

Der Open-Access-Publikationsserver der ZBW – Leibniz-Informationzentrum Wirtschaft
The Open Access Publication Server of the ZBW – Leibniz Information Centre for Economics

Gugler, Klaus; Mueller, Dennis C.; Weichselbaumer, Michael

Working Paper

The Determinants of Merger Waves: An International Perspective

ZEW Discussion Papers, No. 08-076

Provided in cooperation with:

Zentrum für Europäische Wirtschaftsforschung (ZEW)

Suggested citation: Gugler, Klaus; Mueller, Dennis C.; Weichselbaumer, Michael (2008) : The Determinants of Merger Waves: An International Perspective, ZEW Discussion Papers, No. 08-076, <http://hdl.handle.net/10419/27554>

Nutzungsbedingungen:

Die ZBW räumt Ihnen als Nutzerin/Nutzer das unentgeltliche, räumlich unbeschränkte und zeitlich auf die Dauer des Schutzrechts beschränkte einfache Recht ein, das ausgewählte Werk im Rahmen der unter

→ <http://www.econstor.eu/dspace/Nutzungsbedingungen> nachzulesenden vollständigen Nutzungsbedingungen zu vervielfältigen, mit denen die Nutzerin/der Nutzer sich durch die erste Nutzung einverstanden erklärt.

Terms of use:

The ZBW grants you, the user, the non-exclusive right to use the selected work free of charge, territorially unrestricted and within the time limit of the term of the property rights according to the terms specified at

→ <http://www.econstor.eu/dspace/Nutzungsbedingungen>
By the first use of the selected work the user agrees and declares to comply with these terms of use.

Discussion Paper No. 08-076

**The Determinants of Merger Waves:
An International Perspective**

Klaus Gugler, Dennis C. Mueller,
and Michael Weichselbaumer

ZEW

Zentrum für Europäische
Wirtschaftsforschung GmbH

Centre for European
Economic Research

Discussion Paper No. 08-076

The Determinants of Merger Waves: An International Perspective

Klaus Gugler, Dennis C. Mueller,
and Michael Weichselbaumer

Download this ZEW Discussion Paper from our ftp server:

<ftp://ftp.zew.de/pub/zew-docs/dp/dp08076.pdf>

Die Discussion Papers dienen einer möglichst schnellen Verbreitung von
neueren Forschungsarbeiten des ZEW. Die Beiträge liegen in alleiniger Verantwortung
der Autoren und stellen nicht notwendigerweise die Meinung des ZEW dar.

Discussion Papers are intended to make results of ZEW research promptly available to other
economists in order to encourage discussion and suggestions for revisions. The authors are solely
responsible for the contents which do not necessarily represent the opinion of the ZEW.

Non-Technical Summary

While much research has been done on the causes and effects of mergers, surprisingly little exists on the causes of *merger waves*. Recently, however, several theories have appeared that claim to account for merger waves. Two of these make the standard assumptions of neoclassical economics – managers maximize shareholder wealth, capital markets are efficient (see, Jovanovic and Rousseau (2002) and Harford (2005)). The other theories might best be characterized, however, as *behavioral* in that they relax one or more of these standard assumptions (Rhodes-Kropf and Viswanathan (2004), Shleifer and Vishny (2003), and Gugler, Mueller and Yurtoglu (2007)). The behavioral theories take into account the psychology of stock markets and, thus, give explanations for both why merger waves occur, and why they tend to coincide with stock market booms.

In this article we use a natural way to discriminate between the effects of "real" changes in the economy, like technological advances, and the effects of pure stock market phenomena, like overvaluation, on merger activity, by looking at both, listed and unlisted acquirers. If real changes in the economy are responsible for merger activity, as the neoclassical theories claim, 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 their overvalued stocks for less overvalued stocks, as one of the behavioral theories argues.

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 gives support to the behavioral hypotheses that claim that merger waves are driven by stock market bubbles. We present regression results, which offer further support for these hypotheses.

Das Wichtigste in Kürze

Die meisten Fusionsstudien beschäftigen sich mit den Determinanten und Effekten von Fusionen, aber nur sehr wenige mit den Gründen von *Fusionswellen*. Zwei der Theorien zur Erklärung von Fusionswellen (Tobin's q und Industry Shocks) beruhen auf den Standardannahmen neoklassischer Ökonomie: Manager maximieren das Aktionärsvermögen und Kapitalmärkte sind effizient (Jovanovic und Rousseau (2002) und Harford (2005)). Die zwei anderen Theorien (Overvaluation und Manager-Discretion) können am besten als "behavioural" bezeichnet werden, weil sie diese Annahmen abschwächen (Rhodes-Kropf und Viswanathan (2004), Shleifer und Vishny (2003), und Gugler, Mueller und Yurtoglu (2007)). Diese Verhaltenstheorien berücksichtigen explizit die Psychologie der (Aktien)märkte und geben Erklärungen, warum Fusionen in Wellen auftreten und warum diese mit Aktienmarktbooms zusammenfallen.

In dieser Studie diskriminieren wir zwischen "realen" Änderungen in der Ökonomie, wie technologischen Schocks, und reinen Aktienmarktphänomenen, wie Überbewertungen, indem wir beide Arten von Firmen, börsennotierte sowie nicht-börsennotierte, analysieren. Wenn reale Änderungen in der Ökonomie für die Fusionsaktivitäten verantwortlich zeichnen, so sollten beide Arten von Firmen gleichermaßen betroffen sein. Zudem können nicht-börsennotierte Firmen nicht überwertet sein, zumindest nicht vom Aktienmarkt, sodass sie ihre überbewerteten Aktien nicht für weniger überbewertete Aktien tauschen können.

