



The determinants of merger waves: An international perspective

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ABSTRACT

One of the most conspicuous features of mergers is that they come in waves that are correlated with increases in share prices and price/earnings ratios. We use a natural way to discriminate between pure stock market influences on firm decisions and other influences by examining merger patterns for both listed and unlisted firms. If “real” changes in the economy drive merger waves, as some neoclassical theories of mergers predict, both listed and unlisted firms should experience waves. We find significant differences between listed and unlisted firms as predicted by behavioral theories of merger waves.

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Mergers have been a topic of considerable interest in the United States for at least a century. Following the first great merger wave that began at the end of the 19th century, several studies tried to explain its causes and effects.³ An “impelling force” behind the mergers was “a wave of frenzied speculation in asset values” (Markham, 1955). Perhaps unsurprisingly, therefore, the average merger during the wave proved to be unprofitable (Hogarty, 1970). Subsequent US merger waves have also coincided with strong stock market advances, and this pattern can be regarded as a major regularity in aggregate merger data.⁴ Less consensus exists over whether mergers during subsequent waves have been profitable or not.⁵

Merger waves have also occurred in the United Kingdom.⁶ Outside of the United States, the United Kingdom and a few other Anglo-Saxon countries little research has been done on mergers, and essentially no studies exist on whether merger waves also occur in non-Anglo-Saxon countries, and if so, whether their causes are the same as in the Anglo-Saxon countries. This paper seeks to fill this void by examining merger activity in the United States, the United Kingdom and Continental Europe over the period 1991–2004.

While much research has been done on the causes and effects of mergers, surprisingly little exists on the causes of merger waves. Recently, however, a few theories have appeared that claim to account for merger waves. Two make the standard assumptions of neoclassical economics – managers maximize shareholder wealth, capital markets are efficient. Jovanovic and Rousseau (2002a) extend the *q*-theory of capital investment into a theory of merger waves caused by well-managed companies with high *qs* increasing their merger activity. Harford (2005) argues that merger waves in the aggregate occur when several industries simultaneously experience shocks that make mergers more profitable. A third theory of merger waves is best characterized as *behavioral* in that it relaxes the neoclassical assumption of capital market efficiency. Shleifer and Vishny (2003, hereafter S&V) hypothesize that many firms become *overvalued* during a stock market boom, and the managers of these firms undertake mergers to exchange their overvalued shares for real

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³ See, for example, Dewing (1921), Livermore (1935), National Industrial Conference Board (1929), and discussion in Hogarty (1970) and Markham (1955).

⁴ Ralph Nelson (1959, 1966) was the first to document the link between merger activity and share prices, and numerous subsequent studies have confirmed this finding. See, for example, Geroski (1984), Melicher et al. (1983) for the US, and Clarke and Ioannidis (1996) and Geroski (1984) for the UK.

⁵ One difficulty in answering this question arises, because most studies of mergers' effects on profits or shareholder wealth do not concentrate on mergers during wave years.

⁶ See, Hannah and Kay (1977), Gärtner and Halbheer (2009) and Resende (1999).

assets.⁷ In this article, we offer an alternative behavioral theory. More mergers occur during stock market booms, because the optimism that prevails in capital markets during such booms weakens the constraints on managers thereby allowing them to undertake wealth-destroying mergers. Each theory is described in greater detail below.

There is reason to expect that mergers may be less frequent in Continental Europe than in the United States and United Kingdom, and that they may have different causes. Because of widely dispersed share ownership in the two Anglo-Saxon countries, “markets for corporate control” exist where one company can buy a majority of another company’s shares and merge it into itself, even if the managers of the target company oppose the merger. In contrast, share ownership is much more concentrated in Continental Europe making it difficult for two companies to merge, if the major shareholders of one are opposed to the deal. This difference between institutions in Continental Europe and in Anglo-Saxon countries may lead to differences in both aggregate merger activity and its causes.

A natural way to discriminate between the effects on merger activity of “real” changes in the economy, like technological advances, and pure stock market phenomena, like overvaluation, is to examine the merger activity of both listed and unlisted acquirers. If real changes in the economy determine merger waves, we would expect that both types of firms are equally affected. Moreover, unlisted firms cannot be overvalued, at least not by the stock market, and they cannot trade overvalued stocks for less overvalued stocks, as the behavioral theory of S&V argues. This article uses data on acquisitions by listed and unlisted companies to test the different theories of merger waves.

We present evidence that merger waves occurred in all three areas at the end of the 20th century – the USA, UK and Continental Europe. These waves were almost exclusively confined to companies listed on stock exchanges in all three areas, which is inconsistent with the two neoclassical theories and which gives support to the two behavioral hypotheses’ claim that merger waves are driven by stock market bubbles. We present regression results, which offer further support for these hypotheses.

The plan of the article is as follows. We begin by reviewing the four hypotheses, which claim to explain merger waves and discuss previous research testing these hypotheses. (To our knowledge, these are the only theories that attempt to explain merger waves.) In Section II, we discuss the data used in our analysis and present evidence that merger waves occurred in each of the three areas for *listed* companies, but not for unlisted companies. Section III contains regression results that offer support for the two behavioral theories of merger waves. One finding – that merger activity is inversely related to the shareholdings of the largest shareholder – is inconsistent with the overvalued shares hypothesis, however. Various robustness checks are discussed in Section IV. Some conclusions are drawn in the final section.

1. Theories of merger waves

In this section we discuss the four main hypotheses that have been put forward to explain merger waves, the existing evidence in their favor, and their implications with respect to mergers by listed and non-listed companies. We first discuss the two neoclassical theories.

1.1. The *q*-theory of mergers

Jovanovic and Rousseau (2002a) (hereafter J&R) treat mergers as purchases of used plant and equipment, and argue that the gap between the *qs* of potential acquiring firms and targets increases at

particular points in time, and this widening difference leads managers to favor purchasing other firms over used capital equipment thus creating a merger wave. In support of their theory they present time-series evidence of a stronger relationship between assets acquired through mergers and firm *qs* than for assets acquired in the form of used plant and equipment.

Under the *q*-theory of *investment*, when a firm’s return on its capital stock exceeds its cost of capital, $q > 1$, and it expands its capital stock. A straightforward extension of the theory to mergers would imply that firms with $qs > 1$ can profitably expand by acquiring assets either in the form of capital investment or other firms.⁸ Since *q* measures returns on a firm’s *existing* assets, it would seem that the *q*-theory would only allow one to explain *horizontal* mergers, i.e., additions to existing capital stock.

An alternative interpretation of the *q*-theory would be that $q > 1$ does not necessarily imply that a firm can profitably expand by acquiring more assets in its base industry, but that it is well managed and could profitably expand in any direction.⁹ Tobin’s *q* under this interpretation is not a measure of the quality of a firm’s assets, but of its management. A stock market boom represents a massive revaluation of the talents of managers, which produces a merger wave.

An obvious question raised by this explanation for merger waves is what caused the market to change its beliefs about the talents of managers? In other work Jovanovic and Rousseau (2002b) argue that stock market booms are caused by major technological advances like the invention of the automobile (1920s boom). The late-1990s stock market boom was a result of innovations in information technology that also led to increased opportunities for profitable mergers. Thus, the *q*-theory of mergers can be formulated as follows. A major technological advance increases the profitability of investment and leads to an increase in many companies’ Tobin’s *qs*. These increases in *qs* generate a stock market boom and merger wave.

Major technological changes affect *all* companies in an economy, not just those listed on stock exchanges. If rising stock prices reflect an increased potential for making profitable acquisitions due to common, underlying technological factors, then *all* firms, not just listed companies, should experience merger waves during stock market upswings. Thus, a further implication of the *q*-theory of mergers is that both listed and unlisted firms undergo a merger wave during a sustained rise in share prices.

1.1.1. Hypothesis, *q*-theory of mergers

The assets acquired by listed companies are positively related to their *qs*. Both listed and unlisted companies experience merger waves during stock market upswings.

1.2. The industry shocks theory

Jarrad Harford (2005) explicitly proposes his “neoclassical explanation of merger waves” as an alternative to the overvaluation hypothesis discussed later.

...merger waves occur in response to specific industry shocks that require large scale reallocation of assets. However, these shocks are not enough. There must be sufficient capital liquidity to accommodate the asset reallocation. The increase in capital liquidity and reduction in financing constraints that are correlated with high asset values must be present for the shock to propagate a wave.... Thus, the explanation for merger waves is intuitive: they require both an economic motivation for transactions and relatively low transaction costs to generate the large volume of transactions (Harford, 2005).

⁸ See Andrade and Stafford (2004), and Erard and Schaller (2002).

⁹ See, for example, Andrade and Stafford (2004), Chappell and Cheng (1984), and Jovanovic and Rousseau (2002b).

⁷ See also, Rhodes-Kropf and Viswanathan (2004), and Rhodes-Kropf et al. (2005).

Harford presents two pieces of evidence in favor of this hypothesis: a clustering of mergers in several industries at the time of a merger wave, and a negative relationship between the spread over the federal funds rate, his measure of financing constraints, and merger activity.

A relationship between borrowing costs and investment, including the acquisition of other firms, might be predicted by any theory of mergers, and will also be tested in our regressions of merger activity below. The evidence linking industry waves to an aggregate wave in mergers must be regarded as mixed. Gartner and Halbheer (2009), for example, were unable to identify a concurrence of industry waves in their econometric investigation of the 1995–2000 wave.

Where J&R's explanation for merger waves rests on the existence of an underlying common technological shock, Harford's (2005) theory assumes the existence of numerous different shocks – some technological, some regulatory, and some taking still other forms.¹⁰ The two theories are similar, however, in postulating real shocks to the economy that increase the profitability of mergers. Such industry shocks should impact listed and unlisted firms alike and produce merger waves across both types of companies.

1.2.1. Hypothesis, industry shocks theory of mergers

Merger activity during merger waves is clustered in particular industries. Both listed and unlisted companies experience merger waves during stock market upswings.

