EC331

Research in Applied Economics

Mergers and Acquisitions as Risk

Does the Modern Portfolio Theory Apply to Corporate Diversification?

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Table of Contents

ABSTRACT

As suggested by the Modern Portfolio Theory, diversification is supposed to cause risk reduction. However, the empirical findings sit awkwardly with this prediction. The paper presents an empirical inquiry into the influence of Mergers & Acquisitions on the market-based measure of risk level and tests the relevance of the CAPM model to the corporate domain. In all, 535 takeovers launched by American or British firms over 2001-2008 are examined, using both acquirers' stock returns and market betas, with the latter yielding results of higher accuracy and credibility. The findings show that diversification through M&A does lead to risk reduction, especially in terms of the geographical dimension, but they do not support the popular association between risk and industry relatedness.

INTRODUCTION

Corporate takeovers are frequently justified by being designed to reduce a company's exposure to cyclical uncertainties (Steiner, 1975). Since corporate managers are to run businesses in a way that is welfare-improving for the stockholders, it should be the case that most M&A activity undertaken is effective in bringing risk levels down. In analysing the outcomes, the financial market view of risk is commonly employed.

According to the Modern Portfolio Theory (MPT) a combination of risky assets should be less risky than the aggregated riskiness of individual assets, with risk being defined as the normalised variability in asset values over time (Brealey and Myers, 1981). To verify the consistency of this claim its empirical analogue, the Capital Assets Pricing Model (CAPM) has been widely used. By diversifying a portfolio, investors should be able to reduce its overall risk as each individual asset's contribution towards it, measured by its standard deviation, would decrease (Markowitz, 1952).

Treating entire firms as an asset class, just like stocks and bonds, allows for extending CAPM's applications to the domain of mergers and acquisitions, making takeovers

conceptually parallel to diversifying a stock portfolio. However, there is no firm agreement regarding the relevance of CAPM to corporate field, with most of the studies finding M&A effective in bringing risk levels down, and a considerable few proving it to have no influence or even increase the variability of returns and income uncertainty.

The paper presents an empirical test of how strategic diversification *ex ante* influences a market-based risk measure. To this end a sample of 535 large British and American acquisitions over an 8-year period of intense merger activity (2001-2008) has been assembled. Instead of investigating into stock returns exclusively, as most conventional studies did, it will also examine changes in betas. This approach allows a more precise analysis of risk changes by isolating the impact of the acquisition announcement from underlying indices and sector movements. In particular, the model finds takeovers to be risk-reducing indeed, however industry relatedness effects were proved insignificant.

PREVIOUS LITERATURE

Treatment of risk

Empirical studies investigating into M&A activity stress that various risk components react differently to takeover announcements (Checkley, 2007). Just like stockholders may eliminate the diversifiable risk by holding a heterogeneous portfolio, corporate managers can lower unsystematic (business-specific) risk through acquisitions, while the systematic (systemwide) risk levels should remain unaffected (Lubatkin and Chatterjee, 1994). However, it might be that related mergers decrease the latter as well, providing slightly differential responses to business cycle shifts and minimising operational risk (Amit and Livnat, 1989).

Contrasting Strategic Predictions

According to Bettis and Hall (1982) both systematic and unsystematic risk can be reduced by bringing together synergistically interrelated business units, so that they can influence each other. Such companies can capitalise on intangible interrelationships and economies of scope by sharing activities, resources and common business logic. Those findings are echoed by Ramaswamy (1997), who suggests that some relatedness is better than none for risk reduction due to acquired experience in running similar companies and ability to use the same resource and technology base. Lubatkin and Chatterjee (1994) also agree on the above, yet they predict a U-shaped relationship. Their study examined stock prices before and after the takeover announcement, relying on the CAPM equation: the value of each asset depends on how much its price reacts to the risk of the market as a whole (measured by beta). Accordingly, risky assets should earn a premium over the market risk-free rate, as the probability of default or bankruptcy is higher. After controlling for bear and bull market tendencies and capital intensity, Lubatkin and Chatterjee proved corporate diversification to be risk-reducing, however not in a linear manner. Their model also emphasised the necessity of controlling for corporate size, to eliminate the effect of 'too big to fail companies', which repeats the findings of Winn (1977).

A particular type of a related takeover is one leading to vertical integration. Companies acquiring their suppliers or distributors are found to reduce systematic risk, yet only to a certain extent. Vertical diversifiers are tied to environmental uncertainties of a single industry, yet they can easily exercise control over supply and demand uncertainties and transaction costs, co-varying with macroeconomic movements, which brings the overall level of risk down in a way consistent with the U-shaped relationship suggested above

(Chatterjee, Lubatkin and Schoenecker, 1992). For the fully integrated firms, the synergistic benefits become outweighed by an actual surge in both systematic and bankruptcy risk, especially in turbulent industries (D'Aveni and Ilinitch, 1992).

This, however, is challenged by Rumelt (1974), whose study, after having controlled for degree and dimension of relatedness and pre- and post-acquisition risk profiles, portrays related mergers as risk-increasing. His model finds takeovers risk-reducing only if they involve completely unrelated firms, so that their income streams are negatively correlated, making the variance of the combined income streams decline dramatically. This drop in unsystematic risk is only a result of an averaging effect, but it provides a perfect hedging strategy.

Alternative views

Langetieg (1978), however, goes to another extreme, finding all mergers to be in fact, risk increasing. Carrying out a stock price analysis, taking into account only *ex ante* market perceptions of the transaction before and after the announcement, it turns out that the acquiring firm stockholders earn abnormal returns, which he interprets to be a risk premium. This challenges not only the Modern Portfolio Theory, but also the microeconomic predictions concerning acquisitions as the market should have recognised the characteristics of the target firm and bid up its stock price until all the incremental value of the takeover went to the acquired company's investors.

