period 1 is from 1990 to 2000 and includes a distinct aggregate merger wave characterized by the buildup of the dotcom bubble as described by Andrade, Mitchell, and Stafford (2001); period 2 is from 2001 to 2007 and includes the period leading up to the credit crisis as identified by Alexandridis, Mavrovitis, and Travlos (2012); and period 3 is from 2008 to 2014, which includes the increased merger activity that has developed during the recovery following the 2007-2009 recession.

[16] As shown in our robustness checks below, using instead separately either SDC asset sale or Compustat asset sale as the main variable of interest leads to qualitatively similar results.

Within each of the three time periods, we calculate the highest 24-month concentration of acquisition announcements for each industry and pinpoint this period as a potential merger wave. If the bidder and target firm are in different industries, the acquisition announcement in that month will be counted for both industries. However, if the bidder and target firm are in the same industry, the deal is only counted once for that industry. Next, we take the total number of deals within the time period for a given industry and simulate 1,000 distributions of that total number by randomly assigning each occurrence to a month within that period. We then calculate the highest 24-month concentration of activity from each of the 1,000 simulated distributions. If the concentration in the actual 24-month period is higher than 95% of the simulation-based 24-month highest concentration, then this period is classified as a merger wave. For example, over 44% of the 2,714 acquisition announcements in the computer software industry from 1990 to 2000 occurred within one 24-month period starting in December of 1998. Out of 1,000 simulated distributions of 2,714 acquisition announcements across the 11 years of period 1, the 95th percentile of maximum concentration within any 24-month period is 20%. We therefore classify the cluster of bids in the computer software industry starting in December of 1998 as a merger wave. Using this method, we identify 65 merger waves from 45 industries across the three time periods, as shown in Panel A of Table 1, with fewer industries having developed merger waves in the last two periods.

2.3. Asset sale wave identification

We follow the same process to identify asset sale waves as we do to identify merger waves in Section 2.2. We start with all asset sales as identified by the composite asset sale measure as defined in Section 2.1 and identify all 24-month periods with actual asset sale activity higher than 95% of the highest simulated distribution in each of the three time periods. We find 82 asset sale

waves from 40 industries across the three time periods. Additionally, as shown in Panel B of Table 1, we observe that asset sale waves often precede merger waves. We find that 32% of industry merger waves are preceded by an asset sale wave, providing some initial evidence that asset sale waves can lead to merger waves.

Table 1 displays industry asset sale and merger waves by period and displays the years in which each industry experienced the start of a 24-month asset sale or merger wave. For instance, we show that 67% of industries experienced an asset sale wave and 87% of industries experienced a merger wave during period 1, with 28% of merger waves being preceded in the year before by an asset sale wave. Further, 43% and 38% of merger waves are preceded by asset sale waves in periods 2 and 3, respectively. Additionally, only 15% of industries appear to have a concurrent start of an asset sale wave and a merger wave. Finally, and most importantly, only 10% in total asset sales waves are preceded by a merger wave in the overall period, with *0%* of asset sale waves preceded by merger waves in periods 2 and 3, which implies merger waves are most likely to follow asset sale waves and not vice-versa.

[Please Insert Table 1 About Here]

2.4. Sample statistics

We report summary statistics in Table 2 on dependent and control variables for the overall industry-level sample and further partition the sample by industries with asset sale waves and industries without asset sale waves. Variable definitions are provided in the Appendix. We winsorize all non-binary variables at the 1st and 99th percentiles, apart from cash reserves and

leverage, which are used in firm-level tests and are winsorized only at the 99% percentile (right-hand side).[17]

Panel A provides statistics for the dependent variable of Table 5 (i.e., industry merger waves) and offers a first indication that industries with asset sale waves are more likely to experience merger waves in the following year. In Panel B, we display the variables used to create the economic shock index, as in Harford (2005), which is the first principal component of the seven economic shock variables (net income/sales, asset turnover, R&D, capital expenditures, employee growth, ROA, and sales growth). We observe that industries with asset sale waves tend to have lower net income/sales (in mean terms only), asset turnover, and ROA, but higher R&D (in mean terms only), capital expenditures, employee growth, and sales growth.

Panel C provides industry characteristics that have been found in the literature (Harford, 2005) to affect industry merger waves (market-to-book value, three-year return, standard deviation of three-year return, C&I rate spread, deregulatory event, economic shock index, and tight capital liquidity). There are notable mean and median differences in the characteristics between industries with asset sale waves and those without. In particular, we find that industries experiencing asset sale waves also have higher market-to-book value (in mean terms only), higher standard deviation of three-year returns, higher liquidity as proxied by the lower C&I rate spread, higher economic shock index, and less tight capital liquidity than industries without asset sale waves.

[Please Insert Table 2 About Here]

Additionally, because industry characteristics have been shown to vary from one merger wave to another,[18] in Table 3, we divide the sample into three distinct time periods identified in our data

[17] Note that in some regressions we also use the natural logarithm of size which is not winsorized.
[18] For instance, Alexandridis et al. (2012) show that the characteristics of the sixth merger wave are distinctly different to previous waves.

as described in Section 2.2. Similar to Table 2, Panel A provides statistics for the dependent variable and main variable of interest, Panel B displays variables used to measure economic shocks, and Panel C includes industry control variables. Comparing period 1 and period 3, we can discern notable mean and median differences in the characteristics between time periods. Industries in period 1 (1990 to 2000) are more likely to experience merger and asset sale waves than industries in period 3 (2008 to 2014). Additionally, they have relatively higher asset turnover, R&D, capital expenditures, employee growth, ROA, sales growth, market-to-book value, and volatility of returns. They also experience more deregulatory events. However, period 1 is associated with lower returns (in median terms only), C&I rate spreads, and fewer restrictions to capital liquidity than period 3. Subsample statistics not shown here also identify significant differences in industry characteristics between periods 1 and 2 and between periods 2 and 3. These statistics show that industry characteristics differ across time, suggesting that merger waves can develop because of various underlying characteristics, including key economic shock variables.

[Please Insert Table 3 About Here]

However, because univariate comparisons do not consider any confounding effects, they can be misleading. Consequently, to discover the net effect of asset sale waves on our dependent variable, industry-specific characteristics need to be controlled for through multivariate regression analysis, as presented in the next section.

3. Empirical findings

In this section, we provide results from multivariate analysis to identify the relation between asset sale waves and the likelihood of merger waves.

3.1. Asset sales and acquisitions

We first analyze the relation between a firm's asset sales and subsequent acquisition investments, while controlling for a number of firm- and industry-specific characteristics which have been identified in the literature as affecting acquisition investments.

Table 4 reports the results for this analysis. All independent variables are lagged by one year to reduce endogeneity concerns. As in Harford and Uysal (2014), we exclude financial firms (6000–6999) and regulated utilities (4900–4999). We also control for year, industry, and firm fixed effects. Additionally, we use heteroskedasticity-robust standard errors adjusted for clustering at firm-level due to the presence of repeated firm observations in our sample. Further, to ease interpretation of the results, we report marginal effects for all non-linear models, which can be interpreted as the average change in the dependent variable across all observations for firms with asset sales relative to firms without asset sales.

In specifications (1), (2), and (3), we run probit regressions in which the dependent variable takes the value of 1 if the firm makes at least one acquisition in a given year, and 0 otherwise. Our main variable of interest is asset sale, which is an indicator that takes the value of 1 for firms with asset sales in that given year, and 0 otherwise. Specification (1) includes only the asset sale variable, while in specification (2) we employ the same controls as in Harford and Uysal (2014) for comparison reasons, which consist of the existence of bond rating (rated), size, cash reserves, leverage, stock return, market-to-book value, ROA, industry M&A liquidity, and Herfindahl index. To ameliorate concerns that time invariant unobservable firm characteristics may bias our results, specification (3) also includes the lagged dependent variable. Similarly, in specification (4) we run a linear probability model (LPM) using firm fixed effects to further reduce concerns about unobserved heterogeneity at the firm-level that can affect acquisition decisions.

We find that the coefficient on asset sale is positive and statistically significant at conventional levels. In economic terms, having asset sales increases a firm's probability of conducting an acquisition by a significant 0.52% overall, which is an increase of 11.58% relative to the mean value of acquisition probability in our sample.[19] This finding, that firms with asset sales are more likely to make more acquisitions, is consistent with the literature supporting that an increase in firm cash-richness (i.e., capital liquidity) is positively associated with corporate acquisitions. The results of the control variables are in agreement with prior work, indicating that firms are more acquisitive when they have a credit rating, larger size, more cash reserves, less debt, strong stock performance, good growth opportunities, higher operating returns, higher industry M&A volume, and are from more concentrated industries. Overall, our results imply that asset sales are likely to offer firms the essential capital liquidity needed to proceed to an acquisition bid.