Wir präsentieren Evidenz dafür, dass Fusionen in den drei Regionen - USA, UK und Kontinentaleuropa - in Wellen auftreten. Diese Fusionswellen existieren aber fast ausschließlich nur für börsennotierte Firmen, was die Verhaltenstheorien unterstützt, welche als Gründe für die Fusionswellen die Aktienmarktübertreibungen ansehen. Unsere Regressionsanalyse unterstützt diese These weiter.

THE DETERMINANTS OF MERGER WAVES: AN INTERNATIONAL PERSPECTIVE*

Klaus Gugler
Dennis C. Mueller
Michael Weichselbaumer

University of Vienna
Department of Economics
BWZ, Bruennerstr. 72, A-1210
Vienna, Austria
Phone: +43 1 4277 37484
Fax: +43 1 4277 37498

E-Mail:

klaus.gugler@univie.ac.at
dennis.mueller@univie.ac.at
michael.weichselbaumer@univie.ac.at

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.

Keywords: Merger waves, listed versus non-listed firms, managerial discretion, overvaluation
JEL-codes: L2, G3

* We are grateful for support by the FWF project P 19522-G14 and the RNIC project on "Competition and Innovation".

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.¹ 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 merger waves in the United States have also coincided with strong stock market advances, and this pattern can be regarded as a major regularity in aggregate merger data.² Less consensus exists over whether mergers during subsequent waves have been profitable or not.³

Merger waves have also occurred in the United Kingdom.⁴ 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, several theories have appeared that claim to account for merger waves. Two of these make the standard assumptions of neoclassical economics – managers maximize shareholder wealth, capital markets are efficient.⁵ The other theories might best be characterized, however, as *behavioral* in that they relax one or more of these standard assumptions.⁶ The behavioral theories take into account the psychology of stock markets and, thus, give explanations for both why merger waves occur, and why they tend to coincide with stock market booms.

There is reason to expect that mergers may be less frequent in Continental Europe than in the United States and the United Kingdom, and that they may have different causes. Because of widely dispersed share ownership in the United States and the United Kingdom, a “market for corporate control” exists in both countries 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.

In this article we use a natural way to discriminate between the effects of "real" changes in the economy, like technological advances, and the effects of pure stock market phenomena, like overvaluation, on merger activity, by looking at both, listed and unlisted acquirers. If real changes in the economy are responsible for merger activity, as the neoclassical theories claim, 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 their overvalued stocks for less overvalued stocks, as one of the behavioral theories argues. Thus, similar patterns in the two types of mergers is inconsistent with this theory.

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 gives support to the behavioral hypotheses that 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 first present evidence that merger waves did indeed occur in each of the three areas. In Section II, we review some hypotheses, which have been put forward to explain merger waves. Section III presents regression results that are consistent with two behavioral theories of merger waves. Some conclusions are drawn in the final section.

I. The Pattern of Merger Activity, 1991-2004

A. Data Sources

The information on mergers comes from the database “Worldwide Mergers & Acquisitions”, which is produced by Thomson Financial Securities Data (TFSD). It includes all corporate transactions involving at least 5 per cent of the ownership of a company with a transaction value (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 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. All of the automatic matches below a certain similarity threshold were checked manually, amounting to about 24,000 deals. We could match 52.6 per cent of all transactions to an Amadeus company. Data restrictions reduce the sample available for estimation considerably (see Table 1 below). Besides the financial data, we also used the information on the largest shareholder from Amadeus whenever available. To obtain financial information for the US sample, we combined the 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 predetermined by data restrictions. Table 1 shows the number of deals in TFSD, the share of deals matched and the reasons for reducing the number of deals as originally reported in TFSD.

We also calculate the price-earnings (P/E) ratio using GV. The result is a single number for every year (1991-2004) and every country (Austria, France, Germany, Italy, UK, USA) in our sample. It was derived for all the companies where data were available 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.

B. Merger Patterns

Figures 1-3 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. It is readily apparent that all three areas experienced merger waves at the end of the 1990s.⁷ 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 discussed in the next section link merger waves to the psychology and optimism in the stock market. In Figures 4-6, we present the curves indicating the total deal values of the acquisitions by listed and unlisted companies in each area, and weighted averages of company P/E ratios using company market values as weights. The time series are represented as indices to ease comparison between the groups. Mergers by listed companies can be seen to 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 non-listed 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 the acquisitions by listed firms increases 4-fold (USA), 4.5-fold (UK) and 6(!)-fold for Continental Europe in wave years as compared to non-wave years. This compares to only modest increases 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 0.8 in non-wave years to 0.06 in wave years (UK: from 0.4 to 0.1; CE: from 0.24 to 0.2). Thus, there is a complete decoupling of merger activity between listed and unlisted acquirers during waves!

As we shall see in the next section, these patterns are inconsistent with the predictions of two neoclassical theories of merger waves, but are precisely what one anticipates from the behavioral hypotheses.

II. Theories of Merger Waves

In this section we discuss the main hypotheses that have been put forward to explain merger waves and whether or not they are consistent with the patterns of mergers presented in Section I. In the next section, we present some regression results testing the different hypotheses. We first discuss two neoclassical theories of merger waves and then go on to the behavioral theories.

A. The q -Theory of Mergers

Jovanovic and Rousseau (2002a) (hereafter J&R) extend the q -theory of investment to mergers, and claim that this extended q -theory can account for merger waves. They liken mergers to the purchase of used plant and equipment, and argue that the gap between the qs of potential acquiring firms and targets increases at particular points – as during a stock market boom – and this widening difference leads managers to favor purchasing other firms over used capital equipment thus creating a merger wave.