1.3. The managerial discretion theory

Under the managerial discretion theory, managers get utility from their firms' growth either because their incomes are tied to growth, or because they get "psychic income" from managing a larger firm.¹¹ The constraint on the pursuit of growth is the threat of takeover, which is inversely related to q . Thus, managers' utility can be expressed as a function of the growth of their firms, g and q , $U = U(g, q)$, where $\partial U / \partial g > 0$, $\partial^2 U / \partial g^2 < 0$, $\partial U / \partial q > 0$, and $\partial^2 U / \partial q^2 < 0$.¹² Defining M as the amount of assets acquired through mergers, and setting $g = g(M)$, we can maximize $U(g, q)$ with respect to M to determine the utility maximizing level of growth through mergers. This yields the following first order condition:

$$(\partial U / \partial g)(\partial g / \partial M) = -(\partial U / \partial q)(\partial q / \partial M) \quad (1)$$

Since $\partial U / \partial g > 0$, $\partial g / \partial M > 0$, and $\partial U / \partial q > 0$, Eq. (1) cannot be satisfied if $\partial q / \partial M > 0$. For any merger that increases q no trade-off between growth and security from takeovers exists. Growth-maximizing managers undertake all mergers that increase q . Their behavior differs from managers who maximize shareholder wealth only with respect to mergers that decrease q . Fig. 1 depicts the relationship in Eq. 1 for mergers that lower q . When no mergers of this type are undertaken, q is at its maximum and the risk of takeover is minimized. When the relationship between q and M yields a $-(\partial U / \partial q)(\partial q / \partial M)_N > 0$, a utility-maximizing manager undertakes M_N of value destroying mergers.

During stock market booms the degree of optimism in the market rises dramatically. As Galbraith (1961, p. 8) observed, an "indispens-

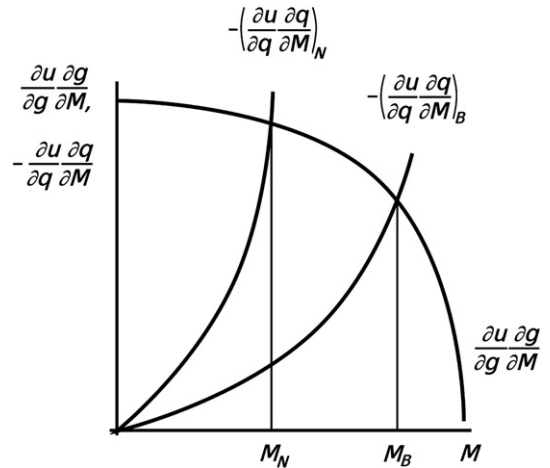


Fig. 1. The managerial trade-off.

able element of fact" during stock market bubbles is that individuals "build a world of speculative make-believe. This is a world inhabited not by people who have to be persuaded to believe but by people who want an excuse to believe." These excuses to believe take the form of "theories" as to why share prices should rise to unprecedented levels, why the economy has entered a "new era" (Shiller, 2000, Ch. 5). Prominent among these are "theories" about wealth increases from mergers. The market begins to believe that certain types of mergers – by conglomerates in the 1960s, media companies in the 1990s – will generate synergies and the announcement of these types of mergers is greeted favorably. Managers are free to undertake such mergers without fear of their company's share price taking a steep fall.

Thus, merger announcements, that would under normal conditions result in large declines in acquirers' share prices, produce only modest declines during a stock market boom, or even share price increases. This shifts $-(\partial U / \partial q)(\partial q / \partial M)$ to the right, as in Fig. 1. The firm acquires more assets through mergers, M_B , since q does not drop by as much or perhaps even rises when a merger is announced. Under the managerial discretion theory, merger waves occur during stock market booms, because the optimism prevailing in the market allows growth-seeking managers to undertake more wealth-destroying mergers than they safely can under normal conditions. This is not the case for unlisted firms, since for them the takeover constraint and/or the monitoring intensity by the owners of closely-held companies are not affected by temporary stock market booms.

Evidence in support of the managerial discretion theory is provided by the many studies that find weak or negative effects of mergers on profitability and sales.¹³ Additional evidence is provided in event studies of the returns to acquirers' shareholders. Although returns to acquirers at merger announcements are generally quite small and of varying signs, over long post merger windows many studies have found sizeable, negative returns. For the period 1955–87, Agrawal, Jaffe and Mandelker (1992) estimate cumulative abnormal return to acquirers over five-year windows of -10% . Significant negative post-merger returns were estimated for the 1950s, 1960s and 1980s, but insignificantly positive returns were estimated for the 1970s. The results for the '60s and '80s are consistent with the hypothesis that merger waves are fueled by stock market optimism and managers take advantage of this optimism by undertaking wealth-destroying mergers. The depressed share prices of the 1970s reduced the number of mergers that fit the managerial discretion theory, and thus were not followed by losses even over long windows.

¹⁰ Michael Jensen (1993) can be said to have offered an early formulation of the industry shocks hypothesis, although he did not use this expression. Mitchell and Mulherin (1996) appear to be the first to have used it. They presented evidence of merger waves in several industries during the 1980s. Unlike Harford, however, they did not show that an increase in the number of industries experiencing waves had produced an aggregate wave. Gartner and Halbheer (2009) fail to identify a wave in aggregate merger activity in the US during the 1980s.

¹¹ Robin Marris (1964, 1998) was the first to posit growth as an objective for managers, and Mueller (1969) applied the theory to explain the conglomerate merger wave of the late 1960s. For recent evidence linking managerial income to growth through mergers, see Khorana and Zenner (1998).

¹² A further justification for including q in the managers' utility function would be that managers own shares in the firm.

¹³ See, surveys by Scherer and Ross (1990), Caves (1989), and Mueller (2003a), Ch. 9. See also Gugler et al. (2003).

Loderer and Martin (1992) estimate returns for long windows over several different time periods and obtain only one significant post-announcement abnormal return – a negative return for mergers during the conglomerate merger wave of 1966–1969, which accompanied a stock market rally. Mueller and Yurtoglu (2007) estimate negative abnormal returns of 18 percent for acquirers over a time period that includes the merger wave of the late 1990s. No study of which we are aware has estimated *positive* returns to acquirers for mergers undertaken during the 1960s and 1990s stock market booms.

Similar results exist for the United Kingdom. Higson and Elliott (1998) find mergers in the UK over the periods 1975–1980 and 1985–1990 to be followed by significant wealth losses to acquirers, while over a period of sluggish stock price movements (1981–84), mergers were followed by significant *positive* abnormal returns. Gregory (1997) estimates a significant – 12.5% abnormal return for acquirers between 1984 and 1992, when stock prices in the UK were generally rising.¹⁴

The managerial discretion theory assumes the existence of a principal/agent conflict between the managers and shareholders regarding growth through mergers. As the fraction of shares held by a manager increases the cost to her of wealth-destroying mergers increases and she should be less inclined to undertake such mergers. In family-controlled firms, one or more members of the family are often part of management, and thus for these companies we anticipate a negative relationship between the fraction of shares held by the largest shareholder and the assets a company acquires. Our data do not identify whether the largest shareholder is a part of the management, but even when the largest shareholder is not a manager, her ability to block a wealth-destroying merger is expected to increase with the fraction of shares she holds. We thus obtain.

1.3.1. Hypothesis, managerial discretion theory of mergers

The merger activity of listed companies is positively associated with the degree of optimism in the stock market. The merger activity of unlisted companies is unrelated to the degree of optimism in the stock market. The merger activity of both listed and unlisted companies is inversely related to the fraction of shares held by the largest shareholder.

1.4. The overvalued shares theory

Shleifer and Vishny (2003) assume that some firms' share prices become *overvalued* during stock market booms. Their managers know their shares are overvalued, and wish to protect their shareholders from the wealth loss that will come when the market lowers its estimates to their warranted levels. They accomplish this by exchanging their overvalued shares for the real assets of another company. Targets' managers are assumed to have short time horizons, so they too gain by “cashing in” their stakes in their firms at favorable terms. Merger waves occur, because the number of overvalued companies increases during a stock market boom.

Rhodes-Kropf and Viswanathan (2004) also predict merger waves during stock market booms, but offer a different explanation for why target managers accept overvalued shares. They claim that the optimism in the market during a boom makes it difficult for target managers to judge whether the price of a bidder's shares is high due to over optimism, or because it reflects the expected synergies from the merger, and thus they mistakenly become willing partners in mergers that do not generate synergies.

When testing the overvalued shares theory, one encounters a methodological difficulty. If a researcher can identify overvalued firms, so too presumably can the capital market and the firms cease to be overvalued. This conundrum notwithstanding, several studies have claimed support for the theory using various measures of overvalu-

ation (Verter, 2002; Ang and Cheng, 2003; Dong, Hirshleifer, Richardson and Teoh, 2006; and Rhodes-Kropf et al., 2005). These measures typically involve ratios of market to book value of equity or their reciprocal.

Since only listed companies have shares outstanding, the overvalued shares theory, like the managerial discretion theory, predicts that merger activity is positively related to share price movements only for listed firms. The two theories differ, however, with respect to their predictions for the shareholding of the largest shareholder of the acquiring company. If he can influence whether a merger takes place or not, and he knows that the company's shares are overvalued, he will benefit as a shareholder from a merger in proportion to the fraction of shares that he owns. This logic obviously does not apply for unlisted companies, and under the assumption that the average merger does not increase the profitability of the acquirer, we still expect a negative relationship between the fraction of shares held by the largest shareholder of an acquirer and assets acquired through mergers for unlisted companies. Thus, we have.

1.4.1. Hypothesis, overvalued shares theory of mergers

The merger activity of listed companies is positively associated with the degree of optimism in the stock market. The merger activity of unlisted companies is unrelated to the degree of optimism in the stock market. The merger activity of listed companies is positively related to the fraction of shares held by the largest shareholder in the acquiring firm, while the merger activity of unlisted companies is inversely related to the fraction of shares held by the largest shareholder.

1.5. Discussion

Under the q -theory of mergers, a company with a high q is predicted to acquire more assets than one with a low q . A q of 2.5 should imply the same amount of assets acquired when the stock market is low as when it is high. All of the explanatory power in a merger equation using firm-level data should come from the company qs , not some aggregate measure like the Dow Jones or S&P Indexes. In contrast, these indexes should be significant under the managerial discretion theory even with acquirer qs in the equation, because they capture the *market's optimism*.