[Please Insert Table 4 About Here]

3.2. Asset sale waves and merger waves

In this section, we focus on the main analysis of this study and examine the relation between asset sale waves and merger waves. We start by aggregating our sample at the industry level using 49 industry groups based on the Fama and French (1997) industry classifications. We also control for industry shocks and other industry-specific characteristics, as identified in the literature. Our results are displayed in Table 5. In all specifications, the dependent variable takes the value of 1 if the industry is experiencing a merger wave in that year, and 0 otherwise. All of the independent variables are lagged by one year, and we also include year fixed effects. As in Table 4, we report marginal effects for ease of interpretation of probit models in specifications (1), (2), and (3).

[19] In our firm-level sample of 330,106 firm-year observations, the mean acquisition probability is 4.49%.

Similar to specification (3) of Table 4, we include the lagged dependent variable in specification (3) of Table 5. We also report LPM results from an industry fixed effects model in specification (4) to further control for unobservable industry characteristics.

Our main variable of interest in these specifications is the asset sale wave variable, which takes the value of 1 if the industry experiences an asset sale wave in year *t*-1, and 0 otherwise (see Section 2.3 for a detailed description of the construction of the asset sale wave variable). Again, for comparison reasons, we employ the same industry controls as in Harford (2005), which consist of market-to-book value, the three-year industry stock return, the standard deviation of the three-year industry stock return, the C&I rate spread, a dummy for years with deregulatory events, the economic shock index, and an interaction term where the economic shock index is interacted with a dummy variable for tight capital. We find that, in all specifications, the coefficients for our asset sale wave variable are positive and statistically significant at the 1% level. Economically, asset sale waves increase the likelihood that an industry will have a merger wave start in the following year by 14.80%.

[Please Insert Table 5 About Here]

Further, we show that over our sample period, some of the control variables run contrary in sign or significance to the results documented by Harford (2005). We attribute this finding to the fact that our sample includes 14 additional years which exhibit significant differences in industry control variables. To further analyze these differences, we run the same specification as in Table 5, but we separate the sample into our three distinct time periods. As noted in Table 3, we find significant differences between time periods in our sample. These differences suggest that varying factors can contribute to the development of merger waves.

Table 6 displays the results of our analysis by time period. Specifications (1), (2), and (3) show results for periods 1, 2, and 3, respectively. Period 1 (1990 to 2000) covers the second half of Harford's (2005) sample period (i.e., 1981 to 2000). We show that results for our period 1 most closely resemble those obtained in Harford (2005). Specifically, we find a similar sign and significance on the C&I rate spread, the main variable of interest in his study. However, periods 2 and 3 show significant deviations from the control variable results of period 1. Additionally, deregulation and the interaction term of economic shock index with tight capital are dropped in tests for periods 2 and 3 due to collinearity caused by the small sample sizes. Above all, consistent in all specifications is the significance of the positive association of asset sale waves with merger waves regardless of the time period examined.

It is particularly important that the relation between asset sale waves and merger waves holds in specifications (2) through (4), for the periods 2001-2007, 2008-2014, and the combined two sub-periods (2001-2014), respectively; these are the periods in which our descriptive statistics of Table 1 (Panel B) show that 0% of asset sale waves are preceded by merger waves, enhancing our confidence that the results are not affected by reverse causality bias.

[Please Insert Table 6 About Here]

4. Endogeneity control

In this section, we address the potential for endogeneity bias. In particular, our main estimates in previous tables could suffer from potential bias arising either from reverse causality or omitted variables that drive both asset sales and acquisition investments. We therefore proceed to further analysis by: i) using a Granger causality test; ii) using an instrumental variable (IV) approach; and iii) using propensity score matching techniques. It is also worth noting here that, in specification

(4) of Table 5, we have also run a linear regression with industry fixed effects, which should mitigate any endogeneity concerns driven by unobserved industry characteristics.

4.1. Granger causality test

One possible issue that could confound our results would be that of reverse causality, suggesting that it is, in fact, industry merger waves that cause industry asset sale waves. In support of this view, Kaplan and Weisbach (1992) study the success of acquisitions by looking at a sample of 282 acquisitions with subsequent divestitures, giving some evidence that acquisitions lead to divestitures, without, however, performing any tests to alleviate reverse causality concerns. As has already been highlighted, Table 1 provides the first indication that our results do not suffer from reverse causality concerns, showing that merger waves are more likely to be preceded by asset sale waves, with almost no asset sale waves being preceded by merger waves in period 1 and none preceded by merger waves in periods 2 and 3. Additionally, as shown in Table 6, the positive relation between asset sales waves and merger waves remains strong when we focus in the latter period (2001 to 2014), in which 0% of asset sale waves are preceded by merger waves, which allows to draw causality inferences.

In addition to the descriptive statistics already provided, Table 7 displays results from a Granger causality test, following Ahern and Harford (2014), to determine whether industry merger waves are Granger caused by industry asset sale waves or vice versa. In Panel A, we run predictive vector autoregressions (VARs) with the lagged values of industry merger wave and industry asset sale wave as our main endogenous variables. We find that the lagged asset sale wave variable is positively related to merger waves, while lagged merger wave is not associated with asset sale waves. Panel B reports the Granger causality Wald tests, in which the first null hypothesis assumes

that asset sale waves do not Granger cause merger waves, and the second assumes that merger waves do not Granger cause asset sale waves. The results in Panel B allow us to reject the null that asset sale waves do not Granger cause merger waves. These results confirm that there is a strong positive time-series relation between asset sale waves and merger waves. On the other hand, we cannot reject the null that merger waves do not Granger cause asset sale waves.

Overall, these predictive tests show that asset sale waves lead to merger waves, rather than merger waves causing asset sale waves.

[Please Insert Table 7 About Here]

4.2. Instrumental variable (IV) approach

To further assuage concerns that our findings could be attributed to some unobservable characteristics that might affect both asset sale and merger waves, we employ an IV approach using a method developed by Lewbel (2012).[20] This approach estimates an instrumental variables regression model with heteroskedasticity-based instruments generated using Lewbel's method. This technique allows the identification of structural parameters in regression models with endogenous regressors when traditional identifying information, such as external instruments, is absent. Identification is accomplished in this context by having regressors that are uncorrelated with the product of heteroskedastic errors, which is a feature of many models where error correlations are due to an unobserved common factor. Using this form of Lewbel's method, instruments are constructed as simple functions of the model's data. Thus, this approach can be

[20] Recent studies using the Lewbel (2012) approach include work by Schlueter, Sievers, and Hartmann-Wendels (2015) and Ivanov, Santos, and Vo (2016).

applied when no external instruments are available, or, alternatively, used to supplement external instruments to improve the efficiency of the IV estimator.[21]

Table 8 displays results from the first and second stage of our IV approach. The external instrument used is industry *asset turnover*. Asset turnover is a determinant of asset sales, as identified by Yang (2008), who finds that asset turnover is negatively associated with asset sales. Specification (1) reports the first stage regression and shows that industry asset turnover is indeed significantly and negatively associated with asset sale waves. While industry asset turnover displays some qualities of a good instrumental variable, an unreported Hausman test shows that it is too weak to be an efficient instrument on its own. Utilizing Lewbel's method, we also include Lewbel estimated instruments in specification (1), not reported for brevity, which are based on the other control variables in the model. Combined with industry asset turnover as our external instrument, we find that the Lewbel estimated instruments provide a strong set of instrumental variables. The Kleibergen-Paap rk Wald F statistic for the weak identification test is comfortably higher than the critical value prescribed by Stock and Yogo (2002) (i.e., LIML Size of Nominal 10% Wald, that is 3.97 in our case), allowing us to reject the null of weak identification. Additionally, the Hansen J statistic is not significant, which gives an indication that we do not have an overidentification problem.

Specification (2) reports the second stage, with asset sale wave exhibiting a positive and significant relation to merger waves. Further, the Wu-Hausman test shows insignificance, indicating that our variables are exogenous and do not suffer from endogeneity concerns; therefore, we can rely upon the results found in our main tests in Table 5.

[Please Insert Table 8 About Here]

[21] We use the user written Stata command *ivreg2h* by Baum and Schaffer (2012) to estimate Lewbel instruments.