Thompson (1984), on the other hand, does not find any relationship between M&A and risk. Yet the diversification measure examined is poor – it ignores the relative importance of each activity to the firm and does not account for any overseas acquisitions. Also, the industry

classification used is too broad as it fails to show industry effects specified by Fabozzi and Francis (1979): industry should impact on inter-firm variation in systematic risk. These data limitations cause the overall fit of the estimation to be quite poor, with R^2=0.041, and casts doubts on the credibility of its findings.

Implications

It is widely held that a well-designed diversification reduces a firm's exposure to the hardships and cyclicalities of a single industry, with there potentially being an optimal level of diversification for firms. However, there is no clear consensus regarding the applicability of the Modern Portfolio Theory to the corporate domain and the studies mentioned above provide contradictory evidence of CAPM's validity in the M&A field. The practical implication of most of those that find takeovers risk-reducing is to 'put all eggs in similar baskets', not identical or starkly different, yet this is not a universal view and there are still papers that find inverse or no relationship at all.

However, the above studies are not limitation-free and show major shortcomings that should be addressed. An analysis of a large, heterogeneous sample is a prerequisite for an improvement in the accuracy of the findings. This will be further assured by the inclusion of size, consideration and ownership controls. A broad industry classification, addition of fundamental accounting variables and the relative importance of the target to the acquirer will altogether ensure the robustness of the results. In the stock returns models market tendencies will be controlled for too.

Yet most criticism comes from the exclusion of the Kahneman and Tversky's Prospect Theory, stating that firms facing poor results should become increasingly risk-seeking. This

behavioural economics fundamental is stressed by Chamberlain and Tennyson (1998), who predict that “troubled and highly indebted companies will take on deliberate risk”, suggesting the need to control for the debt structure as more leveraged companies could be less risk-averse since their cost of financing is more market-sensitive.

DATA AND METHODOLOGY

Sample selection

The sample of acquiring firms was assembled by combining deal and company characteristics from Thompson One Banker with financial variables sourced from Datastream and historical market data obtained with Bloomberg. The choice of an 8-year-long period of relatively merger-intense activity will allow examination of relatively recent trends. The study analyses completed acquisitions of 100% target shares launched by British or U.S. public companies. Firms listed on FTSE or NYSE stock exchanges are legally required to publish their filings and transaction specifics, which ensured the accuracy and transparency of the data. There are no constraints in terms of target firms. This ensures the heterogeneity of the data and eliminates any sampling bias some of the past papers were subject to: acquisitions of unquoted companies, divested subsidiaries and overseas enterprises are included. Diversification by internal growth was ignored and only large merger series were chosen: all partial acquisitions were excluded together with those of less than $500 million in value. By limiting the sample to significant M&A activity, the present study focuses on takeovers that are likely to affect both systematic and unsystematic risk components and have a noticeable impact on market valuation.

Methodology

Markowitz's (1952) market model of the security returns generating process specifies a relationship of the form:

Return on asset = risk-free return + *beta* x (market return – risk free return)

Hence, the CAPM equation shows that stock returns will move together with betas.

Combining this prediction with the proposition of the Modern Portfolio Theory, the model will empirically test the following claim:

Hypothesis

If a diversifying strategy is in fact effective in risk reduction, it is anticipated that both stock returns and market betas will go down.

This will be investigated using a two-step procedure. Firstly, the model will use a more direct approach to test the impact of mergers on betas that capture solely systematic risk of each individual asset and are insensitive to index and sector trends. Then the procedure will be reiterated and applied to stock returns[1], which should yield coefficients of identical signs, if CAPM holds. This will mimic the more conventional practices, thus allowing direct comparisons with previous studies.

An *ex ante* market's response to a firm's first public announcement or rumour[2] of its intention to engage in an acquisition will be examined. Schipper and Thompson (1983) show that most of the value of an eventually finalised merger is in fact capitalised into the

[1] Stock returns rather than price differences are used to keep the same order of magnitude since FTSE-listed companies are quoted in pence and NYSE in US dollars

[2] Dates of announcements and rumours obtained from MergerMarket.

acquirer's stock price at the time of its revelation rather than completion and this is when it truly reflects the market's perception of risk. This favours the use of daily data as "the shorter the time horizon, the less likely that the estimated returns will be biased by extraneous events" (Brown and Warner, 1980). Therefore the dependent variables will be measured as a difference in values from a day before and a day after a merger announcement:

(*a*) $\Delta beta = beta_{t+1} - beta_{t-1}$

$change\ in\ beta = beta\ day\ after\ -\ beta\ day\ before$

(*b*) $return = \frac{price_{t+1} - price_{t-1}}{price_{t-1}}$

$stock\ return = \frac{price\ day\ after\ -\ price\ day\ before}{price\ day\ before}$

Share quotes will also be adjusted for dividends and stock splits and market movements will be controlled for.