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 J&R (2002b) have argued that stock market booms are caused by major technological advances like the invention and spread of the automobile. The late-1990s stock market boom was a result of innovations in the general area of information technology that also led to increased

opportunities for profitable mergers. Although this seems like a plausible explanation for both stock market booms and their accompanying merger waves, it is difficult to reconcile this interpretation of the q -theory to the merger patterns shown in Section I. Major technological changes affect *all* companies in an economy, not just those listed on stock exchanges. If the rise in stock prices at the end of the 20th century reflected an increased potential for making profitable acquisitions due to common, underlying technological factors, then *all* firms, not just listed companies, should have experienced merger waves. This is particularly true for Continental Europe, since a much larger fraction of its economic activity is conducted by non-listed firms.

B. The Industry Shocks Theory

Where J&R's explanation for merger waves appears to rest on an assumed, underlying common technological shock, Harford's (2005) theory assumes the existence of numerous *different* shocks – some technological, some regulatory, and some taking on still other forms. At certain times these shocks buffet several industries simultaneously and produce a wave of mergers across the entire economy. Harford's "neoclassical explanation of merger waves" is thus vulnerable to the same criticism as the q -theory – any industry shocks should hit listed and unlisted firms alike and produce merger waves across both types of companies.

C. 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.¹⁰ 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 $\partial^2 U / \partial q^2 < 0$.¹¹

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 $\partial U / \partial q > 0$, (1) cannot be satisfied if $\partial q / \partial M > 0$. For any merger that increases q *no tradeoff* 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 . Figure 7 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 “indispensable 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 Figure 7. 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 market conditions. This is not the case for non-listed 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.

D. The Overvalued Shares Theory

Shleifer and Vishny (2003) (hereafter S&V) retain the neoclassical assumption that managers maximize shareholders' wealth (at least as far as the acquiring firms are concerned), but relax the assumptions that mergers create wealth and of capital market efficiency. 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.

Neither version of the overvaluation theory can, however, explain the merger activity of non-listed firms. Their shares cannot be overvalued, at least not by the stock market, and they cannot trade overvalued stocks for less overvalued stocks.

III. Tests of the Theories

The behavioral theories rest on assumptions about the optimism or over optimism in the stock market. They thus predict different patterns of merger activity for companies listed on stock exchanges and unlisted companies. We have already observed such differences in aggregate merger patterns in Section I, in this section we present additional evidence by estimating models of the assets acquired by individual companies. The key prediction is that the amount of assets acquired by listed companies is sensitive to the aggregate P/E ratio, which we treat as a measure of the degree of optimism in the market, while the amount of assets acquired by unlisted companies does not depend on the aggregate P/E.

The managerial discretion theory assumes the existence of an Anglo-Saxon institutional structure – specifically widely dispersed share ownership. As the fraction of shares held by the largest shareholder increases, the cost to them of wealth-destroying mergers increases. The managerial discretion theory thus predicts a negative relationship between the fraction of shares held by the largest shareholder and the assets a company acquires.

The overvaluation theory makes the opposite prediction. The more shares the largest shareholder of an overvalued company has, the greater is her personal gain from trading them for the assets of another company. Thus, the overvaluation theory should predict a positive coefficient on the largest shareholder's shareholdings for listed companies, and a zero coefficient for unlisted companies, since the market places no value on them. If we assume that the managers of unlisted companies might also be empire-builders, then a negative coefficient for the largest shareholders' of 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.¹² Cash flows are thus included in our model, as an additional way to discriminate the managerial discretion theory from the others.¹³

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:

$$M_{it} = a + bP/E_t + cS_{it} + dCF_{it-1} + e\ln(A)_{it} + fLev_{it} + \mu_{it} \quad (2)$$

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 , S_{it} is the fraction of outstanding shares held by firm i 's largest shareholder, CF_{it-1} is firm 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.

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 on this variable.

Table 4 presents the means of the variables used in the regression analysis except that we have presented 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 in the regression analysis. The average size of an acquisition by a listed company is largest for Continental Europe and smallest for the UK. Largest shareholder's fraction of ownership is largest for Continental Europe and smallest for the USA. Unsurprisingly, listed companies have smaller holdings of its largest shareholder than 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 non-listed companies, acquirers are bigger than non-acquirers. 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 the sizes of the targets. 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 the different variables. That is to say, 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 results for the probit and Tobit estimations 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. The numbers in parentheses are *t*-values. The *t*-value on the coefficient for unlisted companies is for a comparison with zero. The *t*-value next to the listed companies (-L) is for a test of whether its coefficient is significantly different from that for the unlisted companies. The coefficients for the listed companies are the differences from the unlisted coefficients.

The coefficient on the weighted average P/E ratio for unlisted companies in the UK is -0.006 and is significant at the one per cent 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.¹⁴ 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 three 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 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.

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.

Size continues to have a positive influence on assets acquired in Continental Europe, but leverage is insignificant and cash flows actually pick up negative coefficients, although only the coefficient for the listed companies is statistically significant. 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.

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: 0.016 per cent, 0.113 per cent and 2.75 per cent 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 17.7 per cent at a P/E of 15 compared to 13.9 per cent for non-listed 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 four percentage points for listed firms, whereas the expectation is diminished by almost one percentage point for non-listed 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 non-listed 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 the number of acquisitions do not change dramatically during stock market booms. (The contribution of acquisition size increases from 11 per cent to 15 per cent, 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 acquisition. Moreover, the results are similar for the UK and the US, though 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.