4.3. Propensity score matching

To further reduce concerns of bias based on observable characteristics, we implement a propensity score matching (PSM) process as in Subrahmanyam, Tang, and Wang (2014). We match industries that experienced asset sale waves (treated) with industries exhibiting analogous characteristics but did not experience an asset sale wave (control). The treatment effect from the PSM estimation is the difference between the treated sample and the matched control sample, as measured by the asset sale wave coefficient. In order to match industries, we calculate a one-dimensional propensity score, which is a function of observable characteristics used in Table 5 for merger wave tests. We implement a one-to-one (i.e., nearest neighbor) matching estimator.[22]

Table 9 reports the PSM results for our main regression. The treatment effect of asset sale waves is significantly positive at the 1% level, supporting the finding that asset sale waves are positively related with merger waves. Thus, it appears that selection on observable characteristics does not bias our results.

[Please Insert Table 9 About Here]

5. Further findings

In this section, we examine firm-level effects as implied by this type of selling-to-buy asset restructuring. In Section 5.1, we investigate the impact of asset sales on long-run operating performance for firms that subsequently conduct acquisitions, and in Section 5.2, we consider the effects of asset sales on the choice of method of payment in subsequent acquisition transactions.

[22] For robustness, we also use 30-nearest-neighbors, 50-nearest-neighbors, and Gaussian and Epanechnikov kernel-based matching estimators. We find similar results with these different estimators.

5.1. Long-run operating performance

Prior empirical research shows that focus increasing asset sales result in improved operating efficiency (John and Ofek, 1995; Daley et al., 1997). However, past empirical work has not examined the efficiency effects derived from the double benefit of an asset sale followed by an acquisition. In particular, firms that sell unrelated assets have a first benefit of increasing industry focus which improves their operating efficiency. This effect is magnified, offering a double benefit, if the firm uses the proceeds of the asset sales to buy an asset that improves its focus and operating efficiency. Therefore, we examine three-year industry-adjusted operating performance from the date of the asset sale announcement to detect any efficiency improvements resulting from these two events for firms that used the proceeds of unrelated asset sales to conduct acquisitions versus those that did not make acquisitions. This approach allows us to capture, not only the effect of the asset sale, but also the effect on operating efficiency coming from the use of the asset sale proceeds to conduct acquisitions. Additionally, we expect this effect to be more pronounced for firms that sell unrelated assets and acquire target firms that further increase their industry focus. This effect is precisely what we find.

Table 10 displays the OLS estimates from these tests. We use a sample of focus increasing asset sales, which is the group of asset sellers who divest a unit that has a different 2-digit Standard Industrial Classification (SIC) code relative to their core operations. The dependent variable is the three-year industry-adjusted operating performance as in Healy, Palepu, and Ruback (1992) and Harford, Humphery-Jenner, and Powell (2012). In specification (1), our main variable of interest is *post-sale acquisition*, which is a dummy variable that takes the value of 1 if the firm has an acquisition in the year following the asset sale, and 0 otherwise. In this case, the main variable of interest shows whether firms that made an acquisition after a focus increasing asset sale experience

higher operating efficiency relative to firms that did not make an acquisition. In addition to the customary control variables in the operating performance tests, we also control for the lagged industry-adjusted operating performance (Pre-IAOP$_{t-1}$) as in Healy et al. (1992) and Harford et al. (2012) because past performance is a strong predictor for future performance. We find that firms that sell unrelated assets and use the proceeds to fund a subsequent acquisition experience significantly higher operating performance at the 5% level. This result is driven by firms that use the proceeds of unrelated asset sales to make focus increasing acquisitions as shown in specification (2). In particular, in specification (2) our main variable of interest is *post-sale focus increasing acquisition*, which is a dummy variable that takes the value of 1 if the firm has a focus increasing acquisition in the year following the asset sale, and 0 otherwise. An acquisition is focus increasing if the bidder has the same 2-digit SIC code as the target. We find that firms that sell unrelated assets and conduct focus increasing acquisitions improve their three-year operating performance by 1.72%. This finding is consistent with the notion that firms which concentrate their assets around their core industry (by selling unrelated assets and buying related assets) experience a double benefit effect, improving their operating efficiency.

[Please Insert Table 10 About Here]

5.2. Asset sales and method of payment in M&As

Determinants of the choice of method of payment in acquisitions have been widely discussed in the literature,[23] with Schlingemann (2004) and Martynova and Renneboog (2009) showing also that the method of payment is strongly related to the source of funds. In this section, we examine whether asset sale proceeds, as a funding source, affect the probability and intensity of using cash

[23] For example, Amihud et al. (1990), Faccio and Masulis (2005), Harford et al. (2009), Chemmanur et al. (2009), and Karampatsas et al. (2014).

as means of payment in acquisitions. We report the results in Table 11. Our main variable of interest in these tests is similar to those in previous tests, but we also require that the ratio of the asset sale value to the cash used in the subsequent acquisition is greater than 1 (i.e., the asset sale proceeds cover 100% of the cash used in the deal). In this way, we can identify whether the firm had asset sales that are sufficient to meet the cash-related funding needs of the acquisition.[24]

In specifications (1), (2), and (3), we examine whether asset sales affect the probability of selecting cash as the means of payment in acquisitions where our dependent variable, cash payment, is a dummy variable that takes the value of 1 if the method of payment is 100% cash, and 0 otherwise. Specification (1) includes only deal characteristics, and in specifications (2) and (3) we add the controls for bidder characteristics, similar to Karampatsas et al. (2014). Specifications (1) and (2) present marginal effects from probit analysis, and specification (3) reports the results from an LPM model with firm fixed effects. All specifications show a significantly positive relation between asset sales and the choice of cash as the method of payment at the 1% significance level. This result has a strong economic significance, as we show that asset sales increase the probability that bidding firms will use cash as the method of payment by 25.06%.

In specifications (4), (5), and (6), we examine whether asset sales affect the cash intensity in acquisitions. Our dependent variable, cash percentage, represents the percentage of cash as part of the total price offered by the bidder. In specifications (4) and (5), we present unconditional marginal effects for tobit models, and specification (6) displays results from a firm fixed effects OLS model. We find that our main variable of interest carries a positive and significant coefficient at the 1% significance level. More specifically, we show that firms with an asset sale use approximately 29.15% more cash than those financing through some other means.

[24] As additional auxiliary tests, we change the amount of cash coverage from 100% to 50%, 75%, 125%, and 150%, and find similar results.

We also observe that the coefficients of the control variables are generally similar in sign and significance to those documented in prior M&A literature. More specifically, we report that these transactions include relatively smaller, private targets, but that they are more likely to be hostile deals and transacted through tender offers. Additionally, we show that bidders' rating level, loan rate spread, and free cash flows are positively related to the use of cash as the method of payment. In sum, our results in this section provide evidence that asset sales affect the choice of payment method in M&As, increasing the likelihood and intensity of cash in acquisitions.

[Please Insert Table 11 About Here]

6. Robustness tests

To further substantiate our results, we run a number of additional robustness tests: i) we use different asset sale measures; and ii) we perform a number of other auxiliary tests.

6.1. Asset sale measures comparison

For all tests up to this point, we have used as our main variable of interest, *asset sale wave*, which is a composite of two primary measures of asset sales found in the literature. The first, *SDC asset sale wave*, is determined by identifying firms that sold a business unit or other asset as reported in the SDC database and described in Edmans and Mann (2016). The second, *Compustat asset sale wave*, identifies asset sales from annual accounting and financial data as reported by Compustat and described in Eckbo and Kisser (2016). As a robustness check, we run our main regression again to assess if we observe materially different results when using these two different asset sale wave measures.

[Please Insert Table 12 About Here]

Table 12 reports the results from these additional tests, with SDC asset sale wave in specification (1) and Compustat asset sale wave in specification (2). In both specifications, we find that the results remain consistent with our main findings, irrespective of which asset sale wave measure is used.