The financing cost component of the industry shocks hypothesis only applies to *borrowing* costs being low. High share prices or qs do not imply low financing costs when using equity, since the theory assumes capital market efficiency, so that equity is on average always correctly priced. In contrast, the overvalued shares theory cannot explain acquisitions financed by issuing debt or out of cash. Shareholders of a company with overvalued shares do not benefit if it uses cash to make an acquisition. Under the managerial discretion theory interest rate levels, share prices and cash flows might all be related to merger activity. The managerial discretion theory emphasizes the interest of managers in growth and the weakening constraint on their actions when optimism is high in the market. If a company's shares are overvalued, this is an additional reason to pursue growth and to use shares to finance it. If cash flows are high, they become an attractive means for growth.

2. Patterns of merger activity, 1991–2004

2.1. Data Sources

The information on mergers comes from “Worldwide Mergers & Acquisitions,” produced by Thomson Financial Securities Data (TFSD). It includes all corporate transactions involving at least 5% of the ownership of a company with a transaction (deal) value of at least 1 million US dollars. Public and private transactions are covered. In total, for the period 1978 to June 2005, TFSD records 100,233 deals for

¹⁴ For additional evidence and discussion see the surveys by Agrawal and Jaffe (2000), and Mueller (2003b).

the five European countries that we have examined: Austria, Germany, Italy, France and United Kingdom.

A necessary task was to combine the transactions with the financial data available from the Amadeus database from Bureau van Dijk. To this end, we applied an approximate string matching algorithm, matching via company names for each country. Checking a random sample of the automatic matches showed that virtually all matches with similarity above 90% were correct. Below this threshold, similarity was checked manually, amounting to about 24,000 deals. Thus, 52.6% of all transactions were matched to an Amadeus company. Data restrictions reduce the sample available for estimation considerably (see Table 1). Besides the financial data, we also used information on the largest shareholder from Amadeus when available. To obtain financial information for the US sample, we combined TFSD data with the Global Vantage database (GV). GV contains financial information for listed companies. TFSD lists 193,015 US deals. Once again, the number of deals we could use was to a large extent determined by data restrictions. Table 1 shows the number of deals in TFSD, the share of deals matched and the reasons for reductions of the number of deals as originally reported in TFSD.

A possible difficulty in constructing our sample is that we introduce a sample selection bias, because we cannot match all companies that merged to the Amadeus data. In particular, one worries that we might systematically under represent unlisted companies, because accounting data are less-readily available for them. To determine whether such a bias exists, we ran a probit regression to see whether the probability of a match was related to whether the acquirer was listed or not. We also included in the equation the log of the acquirer's total assets, $\ln(A)$, the target's size as measured by the deal value, D , a control variable to distinguish continental Europe from the UK, and year dummy variables. Ignoring the coefficients on the control variable for continental Europe and the year dummies, we obtained the following results (t statistics are under the coefficients):

$$\pi_m = 5.2 \cdot 10^{-06} D - 0.009 \ln(A) - 0.010 \text{List}, \quad n = 4,263, \text{pseudo } R^2 = 0.038$$

(0.47) (0.95) (0.05)

The probability of a match is insignificantly related to whether an acquirer was listed or not, and to the sizes of both the acquirer and target company. Our approach to matching companies in the two data bases does not seem to introduce any sample selection bias. The reason, we believe, is that Amadeus covers hundreds of thousands predominantly unlisted companies.

Table 1

Deals from Europe matched to Amadeus for 1991–2004, deals from the US, matched to Global Vantage for 1991–2002.

Deals ^a	Restriction	Available	Percent
<i>Europe</i>			
100,233	TFSD deal matched to Amadeus	52,727	52.6
52,727	1991 ≤ year ≤ 2004	35,290	66.9
35,290	One deal (largest) per year and company ^b	22,997	65.1
22,997	Deal value available	11,821	51.4
11,821	Necessary financial data in Amadeus	7457	63.1
7457	Share of largest owner available	3207	43.0
3207	[final sample]		
<i>US</i>			
193,015	TFSD deal matched to GV and 1991 ≤ year ≤ 2002	37,867	0.241
37,867	One deal (largest) per year and company ^c	19,914	0.526
19,914	Deal value available	12,648	0.635
12,648	Necessary financial data in GV	10,612	0.839
10,612	Share of largest owner available	2560	0.241
2560	[final sample]		

TFSD: Thompson Financial Securities Data; GV: Global Vantage Database.

^a Starting value is the number of deals in TFSD until June 2005.

^b Europe: Yearly deals per company: min = 1, max = 25, average = 1.53.

^c US: Yearly deals per company: min = 1, max = 86, average = 1.90.

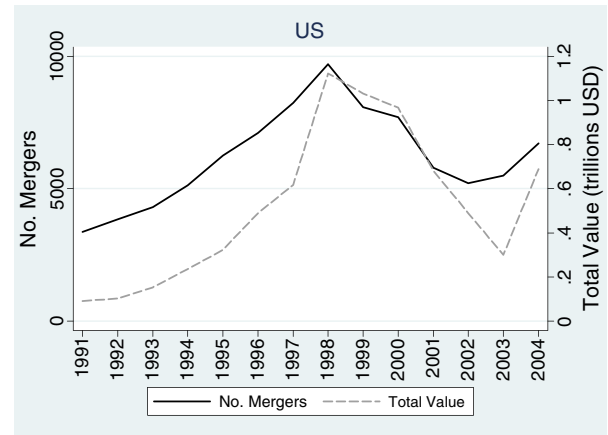


Fig. 2. Number and total deal values of all mergers for the US.

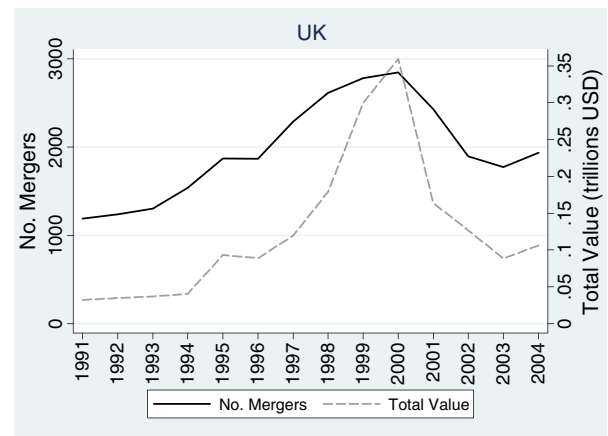


Fig. 3. Number and total deal values of all mergers for the UK.

We use an estimate of the price-earnings (P/E) ratio in a country as our proxy for optimism in the stock market. It was derived for all companies where data were available in GV for a particular year on the variables “income before extraordinary items” (inc) and “market value” (mv) ($P/E = mv/inc$). Each observation is calculated as a weighted sum of the individual P/E ratios, with market values as weights.

3. Merger patterns

Figs. 2–4 present the numbers of completed mergers and total deal values for the USA, UK and Continental Europe over the period 1991 to 2004. The numbers of mergers for each year are given along the left vertical axes, with total deal values along the right axes. Both represent the population of Mergers and Acquisitions that is included in the TFSD, i.e. prior to any selection for our estimation sample. It is readily apparent that all three areas experienced merger waves at the end of the 1990s.¹⁵ Table 2 presents the numbers of domestic and cross-border mergers for the three areas. Waves in both types of mergers are again readily apparent.

The behavioral hypotheses link merger waves to the psychology and optimism in the stock market. Figs. 5–7 present the curves

¹⁵ Gärtner and Halbheer (2009) present econometric evidence establishing that the merger activity in the USA and UK at the end of the 1990s was indeed a wave – that is a statistically significant surge in mergers compared to earlier years.

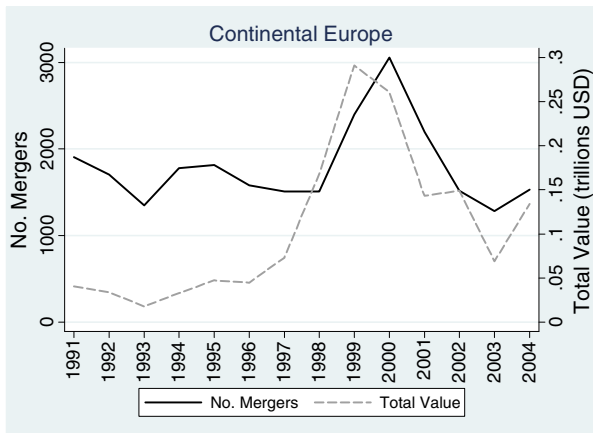


Fig. 4. Number and total deal values of all mergers for Continental Europe.

Table 2
Domestic vs. cross-border mergers.

	US		UK		Cont. Eur.	
	Dom.	Cross-b.	Dom.	Cross-b.	Dom.	Cross-b.
1991	2991	371	884	305	1490	417
1992	3392	443	975	262	1341	362
1993	3780	527	1021	280	1054	295
1994	4495	634	1208	332	1371	407
1995	5447	800	1476	395	1349	466
1996	6140	964	1448	420	1172	409
1997	7109	1132	1805	483	1089	418
1998	8277	1423	2087	528	957	551
1999	6866	1218	2118	661	1531	869
2000	6387	1313	2143	701	1969	1087
2001	4835	947	1844	584	1401	796
2002	4535	671	1538	359	1037	480
2003	4813	682	1411	364	884	398
2004	5734	982	1474	464	1103	426

indicating the total deal values of acquisitions by listed and unlisted companies in each area, and the weighted averages of company P/E ratios. The time series are represented as indices to ease comparison between the groups. Once again, the deal values series are constructed from the TFSD population of M&A activity. Mergers by listed companies peak in all three areas near the peaks of the weighted average P/E ratios. No waves are visible for mergers by unlisted companies in the UK and Continental Europe, however, and only a small blip in acquisitions by unlisted firms occurred in the USA, and its peak lagged the peak for listed companies by about two years.