IV. Conclusions

Merger waves 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 merger waves coincided more or less with the peaks of stock market booms. In the United Kingdom and Continental Europe, the merger waves were confined exclusively to companies listed on the major stock exchanges. Although a modest wave (ripple) in acquisitions by unlisted companies was observed in the United States, it was dwarfed by the wave for listed companies' acquisitions, and was out of phase with both the stock market boom and the wave in listed company mergers. These patterns are inconsistent with the neoclassical theories of merger waves that posit some underlying common shock to the entire economy driving a merger wave, or a set of simultaneous shocks to a group of industries, since such shocks should produce similar merger patterns for both listed and unlisted companies.

Additional evidence in favor of the behavioral theories was found in the regression results. These results were quite similar for listed companies in the United States and United Kingdom. The aggregate P/E, cash flows, size, leverage and Tobin's q all had positive and significant coefficients in these two countries for listed firms, while the shareholdings of the largest owners of the acquirers were negatively related to the amount of assets acquired. This last result was also observed for Continental European and seems to favor the managerial discretion over the overvaluation hypothesis. Growth oriented managers with large controlling shareholders in their companies should be less free to undertake wealth-destroying mergers. The overvaluation hypothesis assumes that acquirers' managers are trying to protect their shareholders from future declines in their companies' share prices. Under this hypothesis, managers with large personal stakes in their firms should be more eager to make acquisitions.

The results for Continental Europe differed in some respects from those for the two Anglo-Saxon countries. Leverage does appear to be a signal of the aggressiveness of managers in pursuing growth in Continental Europe, and assets acquired are unrelated to cash flows for unlisted companies, and negatively related for listed firms. This latter result contradicts the managerial discretion hypothesis. On the other hand, the coefficients on the aggregate P/E, largest owners' shareholdings, size and Tobin's q are all consistent with the managerial discretion theory. Thus, even for Continental Europe we think that the managerial discretion theory offers a better explanation for the merger wave than either of the two neoclassical theories or the overvaluation hypothesis.

Despite the differences in regression results between Continental Europe and the two Anglo-Saxon countries, we think that the similarities across the three areas outweigh the differences. Merger waves occurred in all three areas at the end of the 20th century, when stock markets were booming. Managers took advantage of the optimism in the stock market to acquire other companies. In all three areas, however, the enthusiasm of managers for mergers was dampened, if their company was not listed on a stock exchange and/or there was a large shareholder in the company.

References

- Andrade, Gregor and Erik Stafford, 2004, Investigating the Economic Role of Mergers, *Journal of Corporate Finance*, 10, 1-36.
- Chappell, H. W. and D. C. Cheng, 1984, Firms, Acquisition Decisions and Tobin's q Ratio, *Journal of Economics and Business*, 36, January, 29-42.
- Clarke, R, and C. Ioannidis, 1996, On the Relationship Between Aggregate Merger Activity and the Stock Market: Some Further Empirical Evidence, *Economics Letters*, 53, 349-356.
- Dewing, A. S., 1921, A Statistical Test of the Success of Consolidations, *Quarterly Journal of Economics*, 36, November, 84-101.
- Erard, B. and H. Schaller, 2002, Acquisitions and Investment, *Economica*, 69, 391-414.
- Gärtner, Dennis and Daniel Halbheer, 2007, "Are There Waves in Merger Activity After All?" mimeo, University of Zurich.
- Galbraith, John Kenneth, 1961, *The Great Crash: 1929*, 2nd ed. Boston: Houghton Mifflin.
- Geroski, P. A., 1984, On the Relationship Between Aggregate Merger Activity and the Stock Market, *European Economic Review*, 25, 223-233.
- Grabowski, H., and Dennis C. Mueller, 1972, Managerial and Stockholder Welfare Models of Firm Expenditures, *Review of Economics and Statistics* 54, 9-24.
- Gugler, Klaus, Dennis C. Mueller and B. Burcin Yurtoglu, 2004, Marginal q , Tobin's q , Cash Flow and Investment, *Southern Economic Journal*, 70 (3), 512-531.
- Gugler, Klaus, Dennis C. Mueller and B. Burcin Yurtoglu, 2007, The Determinants of Merger Waves, mimeo University of Vienna.
- Hannah, L. and J. A. Kay, 1977, *Concentration in Modern Industry*, London: Macmillan.
- Harford, Jarrad, 2005, What Drives Merger Waves? *Journal of Financial Economics*, 77(3), 529-560.
- Hay, Donald A. and Guy S Liu, 1998, When do Firms go in for Growth by Acquisitions? *Oxford Bulletin of Economics and Statistics*, 60(2), 143-64.

- Heckman, J., 1976, The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Simple Estimator for such Models, *The Annals of Economic and Social Measurement* 5: 475-492.
- Hogarty, T. F., 1970, Profits from Mergers: The Evidence of Fifty Years, *St. John's Law Review*, 44, special edition, 378-391.
- Jovanovic, B. and P. L. Rousseau, 2002a, The Q-Theory of Mergers, *American Economic Review Papers and Proceedings*, May, 198-204.
- Jovanovic, B. and P. L. Rousseau, 2002b, Mergers as reallocation., Working Paper No. 9277 (National Bureau of Economic Research, Cambridge MA).
- Khorana, Ajay and Marc Zenner, 1998, Executive compensation of large acquirors in the 1980s, *Journal of Corporate Finance*, 4, pp. 209-240.
- Livermore, S., 1935, The Success of Industrial Mergers, *Quarterly Journal of Economics*, 50, November, 68-96.
- Markham, J. W., 1955, Survey of the Evidence and Findings on Mergers, in: *Business Concentration and Public Policy*, New York: NBER.
- McDonald, John F. and Robert A. Moffitt, 1980, The Use of Tobit Analysis, *Review of Economics and Statistics*, 62(2), 318-321.
- Marris, Robin, 1964, *The Economic Theory of Managerial Capitalism*, Glencoe: Free Press.
- Marris, Robin, 1998, *Managerial Capitalism in Retrospect*, Palgrave-Macmillan, London.
- Melicher, R. W., J. Ledolter and L. J. D'Antonio, 1983, A Time Series Analysis of Aggregate Merger Activity, *Review of Economics and Statistics*, 65, 423-430.
- Mueller, Dennis C., 1969, A Theory of Conglomerate Mergers, *Quarterly Journal of Economics*, 83, November, 643-659.
- National Industrial Conference Board, 1929, *Mergers in Industry. A Study of Certain Economic Aspects of Industrial Consolidation*, New York: National Industrial Conference Board.
- Nelson, Ralph, L. 1959, *Merger Movements in American Industry, 1895-1956*, Princeton: Princeton University Press.