6.2. Other auxiliary tests

We also perform a number of sensitivity tests to further examine the robustness of our results. In particular: i) we exclude financial firms (6000-6999) and regulated utilities (4900-4999) from our samples for merger waves and method of payment (to be comparable with the sample of Harford and Uysal (2014), which is used as our benchmark in the acquisition investment tests, where financial and utility firms had already been excluded for those tests); ii) we control for increased cash flow uncertainty, which is a determinant of merger waves, as per Garfinkel and Hankins (2011); iii) we include equity and debt flows as other potential sources of financing in the regressions; iv) we also add measures of firm distress and further measures of financial constraints, which are commonly cited motivations for asset sales:[25] in particular, we include the distance to default as in Campbell, Hilscher, and Szilagyi (2008) and the Altman Z score as in Altman (1968) to control for financial distress; we also add the Size-Age (SA) index as in Hadlock and Pierce (2010) and rating level as in Karampatsas et al. (2014) to capture further financial constraint concerns (rating level is already included in our standard specifications for method of payment, so we add it for acquisition probability, long-run operating performance, and merger waves tests); v) we include R&D/total assets and R&D/total sales as alternatives to number of analysts as proxies

[25] For instance, Brown, James, and Mooradian (1994) show that creditors strongly influence asset sale decisions by financially distressed firms to pay down debt. Alternatively, Hovakimian and Titman (2006) and Borisova and Brown (2013) provide evidence that financially constrained firms use proceeds from asset sales for corporate investment.

for information asymmetry; vi) for the method of payment analysis, we conduct additional tests in which our main variable of interest requires the proceeds from an asset sale to cover 50%, 75%, 125%, or 150% of the cash used in the deal, as alternative to our main asset sale variable which requires 100% coverage of cash; vii) additionally, for the method of payment analysis, we control for cash reserves, and we further broaden our asset sale variable by requiring the asset sale proceeds to cover the entire deal value rather than just the cash portion of the deal; and viii) we check for the existence of multicollinearity amongst our variables using Variance Inflation Factor (VIF) tests and confirm there are not any multicollinearity issues that would materially affect our estimates.

Altogether, in this section, we confirm that our main findings are robust and provide further evidence to substantiate our initial results, that asset sale waves are positively associated with industry merger waves.

7. Conclusion

This paper provides new evidence on the reallocation of firm assets through the restructuring activities of asset sales and subsequent acquisitions. More specifically, we offer empirical confirmation of the role of asset sale proceeds as a source of funds in acquisitions. We show that asset sales cluster in time, forming into asset sale waves, and that these asset sale waves have a strong positive relation with the subsequent occurrence of merger waves. Additionally, we find that this type of selling-to-buy asset restructuring results in a double benefit for firms that sell unrelated assets and use the proceeds to conduct acquisitions. Particularly, we show that these firms experience greater industry-adjusted operating performance in the three years following the asset sale relative to those firms that do not make any acquisitions, and this result is driven by

focus increasing acquisitions. Further, we show that acquisitions after asset sales are more likely to be transacted in cash. Our results are robust after controlling for potential endogeneity issues.

The findings of this study have important implications for both academics and practitioners. Specifically, our findings reveal the significant importance of asset sale proceeds as an additional funding source for corporate investments, mitigating the negative effects associated with traditional external funding sources such as equity and debt issues. Additionally, given the reported association between asset sale waves and subsequent merger waves, asset sale waves could be used as a potential indicator to predict merger waves. Acquisitions during merger waves are shown to destroy value more than at other times.[26] Having an indication, through the preceding asset sale wave, that a merger wave is likely to occur, will help managers in determining whether it is an appropriate time to engage in acquisitions.

Furthermore, firms that sell assets are more likely to subsequently make cash acquisitions and, consequently, experience the positive wealth effects associated with cash as a method of payment. For example, previous empirical findings show that bidders experience higher abnormal returns when deals are transacted in cash.[27] Moreover, the use of cash as a method of payment has been found to discourage rival bids (Chemmanur et al. (2009)). Managers and financial advisors should take this information into account when engaging in M&A deals.

Finally, our findings imply that researchers should examine the evolution of each merger wave and its potential sources of capital liquidity separately to draw any fruitful conclusions; in particular, while asset sale waves, as a source of capital liquidity, appear to be a persistent driver

[26] Moeller, Schlingemann, and Stulz (2005) and Duchin and Schmidt (2013) find that acquiring firms experience negative stock returns when they conduct acquisitions during merger waves.
[27] Travlos (1987) and Huang and Walkling (1987) show that cash offers are positively associated with higher abnormal returns in the short-run for public acquisitions, while Loughran and Vijh (1997) and Megginson, Morgan, and Nail (2004) find significantly higher long-run abnormal returns.

of merger waves over time, this is not the case for a number of other common sources of capital liquidity that drive M&A waves suggested by the prior literature.

Overall, this study provides evidence on the role of asset sales as a source of funds in acquisitions, and of capital liquidity that drives merger waves.

Appendix

Variable descriptions

Variable	Description
Panel A: Dependent variables	
Acquisition probability	A dummy variable that takes the value of 1 if the firm announced at least one acquisition in year *t*, and 0 otherwise. The variable is created using data from Thomson Financial SDC.
Merger wave	A dummy variable that takes the value of 1 if a given industry was experiencing a merger wave in that year, and 0 otherwise. Merger waves are identified as in Harford (2005). See also Section 2.2. The variable is created using data from Thomson Financial SDC.
Operating performance	The three-year average industry-adjusted operating returns where operating returns are calculated as the operating income before depreciation, scaled by total assets. Industries are defined based on Fama and French 49 industry classification. This variable is created using data from Compustat.
Cash payment	A dummy variable that takes the value of 1 for deals where the method of payment is 100% cash, and 0 otherwise. The variable is created using data from Thomson Financial SDC.
Cash percentage	The percentage of cash as part of the total price offered by the bidder to the target firm. This variable is created using data from Thomson Financial SDC.
Panel B: Measures of asset sales	
Asset sale	A dummy variable that takes the value of 1 if the asset sale is either an SDC asset sale as in Edmans and Mann (2016) as defined below, or a Compustat asset sale as in Eckbo and Kisser (2016) as defined below, and 0 otherwise. This variable is created using data from Thomson Financial SDC (for the SDC asset sales) and Compustat (for the Compustat asset sales).
SDC asset sale	A dummy variable that takes the value of 1 when the asset sale is a completed M&A transaction with the form of transaction being either *acquisition of assets* or *acquisition of certain assets*, where the acquisition technique field includes at least one out of *divestiture*, *property acquisition*, *auction*, *internal reorganization*, or *spinoff*, and none out of *buyout*, *bankrupt*, *takeover*, *restructuring*, *liquidation*, *private*, *tender*, *unsolicited*, and *failed* as in Edmans and Mann (2016), and 0 otherwise. This variable is created using data from Thomson Financial SDC.
Compustat asset sale	A dummy variable that takes the value of 1 when the asset sale is calculated according to the formula: *asset sales* = *siv* + min[*ivstch*,0]*(-1) + min[*ivaco*,0]*(-1) + *sppe*, and 0 otherwise. That is: i) the *sale of investments*, plus ii) the absolute value of the minimum of the *change in short-term investments* and 0, plus iii) the absolute value of the minimum of the *investing activities* and 0, plus iv) the *sale of property, plant, and equipment* as in Eckbo and Kisser (2016). This variable is created using data from Compustat.
Asset sale wave	A dummy variable that takes the value of 1 if a given industry was experiencing an asset sale wave in that industry-year, and 0 otherwise. Asset sale waves are identified using the same methodology used to identify merger waves as in Harford (2005). See also Section 2.3. The variable is created using data from Thomson Financial SDC and Compustat.
Asset sale (100% coverage)	A dummy variable that takes the value of 1 when the ratio of the value of either an SDC asset sale or a Compustat asset sale to the cash used in the deal is great than 1, and 0 otherwise. This variable is created using data from Thomson Financial SDC and Compustat.
Panel C: Variables for acquisition probability tests as per Harford and Uysal (2014)	
Rated	A dummy variable that takes the value of 1 if the firm is rated at fiscal year-end, and 0 otherwise. This variable is created using data from Compustat.
Size	Sales at fiscal year-end. This variable is created using data from Compustat. In the regressions analysis we use the ln(size).
Cash reserves	Cash and short-term investments divided by total assets at fiscal year-end. This variable is created using data from Compustat.
Leverage	Total debt (long-term debt + debt in current liabilities) divided by total assets at fiscal year-end. This variable is created using data from Compustat.
Stock return	The annualized market-adjusted return (using the value-weighted CRSP index as benchmark).
Market-to-book	The market value of equity (common shares outstanding * closing price at fiscal year-end) divided by the book value of equity at fiscal year-end. Similar to Fama and French, book value of equity is total shareholders' equity plus deferred taxes and investment tax credit minus the book value of preferred stock. In case the data are not available, shareholders' equity is calculated as the sum of common and preferred equity. If none of the two are available, shareholders' equity is defined as the differences of total assets and total liabilities. This variable is created using data from Compustat.
ROA	Earnings before interest, taxes, depreciation, and amortization scaled by total assets. This variable is created using data from Compustat.
Industry M&A liquidity	Sum of acquisitions values for each year and three-digit SIC code divided by the aggregated assets of firms in the same three-digit SIC and year. This variable is created using data from Compustat.