OLS and IV regressions

Both models will be estimated using a standard OLS regression of the form

$risk = f(cross-border, relatedness, relative\ importance, industry, acquirer's\ risk\ attitude, consideration\ structure, target\ profitability)$

where target profitability as an endogenous variable will be instrumented with a Two-Stage-Least-Squares (2SLS) procedure

$Target\ EBITDA = f(assets, liabilities, ownership, country\ development\ level)$

For OLS to be consistent the error term and the explanatory variable have to be uncorrelated. Target profitability is non-stochastic as balance sheet items directly impact on

income statement entries: positively via holdings and negatively via loans. Also, public companies are under more pressure to perform well than private or government owned due to the legal requirement of having their filings published, which feeds into their market valuation. Finally, firms from developed economies tend to earn more in absolute terms. Thus, IV regression has to be used to eliminate the endogeneity bias. To ensure instrument validity two tests will be executed:

(1) Instrument Relevance (F test)

H_0 : non-zero correlation between the instruments and the endogenous regressor

$corr(EBITDA, assets, liabilities, ownership, development) \neq 0$

(2) Instrument Exogeneity (J test)

H_0 : instruments and the error term in the risk equation are unrelated

Other tests

To further ascertain the appropriateness of OLS estimation, potential heteroscedasticity issues should be checked for with a White's test:

H_0 : error term depends solely on a constant (no heteroscedasticity)

If errors are not homoscedastic, there will be no bias in coefficients, but the t-statistics will be wrong. However, as the test cannot be executed within an IV estimation and since its power is low, it might be wise to use robust standard errors anyway (as long as potential heteroscedasticity is not in fact a symptom of an Omitted Relevant Variable).

As the paper pools data from the US and UK, which has not been done before, a structural break test will be undertaken through the use of dummy variables to ensure that parameters are constant over the entire sample with the null hypothesis of no structural change.

Diversification and Preliminary Analysis

Outliers

Data has been cleaned from 6 outliers, leaving the total of 529 observations. Outliers were identified on the basis of abnormally high: acquirer's equity values (EV>$1,143 billion), target to acquirer's EV ratio $\left(\frac{\text{target EV}}{\text{acquirer's EV}}>41\right)$, acquirer's absolute leverage (of -258 and 145) and target liabilities (>$1,277 billion). Those could skew the relative importance, risk attitude and target valuation proxies, driving the regression results in the wrong direction. Errors in explanatory variables correlated with the error term would make the OLS estimators biased and inconsistent and thus the odd data points had to be dropped.

Dependent variables

As markets are very information-sensitive, their valuations react instantaneously to merger news. The impact of diversification is simultaneously reflected by changes in betas and share prices, with the latter being directly influenced by the former via the CAPM relationship and thus expected to move in a similar manner. Stock returns range from -21.54% to 34.44% and are positively skewed, with the mean value at -0.48%. This is consistent with the MPT prediction of mergers being risk-reducing. Beta changes, on the other hand follow a leptokurtic distribution on the interval [-15.83 ; 16.61], centred on (-0.08), suggesting a rather limited, but still positive impact of M&A on risk-reduction (Appendix, Figure 1 and 2).

Cross-border

Imposing no strict restrictions on target companies significantly increases data heterogeneity and eliminates any sampling bias some of the past papers were subject to. The issue of overseas acquisitions, whose omission was pointed out as one of the main limitations of the previous studies, is addressed by introducing a binary variable cross-border, with national takeover as a default and 98 and 431 observations in each respective group. While market betas reflect the financial economics prediction of international acquisitions being risk-reducing, stock prices do not pick this trend, perhaps being determined by factors other than risk (Appendix, Figure 3).

Relatedness and Industry

Each firm in the sample was assigned to a macro industry group. The use of a SIC order level classification with 12 categories proved sufficient in the earlier studies. In terms of industry-relatedness the MPT suggestion is overall violated as it is related deals that are found to be risk-reducing (Appendix, Figure 4). Potential reasons for this will be discussed later in the paper. Some industry effects have become apparent though with particular sectors being in general considered safer than others. Those include: consumer goods, staples, high technology, energy and power, real estate and services. On the other hand old and mature industries, such as industrials and materials proved to be rather risky across the board, causing increases in market betas. Stock returns seem to be invariant to those effects (Appendix, Figure 5).

Size and Relative Importance

A variable for the size of target has been introduced in a form of $\frac{\text{target EV}}{\text{acquirer's EV}}$ ratio to show the relative importance of the acquisition to the parent company. On average the target represents 60% of the acquirer's market capitalisation and net debt, with a standard deviation of 1.65. The correlation of between this size proxy and risk variables is fairly strong and statistically significant (p-value=0.00), but its sign is consistent with the MPT prediction only in the market beta case (Appendix, Figure 6).

Risk Attitude

Acquirer's risk appetite is approximated by its leverage levels as suggested by the Prospect Theory and previous papers by Hamada(1972) and Shapiro and Titman (1986). Highly indebted companies are more inclined to take on risk to pay off their loans and they are in general less risk-averse as their cost of financing is very market-sensitive. Such firms are committed to higher cash outflows to cover interest payments, thereby making them vulnerable to environmental uncertainties. Consequently, "companies with high leverage will show high risk appetite" (Barton, 1988). On average their debt to equity ratios are moderate, with the mean of 3.79 and standard deviation of 4.88. The sample is still highly heterogeneous, including firms with capital surpluses as well as deficits, since the leverage ratios, after having been cleaned from outliers, range from -25 to over 31. Both risk variables show a positive relationship with debt (Appendix, Figure 7), proving leverage to be a good proxy.

Target Profitability

Target attractiveness will be controlled for using its profit levels from the base year (last accounting year prior to the merger announcement). Those are measured by Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA) and take on positive as well as negative values, representing firms making losses too, with an average target company making $134.47million annually. The more profitable the company, the less risky it is, which is depicted by market betas in Figure 8, Appendix.