- Nelson, Ralph L. 1966, Business Cycle Factors in the Choice Between Internal and External Growth, in W. Alberts and J. Segall, eds., *The Corporate Merger*, Chicago: University of Chicago Press.
- Resende, Marcelo, 1999, Wave Behaviour of Mergers and Acquisitions in the UK: A Sectoral Study, *Oxford Bulletin of Economics and Statistics*, 61(1), 85-94.
- Rhodes-Kropf, M. and S. Viswanathan, 2004, Market Valuation and Merger Waves, *Journal of Finance*, 59 (6), 2685–2718.
- Rhodes-Kropf, M., David. T. Robinson, and S. Viswanathan, 2005, Valuation Waves and Merger Activity: The Empirical Evidence, *Journal of Financial Economics*, 77 (3), 561-603.
- Schwartz, S., 1984, An Empirical Test of A Managerial, Life-Cycle, and Cost of Capital Model of Merger Activity, *Journal of Industrial Economics*, 32(3), 265-75.
- Shiller, Robert J., 2000, *Irrational Exuberance*, Princeton: Princeton University Press.
- Shleifer, Andrei and Robert W. Vishny, 2003, Stock Market Driven Acquisitions, *Journal of Financial Economics*, 70 (3), 295-489.
- Vogt, S. C., 1994, The Cash Flow/Investment Relationship: Evidence from U.S. Manufacturing Firms, *Financial Management*, 23, 3-20.

Figure 1: Number and Total Deal Values of all Mergers for the US

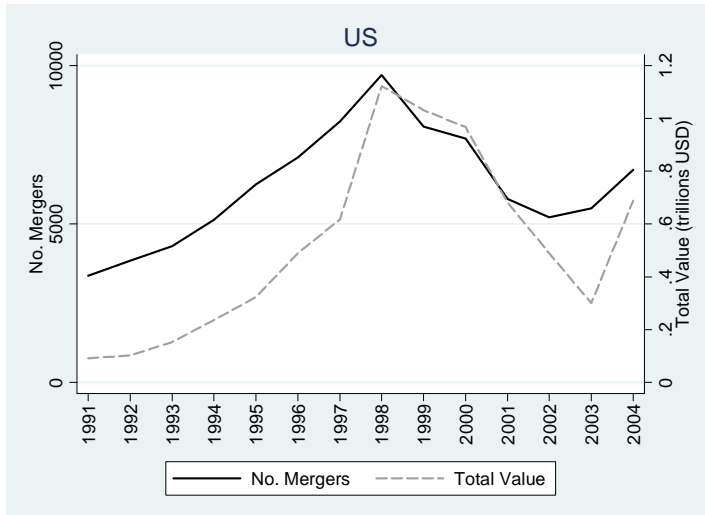


Figure 2: Number and Total Deal Values of all Mergers for the UK

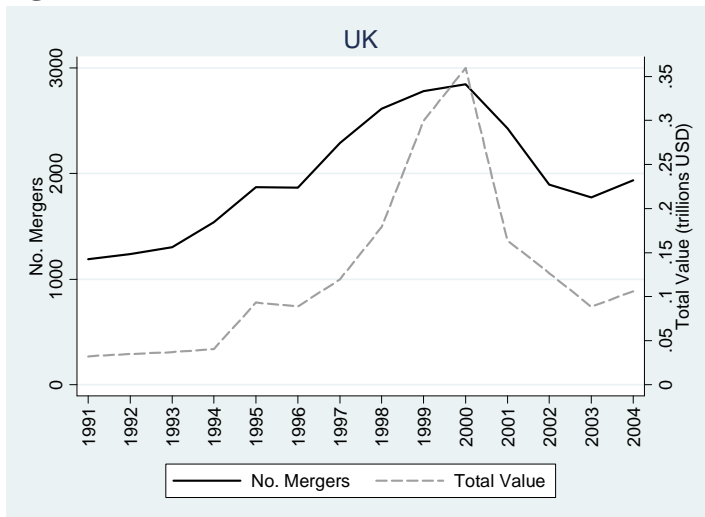


Figure 3: Number and Total Deal Values of all Mergers for Continental Europe

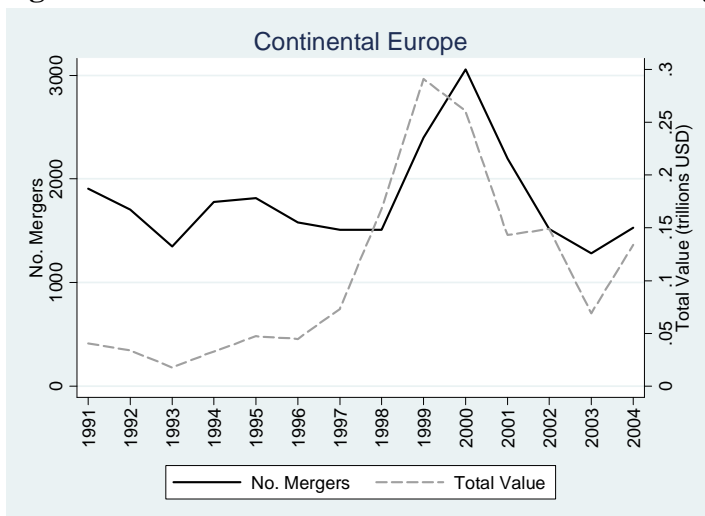


Figure 4: Total Deal Values of listed vs. not-listed acquirers, and P/E for the US