Herfindahl index	Sum of squares of the market shares of all firms sharing the same three-digit SIC, where market share is defined as sales of the firm to the aggregated sales of the industry. This variable is created using data from Compustat.
Panel D: Variables for merger wave tests as per Harford (2005)	
Net income/sales	The industry median net income/sales. This variable is created using data from Compustat.
Asset turnover	The industry median asset turnover ratio. This variable is created using data from Compustat.
R&D	The industry median research and development scaled by total assets. This variable is created using data from Compustat.
Capital expenditures	The industry median capital expenditure scaled by total assets. This variable is created using data from Compustat.
Employee growth	The industry median employee growth. This variable is created using data from Compustat.
ROA	The industry median return on assets. This variable is created using data from Compustat.
Sales growth	The industry median sales growth. This variable is created using data from Compustat.
Market-to-book	The industry median market-to-book ratio. This variable is created using data from Compustat.
3 Year return	The median return in the industry for the three years ending at the end of year *t*-1. This variable is created using data from CRSP.
Std dev 3 year return	The intra-industry standard deviation of the three-year return. This variable is created using data from CRSP.
C&I rate spread	The spread on the interest rate charged for all commercial and industrial (C&I) loans over intended federal funds rate. The spread is from the Survey of Terms of Business Lending published by the Federal Reserve Bank of New York in its E2 release.
Deregulatory event	A dummy variable that takes the value of 1 for years that are preceded by a major deregulatory event, and 0 otherwise.
Economic shock index	The first principal component of the seven economic shock variables, including: net income/sales, asset turnover, R&D, capital expenditure, employee growth, ROA, sales growth.
Tight capital liquidity	A dummy variable that takes the value of 1 for years when market-to-book ratios are below their industry-specific time-series median or the C&I rate spread is above its time-series median, and 0 otherwise.
Panel E: Variables for long-run operating performance and method of payment tests as per Healy et al. (1992) and Karampatsas et al. (2014), respectively	
Post-sale acquisition	A dummy variable that takes the value of 1 if the firm has an acquisition in the year following the asset sale, and 0 otherwise. This variable is created using data from Thomson Financial SDC.
Post-sale focus increasing acquisition	A dummy variable that takes the value of 1 if the firm has a focus increasing acquisition in the year following the asset sale, and 0 otherwise. An acquisition is focus increasing if the bidder has the same 2-digit SIC code as the target. This variable is created using data from Thomson Financial SDC.
Pre-$IAOP_{t-1}$	The industry-adjusted operating return in the year prior to the asset sale, where operating returns is calculated as the operating income before depreciation, scaled by total assets. Industries are defined based on Fama and French 49 industry classification. This variable is created using data from Compustat.
Size	Firm market value of equity 4 weeks prior to the acquisition announcement. This variable is created using data from CRSP. In the regressions analysis we use the ln(size).
Asset sale relative size	The ratio of the asset sale value (from Thomson Financial SDC) to the seller's market value of equity 4 weeks prior to the asset sale announcement (from CRSP database).
Leverage	Total debt (long-term debt + debt in current liabilities) divided by total assets at fiscal year-end. This variable is created using data from Compustat.
Cash reserves	Cash and short-term investments divided by total assets at fiscal year-end. This variable is created using data from Compustat.
Book-to-market	Book value of equity at the fiscal year-end prior to the acquisition announcement divided by the market value of equity 4 weeks prior to the acquisition announcement. Book value of equity is from Compustat, market value of equity is from CRSP.
Asset turnover	Total sales divided by total assets. This variable is created using data from Compustat.
Capital expenditures	The ratio of capital expenditure over the lagged total assets. This variable is created using data from Compustat.
Relative size	The ratio of the deal value (from Thomson Financial SDC) to the bidder market value of equity 4 weeks prior to the acquisition announcement (from the CRSP database).
Diversifying deal	A dummy variable that takes the value of 1 for intra-industry transactions, and 0 otherwise. Industries are defined at the 2-digit SIC level from Thomson Financial SDC.
Hostile deal	A dummy variable that takes the value of 1 for deals defined as hostile or unsolicited, and 0 otherwise. This variable is created using data from Thomson Financial SDC.
Tender offer	A dummy variable that takes the value of 1 for deals defined as tender offers, and 0 otherwise. This variable is created using data from Thomson Financial SDC.
Private target	A dummy variable that takes the value of 1 for deals where the target is a private firm, and 0 otherwise. This variable is created using data from Thomson Financial SDC.

Competing deal	A dummy variable that takes the value of 1 for deals where there is a competing bidder, and 0 otherwise. This variable is created using data from Thomson Financial SDC.
Rating level	A continuous variable for rated bidders: 1 to 22, AAA level takes 22 and D takes 1. This variable is created using data at fiscal year-end. This variable is created using data from Compustat.
Collateral	The ratio of firm's property, plant and equipment to total assets at the fiscal year immediately prior to the acquisition announcement from Compustat.
C&I rate spread	The spread on the interest rate charged for all commercial and industrial (C&I) loans over intended federal funds rate. The spread is from the Survey of Terms of Business Lending published by the Federal Reserve Bank of New York in its E2 release.
Run-up	Market-adjusted buy-and-hold returns of the firm over the period starting (−205, −6) days prior to the acquisition announcement from CRSP.
Blockholder ownership	Aggregate holdings of blockholders who own at least 5% of the company's stock from Thomson One ownership database.
Free cash flows	Income before extraordinary items plus depreciation minus dividends on common and preferred stock divided by the total assets at the fiscal year-end immediately prior to the announcement from Compustat.
Number of analysts	The number of equity analysts following the firm replaced by 0 for firms not covered by IBES.

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Table 1

Industry asset sale and merger waves.

This table presents descriptive statistics for asset sale waves and merger waves by industry and time period. Panel A displays the beginning and ending dates for each wave by industry and year. Panel B presents the total statistics for the 49 industries.

Panel A: Industry asset sale and merger waves

	Period 1 (1990-2000)		Period 2 (2001-2007)		Period 3 (2008-2014)	
Industry	Asset sale	Merger	Asset sale	Merger	Asset sale	Merger
Agriculture	-	1996-1997	-	-	-	-
Aircraft	1991	1996-1998	2004	-	2009	-
Apparel	-	1997	-	-	-	-
Automobiles and trucks	1993-1997	1994-1997	2001	-	-	-
Banking	1995-1999	1992-1998	2003-2006	-	2008-2012	2011-2013
Beer & liquor	1995-1998	-	2001	-	-	-
Business services	1995-1999	1995-1999	2001-2002	2005-2006	-	-
Business supplies	1994	1996-1997	2001	-	-	-
Candy & soda	-	-	-	-	-	-
Chemicals	1994-1998	1996-1999	2001	-	-	-
Coal	-	-	-	2004-2005	-	-
Communication	1995-1999	1994-1999	2001-2004	2005	2008-2009	-
Computer hardware	1994-1995	1996-1999	2001-2002	-	2008	-
Computer software	1995-1999	1996-1999	2001-2002	2003-2004	-	-
Construction	-	1996-1998	2001	-	-	-
Construction materials	1995	1995-1998	2001	-	-	-
Consumer goods	1996	1996-1997	2001	-	-	-
Defense	-	1996-1997	-	-	-	-
Electrical equipment	-	1997-1999	-	-	2008-2009	-
Electronic equipment	1995-1999	1995-1999	-	-	2008-2009	2009
Entertainment	1994-1996	1995-1998	2001	-	-	-
Fabricated products	-	1995-1997	2001	-	-	-
Food products	-	1995-1997	-	-	-	-
Healthcare	1994-1995	1992-1997	2004	2005	2008	2012-2013
Insurance	1993-1998	1993-1997	2001-2005	-	2008-2009	-
Machinery	1994-1995	1994-1998	-	2005-2006	-	-
Measuring and control equipment	1997-1999	1995-1999	2001	-	2008	-
Medical equipment	1995-1996	1994-1997	-	2004-2006	-	-
Non-metallic and industrial metal mining	1998-1999	1997-1999	2005-2006	2005-2006	-	-
Other	1997-1999	1995-1997	2005-2006	-	2011-2013	-
Personal services	1995-1997	1996-1998	2001-2004	-	-	-
Petroleum and natural gas	1994-1999	1995-1997	2001-2006	2005-2006	2008-2013	-
Pharmaceutical products	1995-1999	1997-1999	2003-2006	-	2013	-
Precious metals	-	-	2003-2005	2005-2006	2012	2008-2009
Printing and publishing	-	1997-1999	-	-	-	-
Real estate	-	1995-1998	-	2004-2005	2012-2013	2011-2013
Recreation	1994-1995	1995-1998	2001	-	-	-
Restaurants, hotels, motels	1995-1996	1994-1997	2001-2002	2004-2005	-	2011-2012
Retail	1994-1996	1995-1999	2001	-	-	-
Rubber and plastic products	-	1996-1998	2001	-	2008	-
Shipbuilding railroad equipment	-	1996-1998	-	-	-	-
Shipping containers	1996-1997	-	2001-2002	-	-	-
Steel works etc	-	1995-1997	-	-	-	-
Textiles	-	1993	2001	-	-	-
Tobacco products	1998-1999	-	-	-	-	-
Trading	1995-1999	1995-1998	2003-2006	2004-2006	2010-2013	2012-2013
Transportation	1995-1996	1996-1998	-	-	-	2011-2012
Utilities	1997-1999	1997-1999	2001-2006	-	-	-
Wholesale	1994-1996	1994-1998	2001-2002	2005-2006	-	-
Total # of industries with waves	33	43	33	14	16	8