Table 1: Main Variables

Variable	Definition	Unit of Measurement /Categories
	Dependent Variables	
Δbeta	Change in market beta	0.01 unit
return	Acquirer's stock return	0.01 unit
	Variables of Interest	
cross-border*	Acquirer and target are in different countries	(national) / cross−border
relatedness*	Acquirer and target come from the same industry	(related) / unrelated
relative importance	$=\frac{\text{Target Enterprise Value}}{\text{Acquirer Enterprise Value}}$	0.01 unit
	Control variables	
risk attitude	How risk-seeking acquirer is (approximated by her leverage)	0.01 unit
consideration	Deal financing structure	stock / cash / hybrid
industry	Target macro−industry	consumer / staples / energy&power / financials / healthcare / high technology / industrials / materials / media&entertainment / real estate / retail / telecoms
target EBITDA	Target profitability	$ million
	Instruments	
target assets	Value of Target Assets	$ million
target liabilities	Value of Target Liabilities	$ million
ownership*	Target ownership status	(private or government owned) / public
developed*	Target country development level	(undeveloped or developing) / developed

* indicates a dummy variable, default shown in brackets

RESULTS

Model

The market relationship estimated by OLS yielded significant results, in most part consistent with the MPT predictions.

$$\begin{aligned}\Delta beta = & \underset{(0.44)}{0.43} - \underset{(0.24)}{0.89}\, cross\ border - \underset{(0.31)}{0.27}\, unrelated + \underset{(0.60)}{1.97}\, cross\ border * unrelated \\ & - \underset{(0.02)}{0.04}\, target\ profits + \underset{(0.02)}{0.08}\, leverage - \underset{(0.12)}{0.44}\, relative\ importance \\ & + \underset{(0.26)}{0.63}\, cash + \underset{(0.29)}{0.59}\, hybrid - \underset{(0.47)}{1.27}\, consumer\ \&\ retail - \underset{(0.39)}{0.86}\, high\ tech \\ & - \underset{(0.42)}{1.27}\, energy\ \&\ power - \underset{(0.40)}{1.07}\, services\end{aligned}$$

The data do not suggest large multicollinearity issues as correlations between explanatory variables tend to be low (Figure 9, Appendix).

The model explained 24% of the variation, which is well above the customary threshold of $R^2 = 10\%$. All regressors proved jointly significant with $\chi^2 = 46.24$, (p-value = 0.00), however, on the individual level the industry relatedness variable yielded a z-statistic too low to be considered important.

Table 2: Regression Results

Δbeta	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
cross border	-0.89	0.24	-3.64	0.000	-1.36	-0.41
unrelated	-0.27	0.31	-0.89	0.375	-0.87	0.33
cross*unrelated	1.97	0.60	3.29	0.001	0.79	3.14
target profits	-0.04	0.02	-2.04	0.042	0.00	0.00
leverage	0.08	0.02	3.22	0.001	0.03	0.12
relative importance	-0.44	0.12	-3.65	0.000	-0.68	-0.20
cash	0.63	0.26	2.41	0.016	0.12	1.15
hybrid	0.59	0.29	2.01	0.045	0.01	1.17
consumer&retail	-1.27	0.47	-2.68	0.007	-2.20	-0.34
high tech	-0.86	0.39	-2.20	0.028	-1.63	-0.09
energy&power	-1.14	0.42	-2.75	0.006	-1.96	-0.33
services	-1.07	0.40	-2.69	0.007	-1.84	-0.29
constant	0.43	0.44	0.96	0.335	-0.44	1.30

The appropriateness of the test statistics is ensured by robust standard errors, which in the presence of heteroscedasticity correct the variance estimates and consequently z-ratios. Their use is always right, even with homoscedastic variance, but this causes small efficiency losses. White's test was impossible to carry out though due to the RHS endogeneity issues. Target profitability had to be instrumented with asset and liability values, development level and ownership status. Those proved to highly relevant, yielding an F-statistic F(4, 347)=144.47, much greater than the customary threshold of 10. The exogeneity test has also been passed with the J statistic $J = mF = 4 * 0.12 = 0.48 < \chi^2_{m-k=4-1=3} = 7.81$, which indicates an appropriate choice of the instruments.

Pooling of the data from the US and the UK proved to be correct too. An inclusion of an acquirer's nationality binary control changed hardly any coefficients and the variable itself

was highly insignificant with a p-value=0.75 (Figure 10, Appendix), suggesting no structural break. For the summary of all test statistics see Figure 11, Appendix.

Variables of Interest

The variables of interest included relative importance, cross-border and industry relatedness, but only the first two proved to be significant, however the signs of all three were consistent with the predictions of the Modern Portfolio Theory.

There appeared to be a very strong positive association between the size of the target relative to the acquirer and risk reduction: a unit change in the EV ratio caused a -0.44 decrease in beta. A bigger acquisition represents greater diversification as the new acquisition contributes more to the new entity and also reflects the common perception that sizeable companies may be 'too big to fail', hence safer. This inverse relationship between risk and corporate size has also been found by Winn (1977) and Hoskisson and Turk (1990).

Cross-border deals proved to be more risk-reducing as well, causing betas to go down by 0.88 relative to national acquisitions. A takeover in another country means that target and acquirer's income streams should be less correlated as driven by different macroeconomic conditions. However, the model suggests a caveat to this diversification strategy in the form of an additional industry relatedness effect. The multiplicative dummy shows that even though cross-border deals reduce risk in general (as showed by Figure 3, Appendix), in an unrelated sector they can cause huge risk increases (Figure 12, Appendix). Relative to national acquisitions of similar businesses there can be a beta increase of 1.97, suggesting that there is an optimal level of diversification that should not be exceeded.