That there was no wave for unlisted acquirers but only for listed acquirers is also evident in mean statistics. For example, the total of deal values of acquisitions by listed firms increases 4-fold (USA), 4.5-fold (UK) and 6(!)-fold for Continental Europe in wave as compared to non-wave years.¹⁶ In contrast, only modest increases are observed for unlisted firms. Moreover, if common shocks either to specific industries or to the whole economy were responsible for the observed wave pattern of merger activity, one would expect a large correlation between listed and unlisted firm merger activity particularly during wave years (since the common shock caused it). Table 3 presents evidence to the opposite. The correlation coefficients between (quarterly) listed and unlisted firm merger activity decrease in wave years, most markedly in the USA from 0.7 in non-wave years to 0.06 in wave years (UK: from 0.6 to 0.1; CE: from 0.27 to 0.18). Thus, there is a

¹⁶ The determination of wave and non-wave periods was made using the estimates from the switching model described below.

complete decoupling of merger activity between listed and unlisted acquirers during waves!

Although the existence of merger waves in all three areas is readily apparent in Figs. 2 through 7, the naked eye does not allow us to identify the starting and end dates of each wave, or to establish rigorously that waves did occur for listed firms and only for them. To make these determinations, we employ the switching model first developed by Hamilton (1989, 1994) to identify periods of recession, and later used by Town (1992), and Gärtner and Halbheer (2009) to test for the existence of merger waves. The model utilizes maximum likelihood methods to identify a switch in time series data from one regime to another, in our case between wave and non-wave periods for mergers. With four lags and allowing different means for the different states, the model is:

$$y_t - \mu_{s_t} = \varphi_1 (y_{t-1} - \mu_{s_{t-1}}) + \varphi_2 (y_{t-2} - \mu_{s_{t-2}}) + \varphi_3 (y_{t-3} - \mu_{s_{t-3}}) + \varphi_4 (y_{t-4} - \mu_{s_{t-4}}) + \varepsilon_t.$$

s_t names the state in which the process is. There are two possibilities: y_t is in a high state, that is, a merger wave, or in a low state. The probability of being in a certain state at t is estimated with a maximum likelihood technique, together with the state means and the autoregressive coefficients.

To distinguish a merger wave from the upward drifts in merger activity apparent in the left-hand-side panels of Figs. 5–7, the six series were detrended before estimating the switching model. The results of the estimations using quarterly data are illustrated in the right-hand-side panels of Figs. 5–7. Time in yearly quarters is given along the horizontal axis with the probability of a switch in regime given along the vertical axis. For listed firms in the US, the probability of being in a wave starts to rise in 1994. In the first quarter of 1996, the threshold of a probability larger than 0.5 of being in a wave is surpassed and the US is judged to have entered a merger wave. For several quarters around 1998, the probability of being in a merger wave equals one. After the first quarter of 2000 the results indicate that the merger state has been left and the process falls back into the non-wave state. The shaded area identifies the period of the wave for listed companies.¹⁷ In contrast, the merger data for non-listed firms reveal no switch between high and low states (dashed line along horizontal axis).

The same conclusions hold for the UK and Continental Europe (Figs. 6 and 7). Switches to high states of merger activity can only be identified for listed firms, the exact wave periods again indicated by the shaded areas. The maximum likelihood switching model identifies the longest merger wave for listed firms in the UK, and the shortest wave in Continental Europe.¹⁸ In none of the three areas, was a wave identified in the merger data for unlisted companies. To our knowledge, ours is the first study to rigorously establish the existence of a merger wave in Continental Europe at the end of the 20th century.

These patterns are inconsistent with the predictions of two neoclassical theories of merger waves, but are precisely what one anticipates from the behavioral hypotheses. Further evidence in favor of these hypotheses is presented in the next section.

4. Tests of the theories

In this section we present additional evidence in support of the behavioral theories by estimating models of the assets acquired by individual companies. The key prediction is that the assets acquired

¹⁷ Gärtner and Halbheer (2009) identify the 4th quarter of 1995 as the start of the merger wave in the US, while we estimate the first quarter of 1996. They do not estimate an end to the wave as we do.

¹⁸ Gärtner and Halbheer (2009), however, do not identify a wave in their data for the UK.

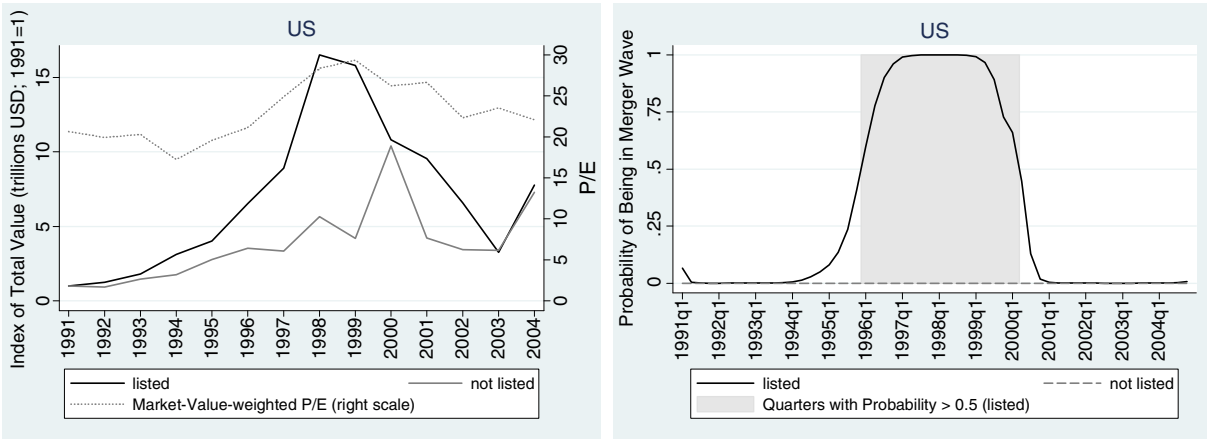


Fig. 5. Indexes of total deal values of listed vs. not-listed acquirers, and P/E for the US (left); estimated probabilities of being in a merger wave (right).

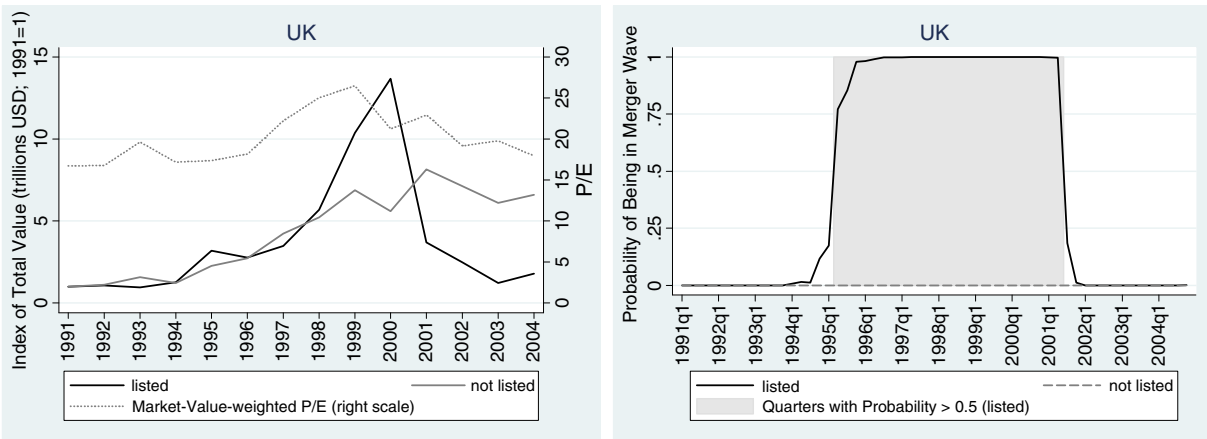


Fig. 6. Indexes of total deal values of listed vs. not-listed acquirers, and P/E for the UK (left); estimated probabilities of being in a merger wave (right).

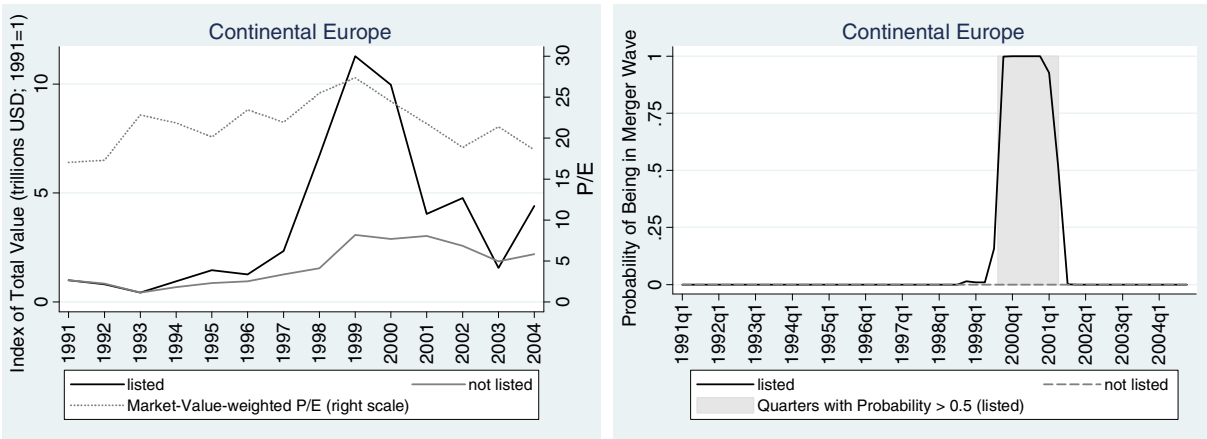


Fig. 7. Indexes of total deal values of listed vs. not-listed acquirers, and P/E for Continental Europe (left); estimated probabilities of being in a merger wave (right).

by listed companies vary with market optimism, as measured by the aggregate P/E ratio, while assets acquired by unlisted companies do not depend on the aggregate P/E.

As a second macroeconomic variable, we include the spread between the federal/national interest rate (Spre) (Austria, Germany, Italy, until 1998: discount rate; France, until 1998: main refinancing

rate; Austria, Germany, France, Italy, from 1999: ECB main refinancing rate; UK: official bank rate; US: federal funds rate) and industrial loan rates (Austria, France, Germany, UK: corporate bond yield, US: commercial and industrial loan rate, Italy: lending interest rate). Since unlisted companies find it harder to issue shares to make acquisitions, their merger activity should be more sensitive to their

Table 3
Wave periods and correlations.