Panel B: Sample total statistics for the 49 industries

	Sample total	Period 1 (1990-2000)	Period 2 (2001-2007)	Period 3 (2008-2014)
% Merger waves preceded by asset sale waves	**32%**	**28%**	**43%**	**38%**
% Concurrent start of merger waves with asset sale waves	15%	21%	7%	0%
% Asset sale waves preceded by merger waves	10%	19%	**0%**	**0%**

Table 2
Sample descriptive statistics by asset sale wave.

This table presents descriptive statistics for the merger waves sample at the industry level. We report the mean, median, and number of observations for the dependent variable in Panel A, the components of the economic shock index in Panel B, and industry characteristics in Panel C. The sample is further classified by whether the industry asset sale wave dummy value is equal to 1 or 0. Refer to the Appendix for detailed variable descriptions. Statistical tests for differences in means and equality of medians for each characteristic between columns (2) and (3) are also included.

	Full sample (1)			Asset sale wave=1 (2)			Asset sale wave=0 (3)			Difference (p-value) (2)-(3)	
	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median
Panel A: Dependent variable											
Merger waves	0.163	-	1,225	0.423	-	213	0.109	-	1,012	0.000	-
Panel B: Economic shock variables											
Net income/sales	0.012	0.026	1,225	-0.015	0.027	213	0.017	0.026	1,012	0.002	0.697
Asset turnover	0.965	1.044	1,225	0.762	0.651	213	1.008	1.071	1,012	0.000	0.000
R&D	0.029	0.010	1,212	0.039	0.006	210	0.027	0.011	1,002	0.001	0.129
Capital expenditures	0.045	0.039	1,225	0.055	0.045	213	0.043	0.039	1,012	0.000	0.041
Employee growth	0.099	0.091	1,225	0.115	0.111	213	0.095	0.088	1,012	0.000	0.000
ROA	0.083	0.103	1,225	0.058	0.087	213	0.088	0.105	1,012	0.000	0.000
Sales growth	0.154	0.139	1,225	0.189	0.173	213	0.147	0.133	1,012	0.000	0.000
Panel C: Industry characteristics											
Market-to-book	1.658	1.517	1,225	1.741	1.543	213	1.640	1.514	1,012	0.063	0.489
3 Year return	-0.145	-0.146	1,225	-0.155	-0.166	213	-0.142	-0.143	1,012	0.720	0.506
Std dev 3 year return	1.289	1.008	1,223	1.408	1.099	213	1.263	0.994	1,010	0.043	0.041
C&I rate spread	2.265	2.060	1,225	2.117	2.040	213	2.297	2.065	1,012	0.000	0.000
Deregulatory event	0.012	-	1,225	0.023	-	213	0.010	-	1,012	0.101	-
Economic shock index	0.000	-0.370	1,182	0.825	0.654	202	-0.170	-0.521	980	0.000	0.000
Tight capital liquidity	0.673	-	1,225	0.531	-	213	0.704	-	1,012	0.000	-

Table 3
Sample descriptive statistics by time period.

This table presents descriptive statistics for the merger waves sample by time period. In Panel A we report the mean, median, and number of observations for the dependent variable and main variable of interest; in Panel B we report components of the economic shock index; and in Panel C we report industry control variables. The sample is further classified into three separate time periods: period 1 is from 1990 to 2000 and includes a distinct aggregate merger wave characterized by the buildup of the dotcom bubble; period 2 is from 2001 to 2007 and includes the period leading up to the recent credit crisis; and period 3 is from 2008 to 2014, which includes the increased merger activity that has developed during the recovery following the 2007-2009 recession. Refer to Appendix for detailed variable descriptions. Statistical tests for differences in means and equality of medians for each characteristic between columns (2) (i.e., period 1) and (4) (i.e., period 3) are also included.

	Full Sample (1)			Period 1 (1990-2000) (2)			Period 2 (2001-2007) (3)			Period 3 (2008-2014) (4)			Difference (p-value) (2) - (4)	
	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median
Panel A: Dependent and main variable of interest														
Merger wave	0.163	0.000	1,225	0.288	0.000	539	0.082	0.000	343	0.050	0.000	343	0.000	-
Asset sale wave	0.174	-	1,225	0.197	-	539	0.210	-	343	0.102	-	343	0.000	-
Panel B: Economic shock variables														
Net income/sales	0.012	0.026	1,225	0.016	0.025	539	-0.003	0.023	343	0.019	0.030	343	0.705	0.016
Asset turnover	0.965	1.044	1,225	1.063	1.180	539	0.914	0.962	343	0.862	0.929	343	0.000	0.000
R&D	0.029	0.010	1,212	0.031	0.012	528	0.028	0.010	341	0.025	0.007	343	0.065	0.002
Capital expenditures	0.045	0.039	1,225	0.053	0.050	539	0.041	0.033	343	0.037	0.031	343	0.000	0.000
Employee growth	0.099	0.091	1,225	0.109	0.102	539	0.096	0.089	343	0.085	0.078	343	0.000	0.000
ROA	0.083	0.103	1,225	0.093	0.111	539	0.074	0.096	343	0.075	0.097	343	0.000	0.000
Sales growth	0.154	0.139	1,225	0.158	0.145	539	0.159	0.140	343	0.144	0.127	343	0.006	0.003
Panel C: Industry characteristics														
Market-to-book	1.658	1.517	1,225	1.702	1.574	539	1.680	1.535	343	1.565	1.425	343	0.005	0.001
3 Year return	-0.145	-0.146	1,225	-0.400	-0.394	539	0.159	0.143	343	-0.046	-0.067	343	0.000	0.000
Std dev 3 year return	1.290	1.008	1,223	1.402	1.123	538	1.490	1.137	342	0.914	0.742	343	0.000	0.000
C&I rate spread	2.265	2.060	1,225	1.906	1.885	539	2.226	2.308	343	2.870	2.970	343	0.000	0.000
Deregulatory event	0.012	-	1,225	0.028	-	539	0.000	-	343	0.000	-	343	0.002	-
Economic shock index	0.000	-0.353	1,182	0.183	-0.093	509	0.178	-0.140	331	-0.445	-0.819	342	0.000	0.000
Tight capital liquidity	0.673	-	1,225	0.462	-	539	0.810	-	343	0.869	-	343	0.000	-

Table 4
Asset sales and acquisition likelihood.

This table presents the effect of asset sales on acquisitions announced over the period 1990-2014 for the universe of US publicly listed firms. We present marginal effects of probit analysis in specifications (1), (2), and (3) and linear probability model (LPM) estimates with firm fixed effects in specification (4). The dependent variable takes the value of 1 if the firm undertakes an acquisition in year *t*, and 0 otherwise. All control variables are measured at year *t*-1. Refer to Appendix for detailed variable descriptions. Year and industry fixed effects, whose coefficients are suppressed, are based on fiscal year and Fama-French 49 industry classification dummies, respectively. The *z*-statistics for probit and *t*-statistics for LPM reported in parentheses are based on standard errors adjusted for heteroskedasticity and firm clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Probit (1)	Probit (2)	Probit (3)	LPM (4)
Asset sale	0.0292*** (17.94)	0.0084*** (2.91)	0.0066** (2.43)	0.0052* (1.84)
Acquisition probability$_{(lagged)}$			0.1179*** (36.70)	
Rated		0.0249*** (5.67)	0.0212*** (5.60)	-0.0069 (-1.27)
Size		0.0098*** (8.38)	0.0081*** (7.95)	-0.0008 (-0.35)
Cash reserves		0.0330*** (3.70)	0.0449*** (5.63)	0.1380*** (11.50)
Leverage		-0.0289*** (-3.92)	-0.0271*** (-4.05)	-0.0730*** (-8.67)
Stock return		0.0224*** (14.07)	0.0215*** (13.25)	0.0162*** (8.89)
Market-to-book		0.0013*** (3.89)	0.0010*** (3.15)	0.0010*** (2.69)
ROA		0.1299*** (11.85)	0.1240*** (12.05)	0.1162*** (10.65)
Industry M&A liquidity		0.1327*** (8.93)	0.1056*** (7.03)	0.1172*** (6.53)
Herfindahl index		0.0233* (1.73)	0.0195* (1.67)	0.0211 (1.55)
Constant				0.0239 (1.60)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	No
Firm fixed effects	No	No	No	Yes
No. of obs.	183,359	81,544	77,292	83,352
Pseudo/adjusted R^2	0.0638	0.0605	0.0970	0.1311

Table 5
Industry asset sale and merger waves.