Surprisingly, no other industry relatedness effect was found as the variable proved insignificant. Financial economics predicted an ambiguous relationship as on the one hand acquisitions within the same sector are value-increasing as firms can capitalise on their experience and share technologies or resource base, creating economies of scale and synergies (Ramaswamy, 1997). However, the more related the businesses of a firm, the more their returns will move in unison, i.e. the less the expected reduction in unsystematic risk (Chang and Thomas, 1989). Thus putting all eggs into the same basket exposes the parent company to the turbulences of a single industry and the Modern Portfolio Theory advocates acquisitions of dissimilar businesses to generate revenue in areas governed by different economic processes, simply hedging oneself (Rumelt, 1974). Yet "lacking a common logic among disparate set of businesses, unrelated firms are less able to address the competitive pressures that may simultaneously occur in any of their activities" (Williams, Paez and Saunders, 1988), thereby making the firm more vulnerable and increasing its riskiness. These two influences cancel out and the model cannot resolve this confusion. It does, nevertheless, reveal some industry patterns. Having included a set of target sector dummies, all of them proved to be risk-reducing relative to the default – industrials and materials, with the highest significance of energy&power and real estate. It might be that firms can best minimise risk by acquiring a business with particular characteristics, rather than considering the relatedness issues. Getting own resource bases, power supplies and properties and keeping away from old, mature and saturated sectors with few development prospects, unlike technology, does cause a relative decrease in beta. Similarly, investing in market-insensitive businesses, such as consumer goods and staples is also considered to be safer and necessities will always be in demand.

Control Variables

A set of control regressors has been added to eliminate any Omitted Relevant Variable bias, which would give inconsistent OLS coefficients. The shortcomings of the previous papers were addressed mainly by the inclusion of accounting terms. Acquirer's leverage proved to be highly significant and positively correlated with risk as predicted by the studies outlined above (Hamada, 1972 and Barton, 1988). A unit increase in the debt to equity ratio increased market risk by 0.08.

Support was also found for the inclusion of target profitability, which unsurprisingly proved to be inversely related to risk. Using target EBITDA instrumented with assets, liabilities, public status and development level reconciled different approaches of Lubatkin and Chatterjee (1994) and Barton (1988), whose measures of profitability were based on net income before taxes and total book assets. The results obtained with the IV approach were similar and had an additional advantage of controlling for ownership and economic influences.

Finally, as the market view of risk was being analysed, there was a need to control for the method of payment, which was one of the sources of bias in the study of Lubatkin, 1987. Two dummies, cash and hybrid, were included and both were found to be more risky than paying with securities (Figure 13, Appendix). They yielded beta increases of approximately 0.6 compared to the stock default, with the riskiness of cash-only deals being more pronounced (hybrids showed the averaging effect of a combination of cash and shares). The estimates are in line with the literature and can be well explained by tax effects premiums that should be larger for cash mergers than for mergers utilising securities for payment

(Wansley, Lane and Yang, 1983). It is not only that takeovers involving cash exclusively tend to be much more expensive, but also any capital gains are taxed in the year of the acquisition, while in stock transaction such can be deferred until the new securities are sold.[3] Also, a bidder offering to buy a company with securities must obtain a registration statement from the Securities and Exchange Commission before stockholders may start tendering their shares, which may make market players perceive the transaction as less risky.

DISCUSSION: MARKET BETA VS. RETURN

The market model of risk measured by beta changes yielded estimates for the most part consistent with the Modern Portfolio Theory, showing that mergers can be seen as motivated by risk reduction via diversification and proving CAPM applicable to the corporate domain, echoing the findings of Lubatkin (1987), Rumelt (1974) and the view promulgated by financial economics. Inclusion of size, accounting, risk attitude and relative importance variables, not only boosts the robustness of their findings, but together with a broader industry classification casts doubt on the credibility of the findings by Langetieg (1978) and Thompson (1984).

When estimating the model with stock returns rather than betas, no such effects have been found.

[3] Carleton *et al.,* 1983, offers a detailed discussion on tax and accounting treatment of different media of exchange in mergers

Figure 3: Regression Results for Stock Returns

return	Coef.	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
index change	0.022	0.16	0.13	0.893	-0.30	0.34
cross border	0.010	0.01	0.85	0.394	-0.01	0.03
unrelated	-0.009	0.01	-0.86	0.387	-0.03	0.01
cross*unrelated	0.026	0.02	1.46	0.143	-0.01	0.06
target profits	0.000	0.00	0.82	0.411	0.00	0.00
leverage	0.000	0.00	0.42	0.676	0.00	0.00
relative importance	0.004	0.00	1.85	0.064	0.00	0.01
cash	0.029	0.01	3.23	0.001	0.01	0.05
hybrid	0.002	0.01	0.19	0.85	-0.02	0.02
consumer&retail	0.005	0.01	0.47	0.641	-0.02	0.02
high tech	-0.019	0.01	-1.71	0.087	-0.04	0.00
energy&power	-0.002	0.01	-0.15	0.882	-0.02	0.02
services	-0.004	0.01	-0.44	0.657	-0.02	0.01
constant	-0.021	0.01	-1.88	0.061	-0.04	0.00

The appropriateness of the estimation for stock returns is reflected by the joint significance of all explanatory variables and its passing the structural break and IV tests (for test statistics see Figure 14, Appendix).