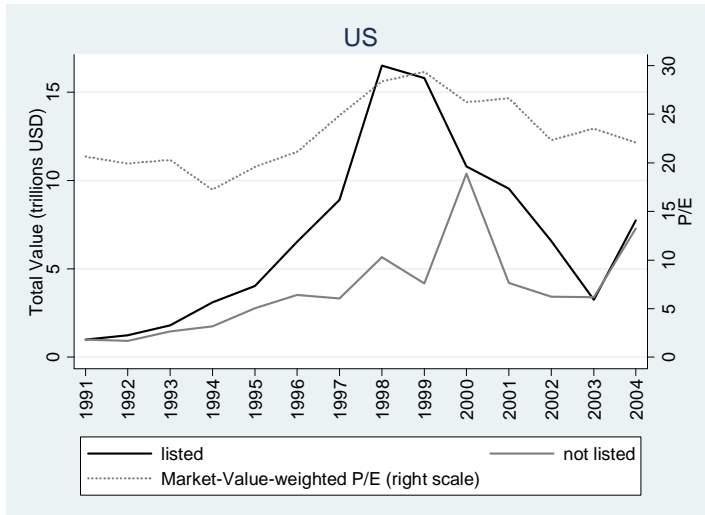


Figure 5: Total Deal Values of listed vs. not-listed acquirers, and P/E for the UK

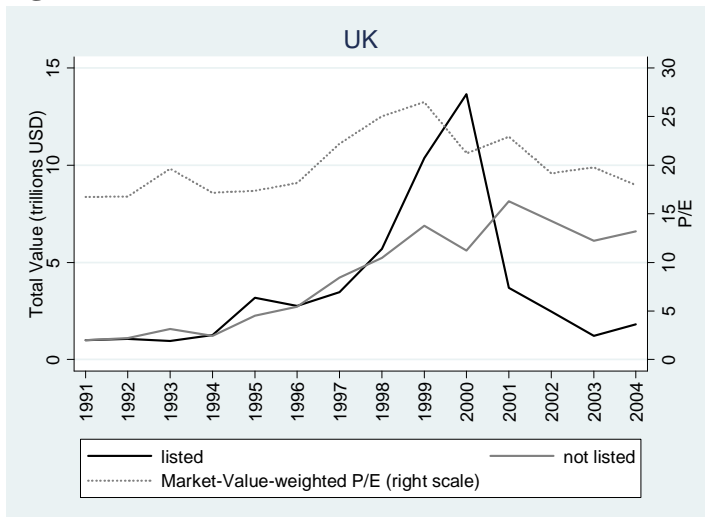


Figure 6: Total Deal Values of listed vs. not-listed acquirers, and P/E for Continental Europe