	Wave	Non-wave
<i>a. Wave and non-wave periods</i>		
US	1996:1–2000:1	1991:1–1994:4 2000:2–2004:4
UK	1995:2–2001:2	1991:1–1995:1 2001:3–2004:4
Cont. Eur.	1999:1–2001:2	1991:1–1998:4 2001:3–2004:4
<i>b. Correlation coefficients of total deal values, listed vs. not-listed</i>		
US: listed, not-listed	0.057 (0.370)	0.671 (0.000)
UK: listed, not-listed	0.114 (0.599)	0.607 (0.000)
Cont. Eur: listed, not-listed	0.178 (0.623)	0.265 (0.075)

Note: p-values in parentheses. Quarterly data was used to calculate these correlations.

ability to raise funds by borrowing.¹⁹ We thus predict a negative coefficient on Spre, which is larger in absolute value for unlisted than for listed companies. This variable was also part of Harford's test of the industry shocks hypothesis.

The key micro-level variable for discriminating between the managerial and overvaluation theories is the ownership stake of the largest shareholder, S . The managerial discretion theory predicts a negative coefficient on S – controlling shareholders avoid wealth-destroying mergers, if their stakes are large – while the overvaluation theory predicts the opposite. The more shares the largest shareholder of an overvalued company has, the greater is her personal gain from trading them for the correctly valued/less overvalued assets of another company. If the managers of unlisted companies might also be empire-builders, then a negative coefficient for the largest shareholder's ownership stake can also be expected.

For a firm that overinvests, the marginal return on investment is below its neoclassical cost of capital. Raising funds externally will seem more expensive than using internal cash flows. Cash flows have, therefore, been a key variable in the literature for distinguishing between the managerial discretion and neoclassical theories of the determinants of investment and R&D.²⁰ Cash flows are thus included in our model, as an additional way to discriminate the managerial discretion theory from the others.²¹

The bigger a firm is, the more expensive it is to take it over and replace its management. Thus, managers of large companies have more discretion to pursue their own goals and the managerial discretion theory predicts a positive coefficient on firm size. None of the other theories makes a prediction for this variable, although one might also simply think of it as a control variable. We also include leverage as an additional control variable. Since debt is one source of finance for mergers, one might predict a negative coefficient on debt – the higher a company's debt, the more constrained it is in financing acquisitions by issuing debt. On the other hand, high leverage may be due to past mergers and may signal a growth-oriented management. This logic predicts a positive coefficient on debt.

The basic model estimated thus looks as follows:

$$M_{it} = a + bP/E_t + cSpre_t + dS_{it} + eCF_{it-1} + f\ln(A)_{it} + gLev_{it} + \mu_{it} \quad (2)$$

¹⁹ Unlisted firms may make an IPO and/or raise funds via a capital increase from private investors and/or make a share swap. This, however, entails much larger transaction costs than for listed firms, thus we expect a larger sensitivity to interest rates for unlisted firms.

²⁰ See, Grabowski and Mueller (1972), Gugler et al. (2004), Hay and Liu (1998), and Vogt (1994).

²¹ To our knowledge Schwartz (1984) is the only study testing the MDH for mergers. He does not link his results to merger waves, however.

where M_{it} is the assets acquired relative to the acquirer's total assets in year t by firm i , P/E_t is the weighted average P/E in t , Spre is the interest rate spread in t , S_{it} is the fraction of outstanding shares held by firm i 's largest shareholder, CF_{it-1} is i 's lagged cash flows, $\ln(A)_{it}$ is the natural log of total assets, Lev_{it} is leverage, and μ_{it} is the error term. Eq. 2 is estimated separately for the United Kingdom and Continental Europe with separate coefficients estimated for each variable for listed and unlisted companies.

Instead of using the assets acquired relative to the acquirer's own size, we might have simply used assets acquired as the dependent variable. Such a specification would have greatly enhanced the explanatory power of the acquirer's size – little firms seldom buy giant companies. This choice of dependent variable would also greatly increase the danger of outliers affecting the results. Our measure of merger activity should still identify waves. For some firms M_{it} goes from zero to >0 during a wave, for others it increases in magnitude. We would have preferred to include intangible capital as well as physical assets in the deflator of M_{it} , but the R&D data needed to calculate intangible capital stocks are unavailable for most UK and Continental European companies.

Unfortunately, our data source did not provide data on acquisitions by unlisted US companies, so the model could only be estimated for listed firms. We present these estimates for the United States for comparison purposes, although they do not allow us to discriminate between the different theories as well as when we have data for both types of companies. Since all US companies are listed, we are also able to include Tobin's q in the equation. The managerial discretion, overvaluation and q -theories all predict a positive coefficient.

Table 4 presents means of the variables used in the regression analysis except that we report mean total assets rather than mean log of assets, which is the variable in the regressions. A–L next to a variable indicates that it is a mean for listed companies. An NA prior to a variable indicates a mean for non-acquiring companies, which serve as the control group. The average size of an acquisition by a listed company is largest for Continental Europe and smallest for the UK. The largest shareholder's fraction of ownership is largest for Continental Europe and smallest for the USA. Unsurprisingly, the largest shareholders of listed companies have smaller holdings than for unlisted companies. Cash flows as a fraction of total assets do not vary greatly except for the USA, where acquirers' cash flows average more than double those of non-acquirers. Listed companies are generally bigger than unlisted companies, acquirers are bigger than non-acquirers. Relative to their size, unlisted companies acquire smaller amounts of assets than listed companies – in Continental Europe only about a tenth as much (see, M and M–L rows). Finally, acquirers have higher qs than non-acquirers.

Our models might be estimated twice, once as a probit regression to determine the probability that a company undertakes an acquisition, and a second time as a Tobit regression to take into account differences in target sizes. Both probit and Tobit regressions were estimated, but only the Tobit results are reported, because they differ from the probit results only with respect to the sizes of the coefficients on different variables – the same variables that explain whether or not a firm undertakes a merger in a particular year explain the amount of assets acquired. The close similarity between the probit and Tobit results also implies that there was little to be gained from adopting Heckman's (1976) two-stage estimation procedure for censored data.

Table 5 presents the regression results. In the left side of the table appear the results for the full sample of companies, listed and unlisted. The numbers in the first column, labeled Unlisted Companies, are the coefficients on the respective variables, with t -values given below the coefficients for a comparison with zero. In the second column, labeled Listed Difference, are the coefficients on the respective variables and t -values for a test of whether the coefficient for listed companies is significantly different from that for the unlisted

Table 4
Variable means wave/non-wave.

		UK	Cont. Eur.	USA
M	Non-wave	0.0032	0.0007	
	Wave	0.0056	0.0013	
M-L	Non-wave	0.0215	0.0078	0.0234
	Wave	0.0398	0.0150	0.0400
S	Non-wave	92.27	79.94	
	Wave	89.15	74.05	
S-L	Non-wave	19.21	45.61	19.66
	Wave	17.12	43.48	18.45
NA S	Non-wave	93.64	74	
	Wave	88.75	74.16	
NA S-L	Non-wave	38.56	61.13	22.44
	Wave	29.88	60.67	21.59
CF	Non-wave	0.097	0.069	
	Wave	0.093	0.06	
CF-L	Non-wave	0.067	0.072	0.053
	Wave	0.10	0.06	0.06
NA CF	Non-wave	0.07	0.069	
	Wave	0.081	0.07	
NA CF-L	Non-wave	0.05	0.073	0.009
	Wave	0.073	0.072	0.013
A	Non-wave	1108.18	3569	
	Wave	506.74	1544.43	
A-L	Non-wave	3621.57	8127.85	7276.44
	Wave	1968.3	5591.16	7039.95
NA A	Non-wave	280.68	120.5	
	Wave	189.28	100.16	
NA A-L	Non-wave	1590.2	1155.97	1886.97
	Wave	812.07	660.96	2084.53
Lev	Non-wave	0.21	0.24	
	Wave	0.21	0.22	
Lev-L	Non-wave	0.20	0.22	0.24
	Wave	0.20	0.21	0.27
NA Lev	Non-wave	0.15	0.16	
	Wave	0.14	0.15	
NA Lev-L	Non-wave	0.19	0.19	0.24
	Wave	0.16	0.19	0.24
q-L	Non-wave	1.02	1.25	1.63
	Wave	1.59	1.93	1.88
NA q-L	Non-wave	0.98	1.11	1.56
	Wave	1.32	1.49	1.78

Note: Variables are acquired assets over total assets (M), acquired assets (D), share ownership of largest shareholder (S), cash flow over total assets (CF), total assets (A), leverage (Lev), and Tobin's q (q). A-L next to a variable indicates that it is a mean for listed companies. An NA prior to a variable indicates a mean for non-acquiring companies.

companies. The third column combines the two coefficients and gives the implied coefficient for the listed companies. The numbers in this column may not always equal the sum of the coefficients in the other two columns, because the sum was made using estimates to more decimal places. The columns on the far right are estimates from regressions limited to acquirers and non-acquirers that were both listed companies. The estimated coefficients need not equal those in the third column on the left side of the table, because the control group of non-acquirers differs.

The coefficient on the weighted average P/E ratio for unlisted companies in the UK is -0.018 and is significant at the 1% level. Unlisted companies actually buy fewer assets through mergers when share prices are relatively high. This may be because the prices of possible targets rise during a stock market boom making the purchase of other companies more expensive. The coefficient on the P/E ratio is both significantly greater for listed companies and positive as predicted by both the managerial and overvaluation theories.

The shares held by the largest shareholder in the UK are negatively related to assets acquired with the coefficient for listed companies being roughly four times larger than for unlisted companies. This result is consistent with the managerial discretion hypothesis, but contradicts the overvaluation hypothesis. If the motivation behind mergers is to trade overvalued shares for real assets, then one would

Table 5
Regression results.