Even though market movements have been controlled for by the inclusion of index changes, this did not improve the overall poor fit of the model, which can only explain 9.2% of the variation. Given that this specification works well for betas, which are a pure market risk measure, it must be that share prices reflect much more than riskiness, blurring the findings. All three variables of interest proved highly insignificant, as their potential diversifying effect could have been outweighed by the synergistic benefits of relatedness, which impact heavily

on stock valuation, but are beyond the scope of this paper. No industry patterns were found either and the only significant factor was the method of payment, which is explainable by the tax effect premium outlined above.

As stock returns exhibit a multitude of influences other than risk, they are only a second-best analysis tool. The representativeness of the results is much higher in the market beta model and more confidence should be put in it, especially given betas' invariance to factors that do not relate to risk *per se.*

CRITIQUE AND CONCLUSION

Takeover moves are often justified on the grounds of risk reduction by reducing a firm's exposure to influences of a single industry or a given economic environment. Using traditional and more direct market-model measures, the results showed that corporate diversification in general is a means to reduce risk levels and that the Modern Portfolio Theory is applicable to the M&A domain. However, the findings question the accuracy of the conventional use of stock returns as market betas are a much better reflection of the risk relationship.

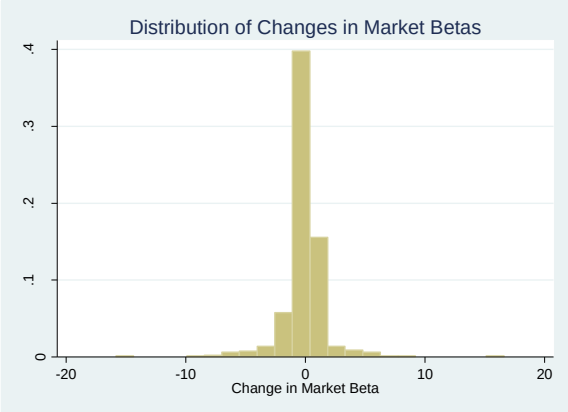
The study estimates were consistent with the relationship between corporate diversification and *ex ante* risk perceptions, which Ramaswamy (1993) theorised and Lubatkin and Chatterjee (1994) found. The practical implication is clear: risk-minimisation can be achieved by bringing together businesses whose cash flows are rather weakly correlated, let it be due to different geographies, as indicated by the cross-border effect of the study. This is intensified by the relative importance of the target to the acquirer, measured by their relative size. It is important to note though that the interactive relationship between

internationalisation and industry relatedness suggested that an optimal level of diversification for firms may exist and that too much differentiation can in fact increase riskiness.

The study, however, is not limitation-free, even though it addressed most shortcomings found in previous papers. There are still opportunities for further research that could explicitly control for the culture of the merging firms (Melicher and Rush, 1974) and predicted synergies (Lubatkin and Chatterjee, 1994), which could help eliminate any bias in the industry relatedness coefficient. These proxies are unfortunately hard to conceptualise and quantify. Also, the paper focuses on aggregated M&A outcomes, ignoring the effect of one deal influencing another and not accounting for managerial behaviour and challenges of post-deal integration. Those are, however, beyond the scope of this piece of analysis, which focuses on various levels of relatedness through the categorisation scheme and shows with a high level of confidence that the Modern Portfolio Theory is applicable to the corporate diversification domain.

APPENDIX

Figure 1: Distribution of Dependent Variables



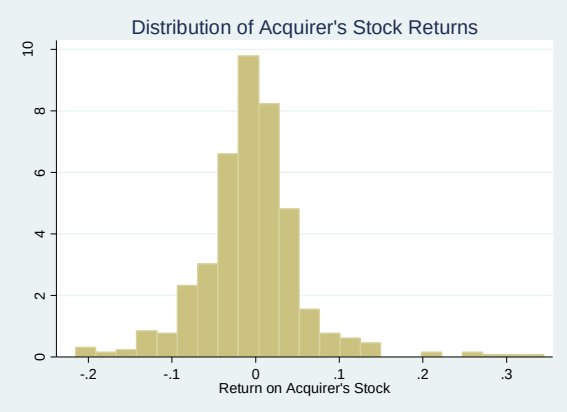
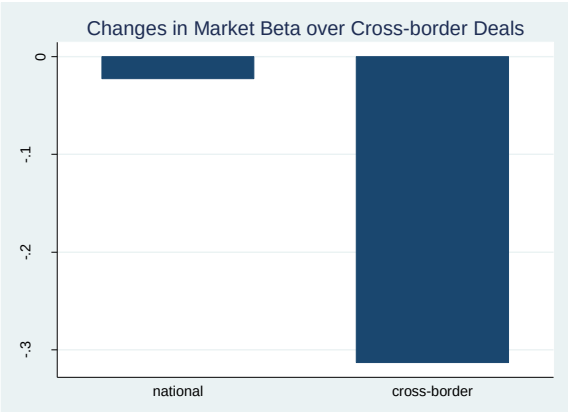


Figure 2: Dependent Variables Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
return	527	-0.44%	0.06	-21.54%	34.44%
Δbeta	527	-0.08	1.91	-15.83	16.61