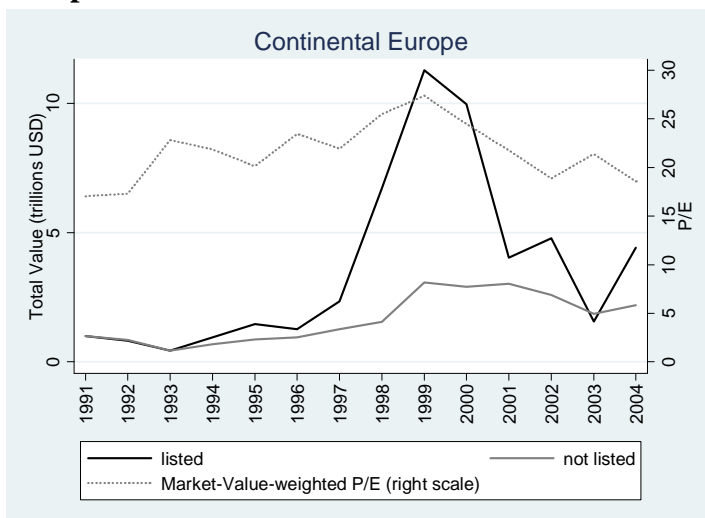


Figure 7: The Managerial Trade-off

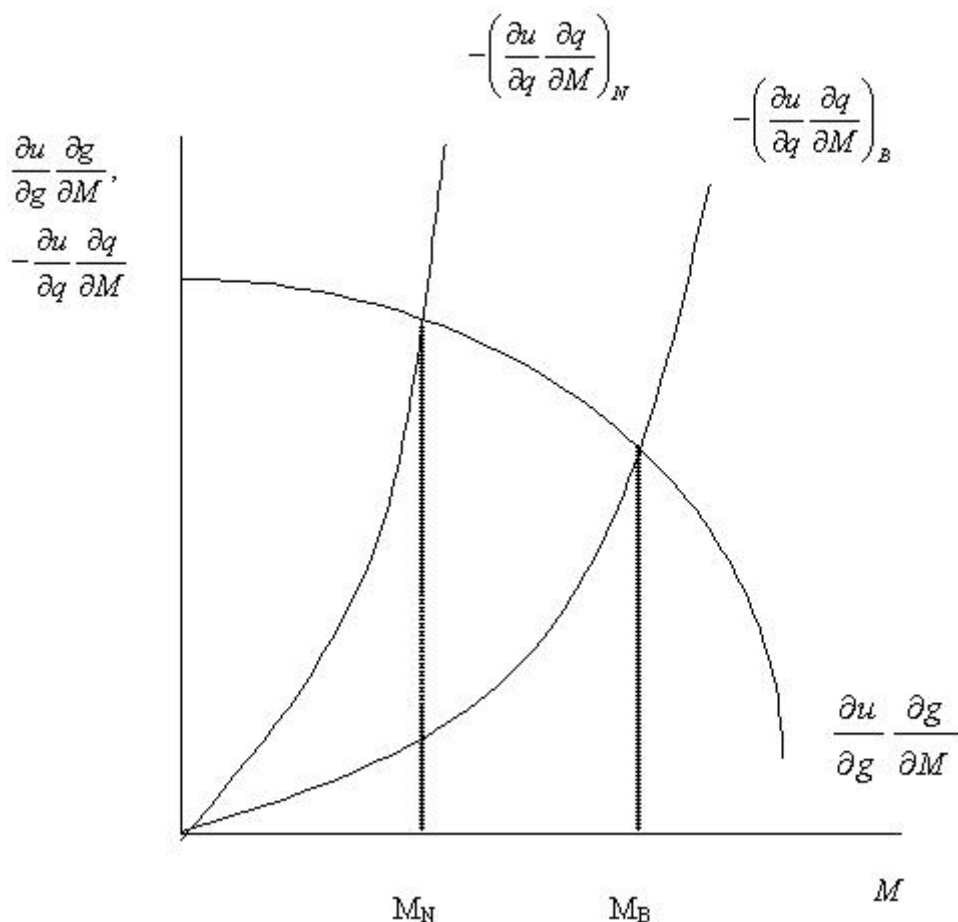


Table 1: Deals from Europe (Austria, Germany, France, Italy, UK), matched to Amadeus for 1991-2004, and deals from the US, matched to Global Vantage for 1991-2002

Deals		Restriction	Share Available	
Europe	US		Europe	US
100,233	193,015	TFSD deal matched to Amadeus/GV	0.526	0.241
52,727		1978 <= year <= June 2005 (rest: no year)	0.783	
41,268		1991 <= year <= 2004 ⁽¹⁾	0.855	
35,290	37,867	one deal (largest) per year & company ^{(2),(3)}	0.651	0.526
22,997	19,914	deal value available	0.514	0.635
11,821	12,648	necessary financial data in Amadeus	0.631	0.839
7,457	10,612	share of largest owner available	0.430	0.241
3,207	2,560	final sample		

⁽¹⁾ Sample for US ends 2002

⁽²⁾ Europe: Yearly deals per company: min=1, max=25, average=1.53

⁽³⁾ US: Yearly deals per company: min=1, max=86, average=1.90

TFSD: Thompson Financial Securities Data

GV: Global Vantage Database

Table 2: Domestic vs. Cross-border Mergers

year	US		UK		Continental Europe	
	domestic	cross-border	domestic	cross-border	domestic	cross-border
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

Table 3: Correlation coefficients between total deal values by listed acquirers and total deal values by not-listed acquirers

	wave	non-wave
<i>US: listed,not-listed</i>	0.0597 (0.7629)	0.8061 (0.0000)
<i>UK: listed,not-listed</i>	0.1040 (0.6625)	0.3972 (0.0076)
<i>Cont. Eur: listed,not-listed</i>	0.2041 (0.3880)	0.2329 (0.1282)

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

wave-period: UK and CE, 1997q1-2001q4; US, 1995q1-2002q4.

non-wave period: UK and CE, 1989q1-1996q4 and 2002q1-2004q4;

US, 1989q1-1994q4 and 2003q1-2004q4.

Table 4: Variable Means Wave/Non-Wave

		UK	Cont.Eur.	USA
<i>M</i>	<i>non-wave</i>	42.09	97.12	
	<i>wave</i>	65.46	140.04	
<i>M-L</i>	<i>non-wave</i>	92.13	299.34	159.89
	<i>wave</i>	248.21	562.23	450.5
<i>S</i>	<i>non-wave</i>	89.88	78.11	
	<i>wave</i>	90.94	73.39	
<i>S-L</i>	<i>non-wave</i>	18.74	44.64	19.51
	<i>wave</i>	16.69	41.7	18.17
<i>NA S</i>	<i>non-wave</i>	91.06	74.82	
	<i>wave</i>	89.18	74.68	
<i>NA S-L</i>	<i>non-wave</i>	35.05	60.78	22
	<i>wave</i>	29.66	60.83	21.68
<i>CF</i>	<i>non-wave</i>	0.087	0.075	
	<i>wave</i>	0.083	0.06	
<i>CF-L</i>	<i>non-wave</i>	0.087	0.073	0.053
	<i>wave</i>	0.092	0.063	0.057
<i>NA CF</i>	<i>non-wave</i>	0.074	0.061	
	<i>wave</i>	0.078	0.063	
<i>NA CF-L</i>	<i>non-wave</i>	0.064	0.075	0.009
	<i>wave</i>	0.066	0.073	0.011
<i>A</i>	<i>non-wave</i>	826.33	2255.68	
	<i>wave</i>	391.16	1985.99	
<i>A-L</i>	<i>non-wave</i>	1940.28	8879.55	5426.89
	<i>wave</i>	2101.66	4869.11	8120.11
<i>NA A</i>	<i>non-wave</i>	128.44	95.13	
	<i>wave</i>	136.68	74.43	
<i>NA A-L</i>	<i>non-wave</i>	893.89	1216.96	1682.34
	<i>wave</i>	788.27	582.97	2160.25
<i>Lev</i>	<i>non-wave</i>	0.21	0.25	
	<i>wave</i>	0.23	0.22	
<i>Lev-L</i>	<i>non-wave</i>	0.18	0.22	0.24
	<i>wave</i>	0.21	0.21	0.26
<i>NA Lev</i>	<i>non-wave</i>	0.14	0.16	
	<i>wave</i>	0.14	0.15	
<i>NA Lev-L</i>	<i>non-wave</i>	0.17	0.19	0.24
	<i>wave</i>	0.16	0.19	0.24
<i>q-L</i>	<i>non-wave</i>	1.14	0.89	1.55
	<i>wave</i>	1.64	1.94	1.82
<i>NA q-L</i>	<i>non-wave</i>	1.05	0.85	1.53
	<i>wave</i>	1.41	1.6	1.72

Note: Wave and non-wave periods, and variable abbreviations are explained in Table 4b.