		UK			US	
		Unlisted companies	Listed difference	Listed	Listed firms only	
P/E		-0.018	0.025	0.007	0.004	0.003
		-9.1	14.4	4.3	1.9	1.7
S		-0.0007	-0.0027	-0.0034	-0.0017	-0.0005
		-3.3	-9.5	-20.0	-5.5	-2.1
CF		0.251	0.220	0.471	0.142	0.138
		5.4	3.6	11.7	3.2	5.3
ln(A)		0.037	-0.007	0.029	0.023	0.034
		13.4	-2.3	13.2	8.8	15.8
Lev		0.099	0.042	0.141	0.074	0.147
		5.2	1.4	6.2	2.7	6.9
Spre		-0.049	0.054	0.005	-0.019	-0.191
		-9.2	9.5	1.2	-3.6	-8.8
q					0.032	0.029
					9.5	10.3
Const.			-0.734		-0.528	-0.310
			-16.4		-8.5	-5.2
Obs.			113,576		5112	16,622
			0.4584		0.0944	0.0611
		CE			US	
		Unlisted companies	Listed difference	Listed	Listed firms only	
P/E		-0.010	0.026	0.016	0.006	0.003
		-4.5	10.2	7.3	2.8	1.7
S		-0.0008	-0.0020	-0.0028	-0.0016	-0.0005
		-2.5	-4.3	-8.7	-4.9	-2.1
CF		-0.081	0.096	0.014	-0.239	0.138
		-0.7	0.6	0.1	-2.2	5.3
ln(A)		0.132	-0.016	0.116	0.077	0.034
		21.4	-2.6	21.3	15.5	15.8
Lev		-0.113	0.016	-0.097	-0.042	0.147
		-2.4	0.2	-1.8	-0.9	6.9
Spre		-0.055	0.062	0.006	-0.019	-0.191
		-4.1	3.6	0.5	-1.4	-8.8
q					0.032	0.029
					6.1	10.3
Const.			-2.468		-1.474	-0.310
			-24.7		-14.4	-5.2
Obs.			198,493		5983	16,622
			0.371		0.183	0.061

Notes: Variables are price-earnings ratio (P/E), share ownership of largest shareholder (S), cash flow divided by total assets (CF), log of total assets (ln(A)), leverage (Lev), spread between federal interest rate and industrial loan rate (Spre), and Tobin's q (q). The numbers below the estimated coefficients are their t-statistics.

expect large (controlling) shareholders to be more eager to make acquisitions, the larger their own shareholdings are.

Cash flows, size and leverage are all positively related to assets acquired for the UK, with the coefficient on cash flows being twice as large for listed companies. These results are consistent with the managerial discretion hypothesis, and suggest that in the UK leverage is associated with aggressive managements, which have undertaken mergers in the past. When the sample is restricted to listed companies, and Tobin's q is added, all variables retain the same signs as before and are significant. Tobin's q picks up a positive and significant coefficient in the sample of listed companies.

As expected, the coefficient on the interest rate spread is negative and much larger in absolute value for unlisted than for listed companies. Indeed, the implied coefficient for listed companies in the full sample is slightly positive. In the regression limited to listed companies, Spre picks up a negative and significant coefficient, albeit one that is considerably smaller than for unlisted companies in the full sample.

The results for the two key variables in the model – the P/E ratio and largest shareholder's holdings – are quite similar for Continental Europe. Unlisted companies are less active buying other companies when share prices are high, listed companies are more active. Merger activity falls as the largest shareholder's ownership stake rises.

The interest rate spread is again negative and much larger for unlisted than for listed companies with the implied coefficient for listed companies in the full sample again being slightly positive. In the regression limited to listed companies, Spre picks up a negative but insignificant coefficient.

Size continues to have a positive influence on assets acquired in Continental Europe, but the cash flows coefficients are statistically insignificant. Leverage has a negative and significant coefficient for both listed and unlisted firms with the difference between them being insignificant. Thus, in Continental Europe, where access to equity markets is more limited than in the UK and USA, high leverage appears to inhibit acquisitions. Finally, Tobin's q again has a positive and significant coefficient when the sample is limited to listed companies.

All coefficients in the US regression are statistically significant, with the sign pattern being consistent with the managerial discretion hypothesis. Higher cash flows and market optimism lead to the acquisition of more assets, while higher ownership of the largest shareholder reduces the amount of assets acquired. US companies' merger activity is much more sensitive to lending conditions than in either the UK or Continental Europe.

The comparison of two point estimates illustrates the magnitude of the effects of the P/E ratio. Column 1 of Table 6 shows the expected values for merger activity in our samples. It is denoted as $E(y|x)$ to indicate that it is for the censored outcome. Because we have large comparison groups of non-merging companies, they are not high: 0.013%, 0.104% and 2.75% for Continental Europe, UK and the US, respectively. The expected value for the truncated outcome, $E(y|y>0, x)$, provides the average value of assets acquired, given an acquisition was undertaken. For listed firms, the conditional expected value for Continental Europe is 17.3% at a P/E of 15 compared to 14.0% for unlisted firms. The effect of a rise in the P/E ratio to 30, a reasonable number during the stock market boom, on listed firms is striking – the difference is almost three percentage points for listed firms, whereas the expectation declines by almost one percentage point for

unlisted firms. The same pattern can be observed for the UK and the result for the sample of listed US-firms is also consistent with this interpretation.

Also in Table 6 are the partial effects of changes in P/E, $\partial E(y|x)/\partial(P/E)$. In the Tobit model, they are not constant, are much higher for listed firms than for unlisted firms, and are largest for listed firms in a stock market boom at a P/E of 30. The decomposition of the partial effects, as presented in McDonald and Moffitt (1980), shows that for listed firms the relative contributions of acquisition size and number of acquisitions do not change dramatically during stock market booms. (For Continental Europe, the contribution of acquisition size increases from 10% to 13%, when the P/E ratio increases from 15 to 30.) Thus, the main explanation for merger waves is the dramatic increase in the number of acquisitive firms during stock market booms, not an increase in the size of acquisitions. The results are similar for the UK and the US, although the fact that relatively more firms are above the threshold (i.e. making acquisitions) puts more weight on the change attributed to increases in the size of the acquisitions.

5. Additional tests

5.1. Allowing for industry differences

The industry shocks hypothesis postulates that aggregate merger waves are due to simultaneous merger waves in several industries. Introducing industry dummies into the basic model tested above should greatly enhance the explanatory power of the model, if the industry shocks hypothesis is correct. Controlling for industry effects may also be interpreted as a robustness check on our results. The first and fifth columns of numbers in Table 7 reproduce the estimates reported in Table 5 to facilitate comparison. To save space we report only the estimates for the unlisted companies as well as the difference in coefficients between the listed and unlisted companies. The second and sixth columns present the estimates after introducing 70 2-digit SIC industry dummies with the assignment based on the industry of the acquiring firm. The number of observations declines slightly because some industries with no mergers had to be dropped to make the Tobit estimation operable. The first thing to note is that the pseudo R^2 s increase only slightly with the addition of the 70 industry dummies. The second thing to note is the coefficients on the main variables of interest change only marginally.

If aggregate waves are driven by industry waves, we should expect to see important differences between industries experiencing large numbers of mergers and the remaining industries. Columns 3 and 7 in Table 7 report the results for the 5 industries with the largest numbers of mergers, while columns 4 and 8 contain the results for the remaining industries.²² A few differences in the coefficients are sizeable. For example, for unlisted companies in Continental Europe merger activity in the low intensity industries is significantly negatively related to the P/E, while in the five merger-intensive industries the coefficient is much smaller and insignificant. In Continental Europe high leverage is a significant deterrent to merger activity in the low intensity industries, but not so in the high intensity industries. The similarities between the two sets of estimates are much stronger than the differences, however. Some industries have more merger activity than others, but the same factors tend to drive mergers in all industries.

As a final check on the importance of industry differences in explaining aggregate merger activity, we correlated merger activity

Table 6
Expected values and marginal effects.

at:	$E(y x)$	$E(y y>0, x)$	$\frac{\partial E(y x)}{\partial(P/E)}$	McDonald–Moffitt decomp.	
				Increased size of acq.	Increased number of acq.
<i>Continental Europe</i>					
Means	0.013	13.67			
Means, P/E = 15, listed = 1	0.234	17.31	0.021	10.3	89.7
Means, P/E = 30, listed = 1	0.840	20.09	0.066	13.2	86.8
Means, P/E = 15, listed = 0	0.018	13.99	−0.001	−7.1	−92.9
Means, P/E = 30, listed = 0	0.006	12.99	−0.0005	−6.2	−93.8
<i>UK</i>					
Means	0.104	10.98			
Means, P/E = 15, listed = 1	2.47	16.80	0.106	19.3	80.7
Means, P/E = 30, listed = 1	4.52	19.11	0.171	23.5	76.5
Means, P/E = 15, listed = 0	0.164	11.49	−0.025	−10.4	−89.6
Means, P/E = 30, listed = 0	0.013	9.23	−0.0024	−7.1	−92.9
<i>US</i>					
Means	2.75	18.26			
Means, P/E = 15, listed = 1	2.51	17.93	0.074	19.0	81.0
Means, P/E = 30, listed = 1	3.24	18.86	0.107	20.5	79.5

²² In the UK these were wholesale, trade and durable goods, business services, real estate, holding and other investment offices, and printing, publishing and allied industries. In Continental Europe, they were holding and other investment offices, business services, chemicals and allied products, wholesale, trade and durable goods, and industrial and commercial machinery and computer equipment.

Table 7
Results with industry adjustments.