Figure 3: Risk Changes over Cross-border Deals



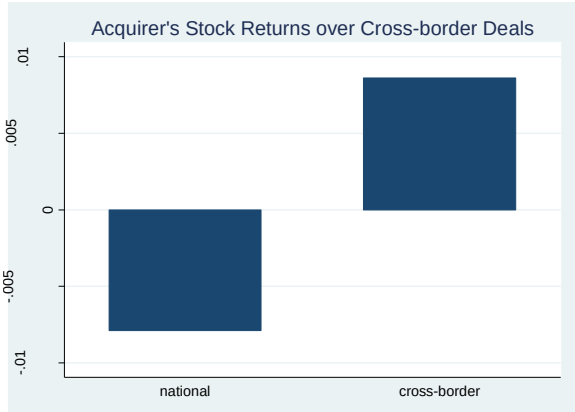


Figure 4: Risk Changes over Industry Relatedness

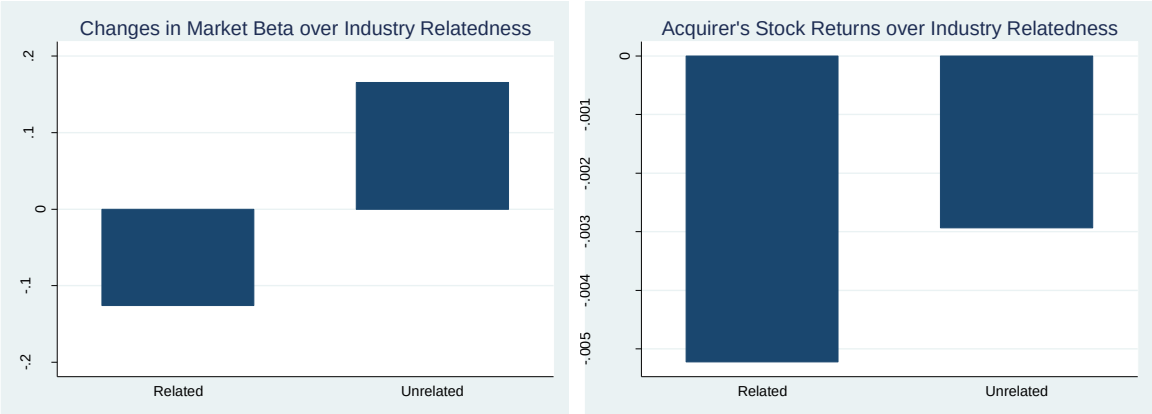


Figure 5: Industry Effects

		Δbeta		return	
Target Industry	**No. deals**	**Mean**	**Std. Err.**	**Mean**	**Std. Err.**
materials and industrials	70	0.53	0.30	0.00	0.01
consumer, staples and retail	62	-0.29	0.25	0.00	0.00
high tech and telecoms	127	-0.10	0.14	-0.02	0.01
energy and power, real estate	91	-0.29	0.16	0.00	0.01
financials, healthcare and media	179	-0.12	0.15	0.00	0.00

Figure 6: Correlation between the Relative Importance of the Target and Risk Variables