This table presents the marginal effects of probit regression analysis in specifications (1), (2), and (3) and linear probability model (LPM) estimates with firm fixed effects in specification (4). The dependent variable takes the value of 1 if an industry merger wave occurred in a given year, and 0 otherwise. Merger waves are identified as in Harford (2005). See also Section 2.2. Explanatory variables are measured at the end of year *t*-1. We use a sample of US public and private acquisitions announced over the period between January 1, 1990 and December 31, 2014. Refer to Appendix for detailed variable descriptions. Year fixed effects, whose coefficients are suppressed, are based on calendar year dummies. Industry fixed effects in specification (4), whose coefficients are also suppressed, are based on Fama-French 49 industry classification dummies. The *z*-statistics for probit and *t*-statistics for LPM reported in parentheses are based on standard errors adjusted for heteroskedasticity and industry clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Probit (1)	Probit (2)	Probit (3)	LPM (4)
Asset sale wave	0.1864*** (5.46)	0.1607*** (4.39)	0.1181*** (4.49)	0.1480*** (3.95)
Merger wave$_{(lagged)}$			0.3946*** (8.24)	
Market-to-book		-0.0355 (-1.06)	-0.0219 (-1.15)	0.0195 (1.19)
3 Year return		0.0897** (2.26)	0.0458** (2.19)	0.0665* (1.81)
Std dev 3 year return		0.0240* (1.74)	0.0194* (1.89)	0.0099 (0.64)
C&I rate spread		0.0006 (0.38)	0.0051** (2.34)	-0.0006* (-1.95)
Deregulatory event		-0.0903 (-0.87)	-0.1925** (-2.36)	-0.1657* (-1.84)
Economic shock index		0.0278*** (2.63)	0.0166** (2.28)	0.0037 (0.31)
Economic shock index * Tight capital		-0.0088 (-0.78)	-0.0093 (-1.07)	-0.0062 (-0.59)
Constant				0.1173 (1.43)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	Yes
No. of obs.	833	802	802	1,180
Pseudo/adjusted R^2	0.3503	0.3846	0.5516	0.4625

Table 6
Industry asset sale and merger waves by time period.

This table presents the marginal effects of probit regression analysis by time period. Specification (1) presents the estimates for the period 1 (1990-2000), specification (2) for the period 2 (2001-2007), specification (3) for the period 3 (2008-2014), and specification (4) for the periods 2 and 3 (2001-2014). The dependent variable takes the value of 1 if an industry merger wave occurred in a given year, and 0 otherwise. Merger waves are identified as in Harford (2005). See also Section 2.2. Explanatory variables are measured at the end of year *t*-1. We use a sample of US public and private acquisitions announced over the period between January 1, 1990 and December 31, 2014. Refer to Appendix for detailed variable descriptions. Year fixed effects, whose coefficients are suppressed, are based on calendar year dummies. The *z*-statistics reported in parentheses are based on standard errors adjusted for heteroskedasticity and industry clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Period 1 (1990-2000) (1)	Period 2 (2001-2007) (2)	Period 3 (2008-2014) (3)	Periods 2 & 3 (2001-2014) (4)
Asset sale wave	0.1872***	0.1125*	0.1248**	0.1323***
	(3.57)	(1.75)	(2.46)	(3.24)
Market-to-book	-0.0664	0.0075	-0.0630	-0.0107
	(-1.54)	(0.19)	(-1.10)	(-0.33)
3 Year return	0.1509	0.0875	0.0083	0.0370
	(1.61)	(1.39)	(0.16)	(0.84)
Std dev 3 year return	0.0718***	-0.0038	-0.0110	-0.0039
	(2.85)	(-0.15)	(-0.42)	(-0.21)
C&I rate spread	-0.0565***	0.0036	0.0000	0.0016
	(-3.65)	(1.61)	(0.07)	(1.21)
Deregulatory event	-0.1258			
	(-1.05)			
Economic shock index	0.0253	0.0317**	0.0080	0.0176*
	(1.38)	(2.50)	(0.61)	(1.86)
Economic shock index * Tight capital	-0.0059			
	(-0.28)			
Year fixed effects	Yes	Yes	Yes	Yes
No. of obs.	370	188	244	432
Pseudo R^2	0.3819	0.2105	0.1879	0.1938

Table 7
Granger causality test for industry asset sale and merger waves.

This table presents results from panel vector autoregression and Granger causality tests. Panel A presents panel vector autoregressions with the lagged values of industry merger wave and asset sale wave as our main endogenous variables with control variables from Table 5 as additional exogenous variables. Merger waves are identified as in Harford (2005). See also Section 2.2. The p-values are reported in parentheses from standard errors corrected for heteroskedasticity and industry clustering. Panel B reports the Granger causality Wald tests, following Ahern and Harford (2014), wherein the null hypotheses assume that i) asset sale waves do not Granger cause merger waves, and ii) that merger waves do not Granger cause asset sale waves. We report the $\chi 2$ and p-value for each test. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Predictive vector autoregressions

	Merger wave (1)	Asset sale wave (2)
Merger wave$_{(lagged)}$	0.5652***	**-0.0071**
	(12.32)	**(-0.20)**
Asset sale wave$_{(lagged)}$	**0.1496*** **	0.4534***
	(3.63)	(10.15)
Market-to-book	0.0608	0.0355
	(1.50)	(0.87)
3 Year return	0.0508*	0.0094
	(1.70)	(0.32)
Std dev 3 year return	0.0172	0.0003
	(1.16)	(0.03)
C&I rate spread	-0.0008***	-0.0008**
	(-2.66)	(-2.41)
Deregulatory event	-0.1203	-0.1861
	(-1.49)	(-1.32)
Economic shock index	-0.0107	-0.0208
	(-0.60)	(-1.08)
Economic shock index * Tight capital	0.0022	0.0089
	(0.16)	(0.61)
No. of obs.	1,034	1,034

Panel B: Granger causality

H_0: Industry asset sale waves $\nRightarrow$ Industry merger waves	
Wald χ^2	15.095
(p-value)	0.000
H_0: Industry merger waves $\nRightarrow$ Industry asset sale waves	
Wald χ^2	0.062
(p-value)	0.804

Table 8
Instrumental variable (IV) approach for industry asset sale and merger waves.

This table presents 1st and 2nd stage results of an instrumental variable (IV) approach to test for potential endogeneity from unobservable characteristics of asset sales waves on merger waves. Specification (1) shows the first stage regression estimates measuring the linear probability of asset sale waves, with instrumental variable shown to impact asset sale likelihood, as well as heteroskedasticity-based instruments estimated following Lewbel (2012). Specification (2) provides results from the second stage linear probability model, with merger waves as the dependent variable. Refer to Appendix for detailed variable descriptions. Year fixed effects, whose coefficients are suppressed, are based on fiscal year dummies. The *t*-statistics reported in parentheses are based on standard errors adjusted for heteroskedasticity and industry clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	1st stage (1)	2nd stage (2)
Asset sale wave		0.1978***
		(2.90)
Asset turnover	-0.1615***	
	(-3.34)	
Market-to-book	-0.0253	-0.0216
	(-1.01)	(-1.09)
3 Year return	-0.0006	0.0722**
	(-0.02)	(2.06)
Std dev 3 year return	0.0229**	0.0209
	(2.07)	(1.57)
C&I rate spread	0.0002	-0.0002
	(0.32)	(-0.96)
Deregulatory event	0.0274	-0.0859
	(0.38)	(-0.84)
Economic shock index	0.0420**	0.0193**
	(2.56)	(1.97)
Economic shock index * Tight capital	-0.0292*	-0.0099
	(-1.82)	(-0.99)
Constant	0.1799	0.0828
	(1.00)	(1.12)
Lewbel estimated instruments	Yes	
Year fixed effects	Yes	Yes
No. of obs.	1,180	1,180
Adjusted R^2	0.3349	0.4426
K-P rk Wald F-test	14.77	
LIML size of nominal 10% Wald	3.97	
Hansen J statistic	6.980	
(p-value)	0.4309	
Wu-Hausman		0.4885
(p-value)		0.4847

Table 9
Propensity score matching for industry asset sale and merger waves.