	Unlisted							
	UK					CE		
	1	2	3	4	5	6	7	8
	Basic regr.	Industry dummies	Largest 5	Without largest 5	Basic regr.	Industry dummies	Largest 5	Without largest 5
P/E	−0.018	−0.017	−0.016	−0.017	−0.010	−0.011	−0.003	−0.015
	−9.1	−8.7	−4.9	−7.2	−4.4	−4.6	−0.9	−4.8
S	−0.0007	−0.0007	−0.0007	−0.0007	−0.0008	−0.0008	−0.0016	−0.0005
	−3.3	−3.2	−1.8	−2.4	−2.4	−2.5	−3.1	−1.1
CF	0.251	0.247	0.355	0.192	−0.080	−0.101	−0.027	−0.127
	5.4	5.3	4.5	3.3	−0.7	−0.9	−0.2	−0.8
ln(A)	0.037	0.038	0.032	0.039	0.132	0.130	0.122	0.141
	13.4	13.5	6.6	12.0	21.4	20.3	13.0	16.8
Lev	0.099	0.101	0.115	0.094	−0.114	−0.060	0.065	−0.189
	5.2	5.3	3.4	4.1	−2.5	−1.3	0.9	−3.0
Spre	−0.049	−0.047	−0.064	−0.039	−0.055	−0.055	−0.067	−0.045
	−9.2	−8.9	−6.7	−6.0	−4.1	−4.0	−3.1	−2.6
Const.	−0.734	−0.792	−0.721	−0.775	−2.468	−2.439	−2.377	−2.546
	−16.4	−15.5	−9.3	−14.2	−24.7	−15.6	−16.1	−18.6
Obs.	113,576	113,219	37,376	75,843	198,493	198,160	60,115	138,378
Psd-R ²	0.458	0.470	0.473	0.453	0.370	0.386	0.360	0.376

	Listed difference							
	UK					CE		
	9	10	11	12	13	14	15	16
	Basic regr.	Industry dummies	Largest 5	Without largest 5	Basic regr.	Industry dummies	Largest 5	Without largest 5
P/E	0.025	0.023	0.021	0.025	0.026	0.026	0.023	0.027
	14.4	13.4	6.9	11.9	10.2	10.0	6.1	7.7
S	−0.0027	−0.0027	−0.0027	−0.0028	−0.0020	−0.0017	−0.0018	−0.0016
	−9.5	−9.5	−5.5	−8.0	−4.3	−3.8	−2.6	−2.6
CF	0.220	0.220	0.238	0.219	0.096	0.109	0.132	0.077
	3.6	3.6	2.3	2.7	0.6	0.7	0.6	0.3
ln(A)	−0.007	−0.004	0.002	−0.008	−0.016	−0.018	−0.017	−0.017
	−2.3	−1.3	0.3	−2.1	−2.6	−3.0	−1.8	−2.0
Lev	0.042	0.032	0.031	0.024	0.016	0.026	−0.043	0.030
	1.4	1.1	0.6	0.7	0.2	0.4	−0.4	0.3
Spre	0.054	0.051	0.066	0.045	0.062	0.064	0.075	0.056
	9.5	8.9	6.5	6.5	3.6	3.7	2.8	2.5

Notes: Variables are price-earnings ratio (P/E), share ownership of largest shareholder (S), cash flow divided by total assets (CF), log of total assets (ln(A)), leverage (Lev), and spread between federal interest rate and industrial loan rate (Spre). Largest 5 contain the five most merger intensive 2-digit industries. The numbers below the estimated coefficients are their t-statistics.

by industry during non-wave periods with merger activity by industry during waves.²³ If an aggregate wave occurs because some industries enter a wave but others do not, then this correlation should be weak. In fact, it was 0.97. Although there are significant differences in merger activity across industries at any point in time, merger waves seem to take place because companies in all industries tend to increase their merger activity, not just those in a few industries.²⁴

5.2. Controlling for size differences between listed and unlisted companies

In this section we explore whether our results are somehow due to differences between listed and unlisted companies not accounted for in our basic model. One possibility might be a difference in the industry composition of the two types of companies. A comparison of the distributions of mergers across industries reveals that this is not the case, however. The Pearson correlation between two vectors in which the elements are the fractions of mergers in each 2-digit SIC industry for listed and unlisted companies is 0.95. Unlisted companies undertake fewer mergers on average than listed firms, but their

mergers tend to be concentrated in the same industries as for listed companies.

A conspicuous difference between the two types of companies is, of course, that listed firms are on average much larger than unlisted companies. Our basic model controls for company size, but one still might wonder if size differences are somehow driving the results. To check whether this is the case, we matched each unlisted company making a merger to a listed company of similar size that also undertook an acquisition. Fig. 8 shows the density functions for the two size-matched samples for the United Kingdom and Continental Europe. Company size is along the horizontal axis, and merger intensity along the vertical axis. The match between the two samples is obviously very good.

Columns 1 and 8 in Table 8 again reproduce our basic results for the UK, while columns 2 and 9 contain the results for the matched sample. Significance levels decline with the much smaller sample, but all coefficients have the same signs and orders of magnitude except for the coefficient on ln(A) for listed companies. In the basic regression, it is somewhat smaller than for unlisted companies, while in the size-matched regression the difference is insignificant. The same conclusions drawn for the full sample of UK companies can be drawn for the size-matched sample.

The same can be said for Continental Europe (see Table 8, Columns 3, 4, 10 and 11). Every coefficient that is significant in the full sample is significant with the same sign in the size-matched sample except again for ln(A) for listed companies. Its sign is negative as in the full

²³ The merger activity of an industry is measured by the number of M&As in the industry.

²⁴ See again, Gärtner and Halbheer (2009) for further evidence that aggregate merger waves are not caused by industry waves.

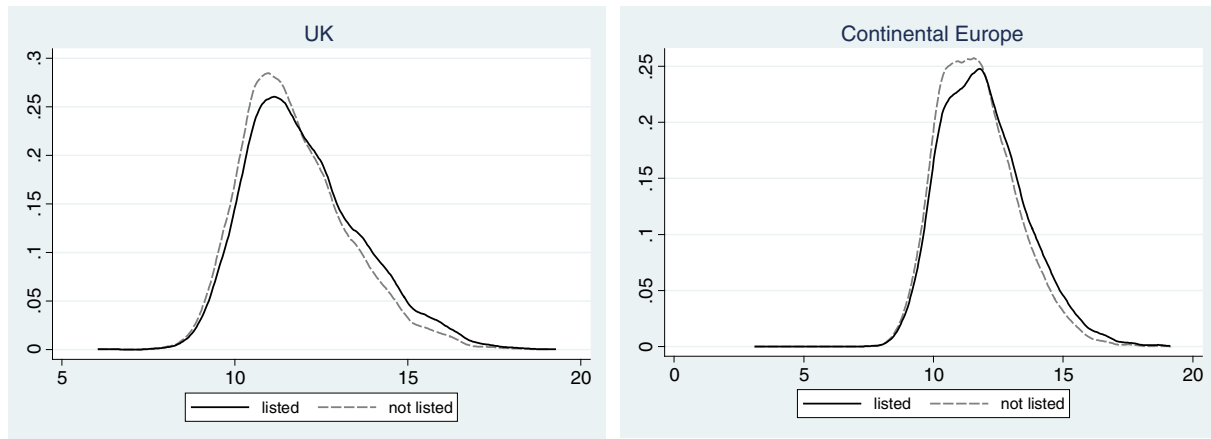


Fig. 8. Kernel densities of size-matched samples (log of total assets).

equation, but insignificant in the matched sample. Our results and conclusions are not an artifact of size differences between listed and unlisted companies.

Our claim that our results do not support the neoclassical explanations for merger waves rests on the assumption that listed and unlisted companies should both respond positively to external

shocks that make mergers more profitable. One may object to this reasoning on the grounds that unlisted firms, because of their inability to access the equity market, face more severe financial constraints than listed companies, and thus may not respond to external shocks that make mergers more profitable. Because there is no trading in them, the assets of unlisted companies are more difficult to price,

Table 8

Results for size matched firms and individual countries.

	Unlisted						
	UK				CE		
	1	2	3	4	5	6	7
	Basic regr.	Size matched	Basic regr.	Size matched	AT DE	FR	IT
P/E	-0.018	-0.017	-0.010	-0.011	-0.011	-0.002	-0.017
	-9.1	-6.2	-4.4	-3.2	-3.2	-0.3	-3.7
S	-0.0007	-0.0011	-0.0008	-0.0001	0.0000	-0.001	-0.0007
	-3.3	-2.9	-2.4	-0.2	0.0	-1.9	-1.2
CF	0.251	0.289	-0.080	0.040	0.133	-0.039	-0.391
	5.4	3.5	-0.7	0.2	0.8	-0.2	-1.6
ln(A)	0.037	0.021	0.132	0.108	0.109	0.150	0.109
	13.4	4.7	21.4	12.4	12.1	15.0	8.4
Lev	0.099	0.068	-0.114	-0.090	-0.090	-0.140	0.099
	5.2	2.2	-2.5	-1.3	-1.5	-1.8	0.8
Spre	-0.049	-0.050	-0.055	-0.046	-0.020	-0.099	-0.079
	-9.2	-5.9	-4.1	-2.2	-0.8	-3.0	-2.4
Const.	-0.734	-0.406	-2.468	-2.107	-1.899	-3.028	-1.812
	-16.4	-8.5	-24.7	-18.7	-14.2	-14.5	-9.5
Obs.	113,576	30,155	198,493	32,075	28,927	134,887	34,679
Psd-R ²	0.458	0.377	0.370	0.226	0.396	0.371	0.376
Listed difference							
	UK				CE		
	8	9	10	11	12	13	14
	Basic regr.	Size matched	Basic regr.	Size matched	AT DE	FR	IT
P/E	0.025	0.016	0.026	0.022	0.011	0.032	0.025
	14.4	6.3	10.2	6.0	2.5	7.2	4.4
S	-0.0027	-0.0020	-0.0020	-0.0027	-0.0011	-0.0029	0.0000
	-9.5	-4.8	-4.3	-4.2	-1.8	-3.9	0.0
CF	0.220	0.132	0.096	-0.033	-0.122	0.125	0.501
	3.6	1.5	0.6	-0.2	-0.5	0.6	1.4
ln(A)	-0.007	0.001	-0.016	-0.005	0.003	-0.026	-0.016
	-2.3	0.1	-2.6	-0.6	0.4	-2.5	0.2
Lev	0.042	0.083	0.016	-0.015	-0.282	0.312	-0.417
	1.4	2.6	0.2	-0.2	-3.1	2.7	-2.1
Spre	0.054	0.039	0.062	0.045	0.055	0.100	0.055
	9.5	4.6	3.6	1.9	1.7	2.8	1.2

Notes: Variables are price–earnings ratio (P/E), share ownership of largest shareholder (S), cash flow divided by total assets (CF), log of total assets (ln(A)), leverage (Lev), and spread between federal interest rate and industrial loan rate (Spre). AT Austria, DE Germany, FR France, and IT Italy. The numbers below the estimated coefficients are their t-statistics. Columns 1, 2, 8 and 9 are for the UK. Columns 3 to 7 and 10 to 14 for Continental Europe.

which also may make it difficult to finance mergers. We find these reasonable explanations for why unlisted companies undertake fewer mergers than listed companies on average, but not an adequate explanation for why they fail to increase their merger activity at times when mergers are supposed to have become more profitable.