	relative importance	**p-value**
Δbeta	-0.38	0.00
return	0.15	0.00

Figure 7: Acquirer's Leverage and Risk

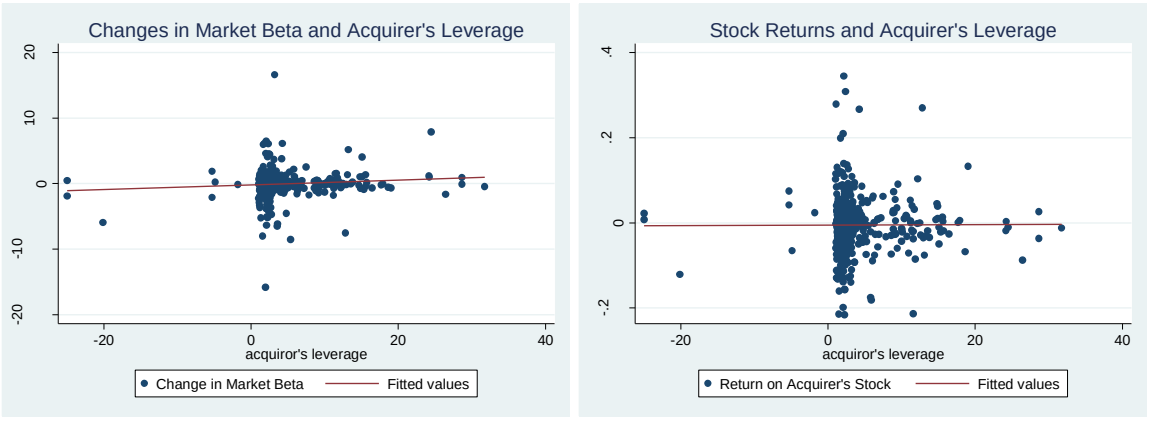


Figure 8: Target Profitability and Risk

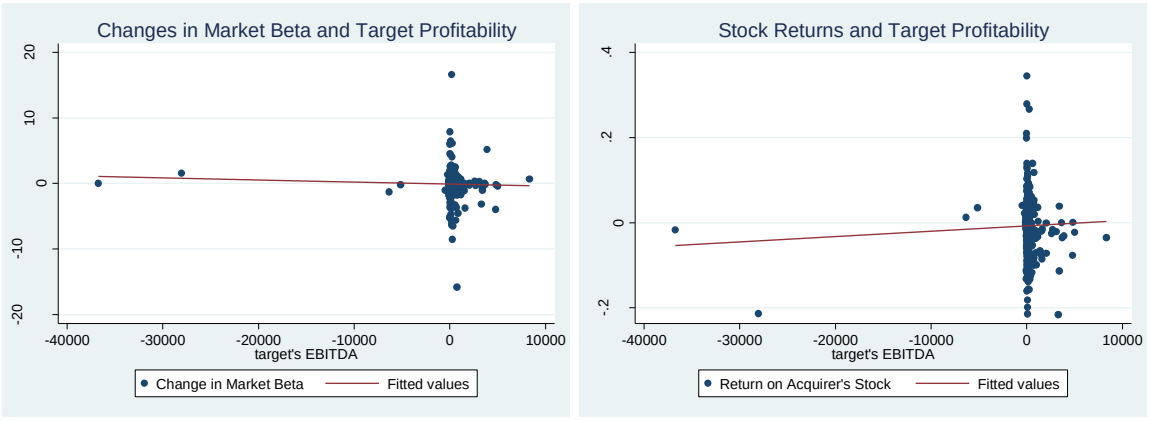


Figure 9: Correlations between Regressors

	cross border	unrelated	leverage	rel.imp.	cash	hybrid	cons. &retail	high tech	energy& power	services	target profits	assets	liabilities	ownership
cross border														
unrelated	0.06													
leverage	0.01	0.05												
rel. imp.	0.03	-0.03	0.07											
cash	0.15*	0.15*	-0.04	-0.13*										
hybrid	-0.06	-0.13*	0.00	0.11*	-0.77*									
consumer&retail	0.04	0.23*	-0.02	-0.06	0.05	0.00								
high tech	-0.02	0.05	-0.24*	-0.08	0.08	-0.13*	-0.20*							
energy&power	-0.08	-0.14*	0.00	-0.04	-0.14*	0.16*	-0.17*	-0.26*						
services	-0.03	-0.11*	0.28*	0.14*	-0.03	0.00	-0.26*	-0.40*	-0.33*					
target profits	0.01	0.01	-0.07	-0.04	0.01	0.10*	0.01	0.02	0.06	-0.09				
assets	-0.05	-0.06	0.23*	0.10	-0.12*	-0.04	-0.05	-0.07	-0.05	0.17*	-0.76*			
liabilities	-0.05	-0.06	0.23*	0.09	-0.11*	-0.05	-0.04	-0.07	-0.05	0.17*	-0.77*	1.00*		
ownership	-0.01	-0.09*	0.03	0.05	0.06	-0.16*	-0.11*	0.07	-0.09*	0.06	0.00	0.04	0.03	
developed	-0.29*	-0.01	-0.08	0.00	-0.02	-0.01	-0.17*	0.01	0.06	0.01	0.00	0.01	0.01	0.12*

* indicates a correlation statistic significant at a 5% level

Figure 10: No Structural Break Detection

Δbeta	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
acquirer's nation	0.09	0.29	0.32	0.749	-0.48	0.67
cross border	0.00	0.00	-2.07	0.039	0.00	0.00
unrelated	-0.91	0.24	-3.80	0.000	-1.39	-0.44
cross*unrelated	-0.27	0.31	-0.87	0.382	-0.87	0.33
target profits	1.98	0.61	3.26	0.001	0.79	3.16
leverage	0.08	0.02	3.25	0.001	0.03	0.12
relative importance	-0.44	0.12	-3.66	0.000	-0.68	-0.20
cash	0.63	0.26	2.40	0.017	0.11	1.14
hybrid	0.59	0.29	2.01	0.044	0.01	1.17
consumer&retail	-1.27	0.47	-2.69	0.007	-2.20	-0.34
high tech	-0.86	0.39	-2.19	0.028	-1.63	-0.09
energy&power	-1.14	0.42	-2.73	0.006	-1.96	-0.32
services	-1.07	0.40	-2.69	0.007	-1.84	-0.29
constant	0.43	0.44	0.96	0.335	-0.44	1.30

Figure 11: Test Statistics in Market Beta Regression

Test	H0:	test statistic	critical value	p-value	passed?
Join significance	Explanatory variables jointly significant	χ^2=46.24	χ^2=21.03	0.00	✓
Instrument Relevance	Instruments are relevant	F=144.47	F=10	0.00	✓
Instrument Exogeneity	Instruments are exogenous	J=0.48	χ^2=7.81	0.04	✓
Structural Break	There's no structural break	z=0.32	z=1.96	0.75	✓

Figure 12: Risk in Cross-border Deals by Industry Relatedness

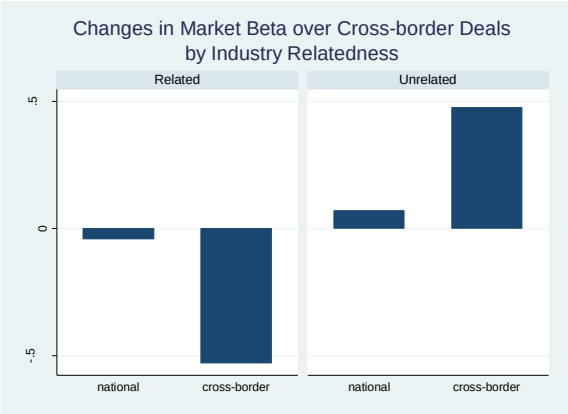


Figure 13: Risk in Different Deal Consideration Structures

		% of deals causing risk reduction measured by	
	No. Deals	**Δbeta**	**return**
shares	68	59%	69%
cash	222	47%	47%
hybrid	239	54%	58%

Figure 14: Test Statistics in Stock Returns Regression

Test	**H0:**	**test statistic**	**critical value**	**p-value**	**passed?**
Join significance	Explanatory variables jointly significant	χ^2=39.17	χ^2=22.36	0.00	✓
Instrument Relevance	Instruments are relevant	F=144.29	F=10	0.00	✓
Instrument Exogeneity	Instruments are exogenous	J=7.35	χ^2=7.81	0.04	✓
Structural Break	There's no structural break	z=0.31	z=1.96	0.76	✓

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