Table 4b: Sample periods and variable definitions for Table 4

	UK	Cont.Eur.	US
<i>sample-period</i>	1991-2004	1991-2004	1991-2002
<i>wave-period</i>	1997-2001	1997-2001	1995-2002

Variables	
<i>M</i>	deal value (in millions USD)
<i>S</i>	percentage of largest shareholder
<i>CF</i>	cash flow over total assets (lag 1)
<i>A</i>	total assets (in millions USD)
<i>Lev</i>	leverage (= non-current liabilities / <i>A</i>)
<i>Q</i>	Tobin's q (= (market capitalization + non-current liabilities) / <i>A</i>)
<i>-L</i>	[Variable] for listed firms
<i>NA</i>	[Variable] for non-acquirers

Table 5: Regression Results

	UK		Cont.Eur.		US
	All Coeff	Listed Coeff	All Coeff	Listed Coeff	Listed Coeff
<i>P/E</i>	-0.0062 (-3.25)	0.0095 (4.52)	-0.0085 (-3.15)	0.0071 (2.67)	0.0055 (3.06)
<i>P/E-L</i>	0.0169 (8.24)		0.0286 (8.77)		
<i>S</i>	-0.0012 (-4.55)	-0.0019 (-4.99)	-0.0011 (-2.74)	-0.0021 (-4.66)	-0.0005 (-2.08)
<i>S-L</i>	-0.0019 (-5.88)		-0.0019 (-3.31)		
<i>CF</i>	0.241 (4.08)	0.1533 (2.74)	-0.0458 (-0.32)	-0.3798 (-2.67)	0.1232 (4.58)
<i>CF-L</i>	0.2072 (2.70)		-0.2699 (-1.29)		
<i>ln(A)</i>	0.0238 (7.20)	0.0241 (7.24)	0.1211 (16.44)	0.0702 (11.16)	0.0344 (15.50)
<i>ln(A)-L</i>	0.009 (2.46)		-0.0073 (-1.14)		
<i>Lev</i>	0.0573 (2.30)	0.0783 (2.30)	-0.0491 (-0.86)	-0.0114 (-0.19)	0.1442 (6.52)
<i>Lev-L</i>	0.0595 (1.59)		-0.0024 (-0.03)		
<i>q-L</i>		0.029 (6.67)		0.0366 (4.99)	0.0275 (9.56)
<i>N</i>	64,164	3,028	115,879	3,661	14,855
<i>Psd-R2</i>	0.4703	0.1075	0.3644	0.1616	0.0557

Note: t-values in parentheses. Variables abbreviated as in Table 4b.

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.
		Cont. Eur.			
means	0.0163	13.76			
means,P/E=15, listed=1		17.65	0.0339	10.73	89.23
means,P/E=30, listed=1		21.46	0.1318	14.88	85.12
means,P/E=15, listed=0		13.91	-0.0012	-7.07	-92.93
means,P/E=30, listed=0		13.06	-0.0005	-6.31	-93.69
		UK			
means	0.1133	10.62			
means,P/E=15, listed=1		13.54	0.0673	14.74	85.26
means,P/E=30, listed=1		16.26	0.1646	19.74	80.26
means,P/E=15, listed=0		10.51	-0.0060	-9.63	-90.37
means,P/E=30, listed=0		9.68	-0.0026	-8.33	-91.67
		US			
means	2.7511	17.89			
means,P/E=15, listed=1		17.31	0.0743	18.68	81.32
means,P/E=30, listed=1		18.99	0.1074	21.54	78.46

Notes:

¹ See, for example, Dewing (1921), National Industrial Conference Board (1929), Livermore (1935), and discussion in Markham (1955) and Hogarty (1970).

² 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, Melicher, Ledolter and D'Antonio (1983), Geroski (1984) for the US, and Geroski (1984) and Clarke and Ioannidis (1996) for the UK.

³ 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.

⁴ See, Hannah and Kay (1977), Resende (1999) and Gärtner and Halbheer (2007).

⁵ See, Jovanovic and Rousseau (2002); and Harford (2005). Rhodes-Kropf and Viswanathan (2005); and Shleifer and Vishny (2003).

⁶ Rhodes-Kropf and Viswanathan (2004); Shleifer and Vishny (2003); and Gugler, Mueller and Yurtoglu (2007).

⁷ Gärtner and Halbheer (2007) 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.

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

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

¹⁰ 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).

¹¹ A further justification for including q in the managers' utility function would be that managers own shares in the firm.

¹² See, Grabowski and Mueller (1972), Vogt (1994), Hay and Liu (1998), and Gugler, Mueller and Yurtoglu (2004).

¹³ To our knowledge Schwartz (1984) is the only study testing the MDH for mergers. He does not link his results to merger waves, however.

¹⁴ Evidence of this for the United States is presented in Gugler, Mueller and Yurtoglu (2007).