During the merger waves at the end of the 20th century 56.9% of the mergers by listed companies in the US, 70.9% of the mergers by listed companies in the UK, and 78.4% in Continental Europe were financed by combinations of debt and cash, i.e., without issuing any equity.²⁵ These percentages are only slightly lower than the averages over the five years prior to the waves (US 59.3%, UK 74.5%, Continental Europe 89.0%). In no year in any area were as many as 50 percent of the acquisitions by listed companies financed even partially through equity. Unlisted companies can and do use debt and cash to finance the mergers that they do consummate. Some unlisted companies also use equity to finance acquisitions.²⁶ To reconcile our findings on merger waves with the neoclassical theories, a shock that made mergers more profitable for all firms in an industry would have to elicit a response by listed firms in the form of additional mergers some of which are financed by debt and cash, while the shock elicited no response whatsoever by unlisted firms. Stated differently, for the neoclassical theories to be consistent with our findings, the merger activity of unlisted firms, which are assumed to be led by profit maximizing managers, would have to be unrelated to changes in the profitability of mergers.

Returning to Table 6, we see from the E(y|x) column that unlisted companies do have lower propensities to acquire assets during normal times (P/E=15). In Continental Europe the difference in propensities is 0.234 versus 0.018, a multiple of 13. In the United Kingdom, the propensity of listed companies to acquire other companies' assets is 15 times greater than for unlisted firms (2.47 versus 0.16), when the P/E is 15. When the P/E rises to 30, however, unlisted firms not only do not increase the volume of their acquisitions, they reduce it. This response is difficult to reconcile with the assumption that managers are maximizing profits and that a rise in the aggregate P/E signals an economic shock making mergers more profitable.

5.3. Results by country for Continental Europe

Columns 5–7 and 12–14 in Table 8 contain regression results for the individual countries in our sample for Continental Europe. An F-test revealed that the observations for Austria and Germany could be pooled. The pattern of coefficients on the key variables involved in our tests of the various hypotheses is similar for the individual countries to the aggregate sample for Continental Europe. Merger activity for unlisted companies falls as the aggregate P/E rises, but rises with P/E for listed companies. High interest rates deter the merger activity of unlisted companies, but do not affect the activity of listed companies. The fraction of shares held by the largest shareholder is negatively related to assets acquired for both listed and unlisted companies, with the relationship being stronger for listed companies. Big companies acquire more assets than small ones. Not all of the coefficients that are significant for Continental Europe as a whole are significant for the individual countries, but the picture is much the same on the country level. In particular, the results for France, for which we have the most observations, are quite strong and consistent with the managerial discretion hypothesis.

²⁵ Source: Thompson Merger Database.

²⁶ While unlisted companies are by definition not listed on a stock exchange, some have issued shares to their owners, and some issue additional shares to finance acquisitions. For example, in 1999 the Italian firm Caer acquired Casse Venete through a 100% exchange of equity in a deal valued at \$3.9 billion. Source: Thompson Merger Database.

5.4. Endogeneity of the shares of the largest shareholder

A possible difficulty with our estimations is that the fraction of shares held by the largest shareholder might be endogenous to companies' merger activity. To check for this we re-estimated the basic model using a lagged measure of the fraction of shares held by the largest shareholder, S. Data for this variable are not available on an annual basis, so we used the most recent value of lagged S in our data set.

Table 9 presents the results for the same regressions as run for Table 5, but with S replaced by lag S. The results for lag S are similar to those for S. In the UK and Continental Europe, assets acquired decline as the size of the largest shareholder's stake in a company increases, and the decline is steeper for listed than for unlisted companies. The coefficient on lag S in the equation for listed companies in the USA is negative as it was for S, but now is insignificant. Increasing the size of the largest shareholder's stake in a company reduces agency problems and the company's acquisition of other companies' assets. The effects are larger in the UK and Continental Europe, where the stakes of the largest shareholder are larger.

Table 9
Regression results with shareholder (S) lagged by one year.

	UK			UK	US
	Unlisted companies	Listed difference	Listed	Listed firms only	
P/E	-0.018	0.026	0.008	0.005	0.006
	-8.4	13.8	4.4	2.6	5.2
S-Lag	-0.0005	-0.0029	-0.0034	-0.0015	-0.0003
	-1.8	-9.2	-17.9	-4.8	-1.1
CF	0.265	0.220	0.485	0.152	0.185
	5.2	3.3	11.1	3.4	6.8
ln(A)	0.037	-0.007	0.030	0.024	0.034
	12.5	-2.0	12.5	9.0	16.4
Lev	0.095	0.048	0.143	0.056	0.158
	4.6	1.5	5.9	2.1	7.7
q				0.033	0.030
				9.6	10.8
Spre	-0.050	0.047	-0.003	-0.018	-0.186
	-8.6	7.3	-0.7	-3.4	-8.4
Const.		-0.768		-0.565	-0.396
		-15.8		-9.3	-7.5
Obs.		97,987		5033	16,901
Psd-R ²		0.450		0.097	0.073

	CE			CE	US
	Unlisted companies	Listed difference	Listed	Listed firms only	
P/E	-0.008	0.024	0.015	0.008	0.006
	-3.4	8.5	6.6	3.5	5.2
S-Lag	-0.0011	-0.0014	-0.0025	-0.0015	-0.0003
	-3.0	-2.8	-7.2	-4.5	-1.1
CF	-0.113	0.262	0.149	-0.213	0.185
	-0.9	1.4	1.1	-1.9	6.8
ln(A)	0.137	-0.015	0.123	0.079	0.034
	20.1	-2.2	20.4	15.4	16.4
Lev	-0.131	0.058	-0.073	-0.034	0.158
	-2.6	0.8	-1.3	-0.7	7.7
q				0.033	0.030
				6.1	10.8
Spre	-0.059	0.059	0.000	-0.017	-0.186
	-3.7	3.0	0.0	-1.3	-8.4
Const.		-2.557		-1.550	-0.396
		-23.5		-14.4	-7.5
Obs.		171,016		5663	16,901
Psd-R ²		0.374		0.201	0.073

Notes: Variables are price-earnings ratio (P/E), lagged share ownership of largest shareholder (S-Lag), cash flow divided by total assets (CF), log of total assets (ln(A)), leverage (Lev), and spread between federal interest rate and industrial loan rate (Spre). The numbers below the estimated coefficients are their t-statistics.

Replacing S with lagged S reduces the number of observations available in each sample, and may explain why some coefficients on the other variables change when lagged S is substituted for S . The basic patterns of results for the P/E ratio and cash flows remain unchanged, however. In the Continental European sample, the coefficient on cash flow for listed firms now becomes positive as predicted, although it remains insignificantly different from the coefficient for unlisted firms and from zero.

We also experimented with using lagged values of the interest rate spread. This substitution had no substantive effect on the basic results.

6. Conclusions

Merger waves for listed companies occurred in the United States, United Kingdom and Continental Europe at the end of the 20th century. In all three areas, the peaks of the waves coincided more or less with the peaks of stock market booms. This pattern can be regarded as a stylized fact regarding merger waves in the United States and United Kingdom over the past century. Our study is the first to identify such a pattern in Continental Europe.

The q -theory, as applied to merger waves, claims that this pattern is due to an underlying technological shock that impacts the entire economy causing stock prices and therefore q s to rise, and makes mergers more profitable thereby generating a merger wave. Because the technological shock is supposed to affect the entire economy, it should make mergers more profitable for both listed and unlisted companies. Although unlisted firms generally engage in less merger activity than listed companies, there is no reason to expect that they would fail to respond to a major event that made mergers more profitable.

The industry shocks hypothesis differs from the q -theory in positing different and industry-specific shocks that raise the profitability of mergers in certain industries. It too should predict merger waves for both listed and unlisted companies in the industries experiencing shocks, and thus is also contradicted by our failure to identify waves for unlisted companies.

Under the two behavioral theories, the common “shock” that generates a merger wave for listed companies is the increase in optimism in the equity market that leads to a stock market boom. The managerial discretion theory claims that this increase in optimism reduces the constraint on managers pursuing growth through mergers. Wealth-destroying mergers that would normally be greeted with substantial declines in the acquirer's share price are greeted more favorably during a stock market boom. The overvaluation theory claims that the increase in optimism in the market produces a greater number of overvalued companies during a stock market boom, thus yielding more mergers that fit this hypothesis. Since both behavioral theories are linked to the degree of optimism in the equity market, both are consistent with our finding that merger waves did not occur for unlisted companies.

Under the overvaluation theory mergers during stock market booms are driven by the desire of managers to exchange the overvalued shares of their companies for real assets. The theory can only account for mergers financed through an exchange of stock, therefore. In contrast, under the managerial discretion theory firms that are not overvalued may still undertake mergers when optimism in finance markets is high, and they may choose to finance them with cash if it is in abundance, or issue debt. The positive and significant coefficients on cash flows in the two Anglo-Saxon countries thus lend further support to the managerial discretion theory. The positive and significant coefficients on leverage in these two countries suggest that this variable identifies companies with aggressive managements who are more prone to issue debt than other managers. Leverage had a negative coefficient in the equation for Continental Europe, on the other hand, while cash flow was insignificant. Continental European companies behave differently from Anglo-Saxon companies in this

regard. Nevertheless, listed companies did respond to the stock market boom in Continental Europe at the end of the last century by greatly expanding their merger activity.

The significant negative coefficient on the fraction of shares held by the acquirer's largest shareholder for listed companies in all three areas contradicts the overvaluation hypothesis. The larger the stake of a major shareholder in a company, the more willing she should be to exchange its overvalued shares for real assets. A negative coefficient is, on the other hand, what one expects under the managerial discretion theory. The larger a major shareholder's stake is, the less willing she should be to have her company undertake wealth-destroying mergers.

In closing it is perhaps worth pointing out that the managerial discretion theory does not claim to account for *all* mergers. Opportunities for profitable mergers are continuously arising, and managers can be expected to seize them when they do. Some industries may receive shocks that make mergers more profitable and lead to a wave of mergers at the industry level. When optimism in the equity market increases, however, the market's constraint on managers wishing to grow through mergers that destroy shareholder wealth weakens, and more such mergers take place. The optimism associated with stock market booms thus explains both the increase in merger activity during booms, and the subsequent negative effects of the mergers on shareholder returns.

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