This table presents a test using a propensity score matching (PSM) method to control for potential endogeneity from observable characteristics. We calculate a one-dimensional propensity score, which is a function of observable characteristics used in Table 5, and we use a one-to-one (i.e., nearest neighbor) matching estimator. Specification (1) presents the marginal effects from probit analysis of asset sale waves on merger waves. The sample period is between January 1, 1990 and December 31, 2014 for the universe of US publicly listed firms. Refer to Appendix for detailed variable descriptions. Year fixed effects, whose coefficients are suppressed, are based on fiscal year dummies. The *z*-statistics reported in parentheses are based on standard errors adjusted for heteroskedasticity and industry clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)
Asset sale wave	0.2564***
	(4.41)
Market-to-book	-0.0008
	(-0.01)
3 Year return	0.1931*
	(1.91)
Std dev 3 year return	0.0682**
	(2.01)
C&I rate spread	-0.0006
	(-0.12)
Deregulatory event	-0.1175
	(-0.76)
Economic shock index	0.0038
	(0.15)
Economic shock index * Tight capital	0.0313
	(1.05)
Year fixed effects	Yes
No. of obs.	301
Pseudo R^2	0.3406

Table 10
Long-run operating performance.

This table reports the OLS regression analysis of three-year industry-adjusted operating performance for firms that made focus increasing asset sales, which is the group of asset sellers who divest a unit that has a different 2-digit SIC code relative to their core operations. Refer to the appendix for detailed variable descriptions. Year and industry fixed effects, whose coefficients are suppressed, are based on fiscal year and Fama-French 49 industry classification dummies, respectively. The *t*-statistics reported in parentheses are based on standard errors adjusted for heteroskedasticity and firm clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Post-sale acquisition	0.0177**	
	(2.23)	
Post-sale focus increasing acquisition		0.0172*
		(1.74)
Pre-IAOP$_{t-1}$	0.4417**	0.4423**
	(2.00)	(2.00)
Size	0.0141***	0.0142***
	(3.99)	(3.99)
Asset sale relative size	-0.0102**	-0.0103**
	(-2.09)	(-2.09)
Leverage	0.0209	0.0206
	(0.95)	(0.94)
Cash reserves	-0.0920*	-0.0918*
	(-1.94)	(-1.93)
Book-to-market	0.0002	0.0001
	(0.88)	(0.77)
Asset turnover	0.0301***	0.0304***
	(3.43)	(3.44)
Capital expenditures	0.0369	0.0344
	(0.45)	(0.42)
Constant	-0.0675	-0.0734
	(-0.72)	(-0.77)
Year and industry fixed effects	Yes	Yes
No. of obs.	1,873	1,873
Adjusted R^2	0.3865	0.3859

Table 11
Choice of method of payment and asset sales.

This table presents the marginal effects of probit regression analysis in specifications (1) and (2), unconditional marginal effects of tobit regression analysis in specifications (4) and (5), and LPM and OLS estimates with firm fixed effects in specifications (3) and (6), respectively. The dependent variable in specifications (1), (2), and (3) takes the value of 1 if the method of payment was 100% cash, and 0 otherwise. In specifications (4), (5), and (6), the dependent variable is the percentage of cash used in the transaction. We use a sample of US public and private acquisitions announced over the period between January 1, 1990 and December 31, 2014. Refer to Appendix for detailed variable descriptions. Year and industry fixed effects, whose coefficients are suppressed, are based on calendar year and Fama-French 49 industry classification dummies, respectively. The *z*-statistics for probit and *t*-statistics for LPM, tobit, and OLS reported in parentheses are based on standard errors adjusted for heteroskedasticity and firm clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Probit	Probit	LPM	Tobit	Tobit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
Asset sale (100% coverage)	0.1544***	0.1953***	0.2506***	0.2321***	0.2635***	0.2915***
	(13.60)	(8.17)	(7.01)	(25.26)	(12.17)	(9.45)
Relative size	-0.2064***	-0.3827***	-0.4221***	-0.0544***	-0.1234***	-0.2112***
	(-12.26)	(-7.37)	(-8.85)	(-4.86)	(-4.12)	(-5.06)
Diversifying deal	-0.0014	0.0276	0.0119	0.0037	0.0325**	0.0178
	(-0.17)	(1.47)	(0.50)	(0.51)	(2.13)	(0.95)
Hostile deal	0.1686***	0.1731***	0.1827**	0.1420***	0.1208***	0.1032**
	(5.02)	(2.70)	(2.36)	(5.84)	(2.84)	(1.98)
Tender offer	0.3642***	0.2815***	0.2617***	0.3862***	0.3280***	0.3040***
	(18.37)	(8.87)	(6.51)	(26.75)	(13.61)	(9.81)
Private target	0.0644***	0.0613***	0.0539**	0.1485***	0.0969***	0.0777***
	(5.84)	(2.95)	(2.10)	(14.53)	(4.94)	(3.42)
Competing deal	0.0264	0.0166	0.0137	0.0450**	0.0316	0.0526
	(0.91)	(0.32)	(0.21)	(1.97)	(0.90)	(1.20)
Rating level		0.0171***	0.0137		0.0146***	0.0093
		(3.59)	(1.02)		(3.46)	(0.83)
Size		-0.0371***	-0.0386		-0.0462***	-0.0410*
		(-3.41)	(-1.28)		(-4.62)	(-1.70)
Leverage		0.0375	-0.3279**		0.0967	-0.2994**
		(0.51)	(-2.05)		(1.60)	(-2.46)
Collateral		-0.2007***	-0.5751**		-0.0704	-0.3195
		(-2.71)	(-2.19)		(-1.15)	(-1.45)
C&I rate spread		0.2822***	0.2026***		0.4090***	0.2272***
		(4.71)	(4.66)		(7.33)	(6.49)
Book-to-market		0.0191	0.0538		-0.0005	0.0010
		(1.60)	(1.45)		(-0.05)	(0.03)
Run-up		-0.0337	-0.0341		-0.0247	-0.0267
		(-1.50)	(-1.20)		(-1.25)	(-1.12)
Blockholder ownership		0.0011	0.0134		0.0085	0.0002
		(0.04)	(0.25)		(0.40)	(0.00)
Free cash flows		0.2094**	-0.3753**		0.2713***	-0.1934
		(2.10)	(-2.00)		(3.15)	(-1.38)
Number of analysts		-0.0007	-0.0020		-0.0008	-0.0007
		(-0.62)	(-0.64)		(-0.80)	(-0.24)
Constant			0.3205			0.2849
			(1.32)			(1.32)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	No	Yes	Yes	No
Firm fixed effects	No	No	Yes	No	No	Yes
No. of obs.	15,055	2,475	2,484	15,055	2,484	2,484
Pseudo/adjusted R^2	0.1505	0.3025	0.2293	0.1897	0.3492	0.3136

Table 12
Asset sale measures and industry merger waves.

This table presents the marginal effects of probit regression analysis by SDC and Compustat asset sale wave measures. The dependent variable takes the value of 1 if an industry merger wave occurred in a given year, and 0 otherwise. Merger waves are identified as in Harford (2005). See also Section 2.2. Explanatory variables are measured at the end of year t-1. We use a sample of US public and private acquisitions announced over the period between January 1, 1990 and December 31, 2014. Refer to Appendix for detailed variable descriptions. Year fixed effects, whose coefficients are suppressed, are based on calendar year dummies. The *z*-statistics reported in parentheses are based on standard errors adjusted for heteroskedasticity and industry clustering. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
SDC asset sale wave	0.0947**	
	(2.40)	
Compustat asset sale wave		0.2162***
		(3.01)
Market-to-book	-0.0317	-0.0368
	(-0.99)	(-1.10)
3 Year return	0.0969**	0.0889**
	(2.43)	(2.26)
Std dev 3 year return	0.0264*	0.0277**
	(1.96)	(2.02)
C&I rate spread	-0.0003	-0.0004
	(-0.20)	(-0.28)
Deregulatory event	-0.0918	-0.0732
	(-1.04)	(-0.69)
Economic shock index	0.0333***	0.0214*
	(2.96)	(1.92)
Economic shock index * Tight capital	-0.0097	0.0001
	(-0.80)	(0.00)
Year fixed effects	Yes	Yes
No. of obs.	802	802
Pseudo R^2	0.3625	0.3692