5

The Profitability of Merger Arbitrage: Some Australian Evidence

by
Krishnan Maheswaran †
Soon Chin Yeoh †

Abstract:

In this paper we examine the risk-adjusted profitability of merger arbitrage in Australia. Using a sample of 193 merger and acquisition bids from January 1991 to April 2000, we construct a time series of returns on equal and value-weighted merger arbitrage portfolios. Benchmarking the returns on the merger arbitrage portfolios against the CAPM and Fama and French (1993) three-factor models, we find that merger arbitrage generates statistically and economically significant excess risk-adjusted returns before transaction costs, ranging from 0.84% to 1.20% per month. However, after adjusting for transaction costs, the risk-adjusted returns are no longer statistically significant. Further, in contrast to the United States, our evidence indicates that merger arbitrage in Australia is a market-neutral investment strategy. Indeed, the results from our estimations of the linear CAPM and Fama and French (1993) three-factor models suggest that merger arbitrage returns are not significantly sensitive to market-wide factors.

Keywords:

MERGERS AND ACQUISITIONS; MERGER ARBITRAGE; RISK ARBITRAGE.

† Department of Finance, University of Melbourne, The University of Melbourne, Parkville, 3010. Email: k.maheswaran@unimelb.edu.au

We gratefully acknowledge the helpful comments of Kevin Davis and an anomous referee, Robert Faff for kindly providing the ASX/Russell Style Indices, the computer programming of Chean-Hou Loke and the assistance of the University of Melbourne Kinsman Scholarship.

Australian Journal of Management, Vol. 30, No. 1 June 2005, © The Australian Graduate School of Management

1. Introduction

Merger arbitrage is a risky investment strategy that exploits pricing discrepancies in the market for corporate control.[1] On announcement of an acquisition, the target will typically trade at a discount to the bid price. This discount is determined by the probability of the bid's success.[2] Merger arbitrageurs aim to capture the discount by buying the target stock on announcement of the acquisition with the intention of tendering the stock to the bidder on completion of the bid. If a bid is successful, the arbitrageur locks in a return equal to the discount. But, if the bid is unsuccessful, the target share price will typically fall and the arbitrageur will face selling the shares on market for a lower price.[3] In this case, the return on the position taken by the arbitrageur will be negative. Thus, unlike pure arbitrage, merger arbitrage is risky and requires an outlay of capital. In this paper, we examine the risk-adjusted returns to merger arbitrage in Australia.

There is anecdotal evidence from individual investors and hedge fund managers that merger arbitrage earns spectacularly high returns.[4] Early academic studies of merger arbitrage quantify raw and risk-adjusted returns to merger arbitrage in the United States and Canadian markets by using standard event study methodology (e.g. Larker & Lys 1987; Dukes, Frolich & Ma 1992; Karolyi & Shannon 1998). These studies support the claim that merger arbitrage earns significant returns. For example, Karolyi and Shannon (1998) find annualised risk-adjusted returns as high as 33.9%.

However, Mitchell and Pulvino (2001) and Baker and Savasoglu (2002) show that the annualised returns reported in previous studies overstate the profitability of merger arbitrage. Because merger arbitrage does not usually earn returns on a continual basis, it is not appropriate to annualise event window returns. The two papers use a calendar-weighted portfolio approach to overcome this problem. Mitchell and Pulvino (2001) report merger arbitrage returns of 4% per annum. They construct a hypothetical portfolio of merger arbitrage positions subject to capital and price impact constraints. They also adjust for a non-linear relationship between portfolio and market returns using a contingent claims analysis. Baker and Savasoglu (2002) find that merger arbitrage yields risk-adjusted returns after direct transaction costs of 7.2%–10.8% per annum.[5]

The risk-adjusted profitability of merger arbitrage is controversial. Outside the United States there is a lack of evidence on the returns generated by merger arbitrage.[6] In addition to providing Australian evidence on the profitability of

1. Merger arbitrage is also commonly called risk arbitrage.
2. For example, see Samuelson and Rosenthal (1986), Brown and Raymond (1986) and Hutson (2000).
3. Although, it is possible for the target share price to rise and the arbitrageur to derive a positive return when selling on market.
4. For example see Boesky (1985) and in the Australian context, Clegg, B (2003) Arbitrage Plays Increasing Role in Takeovers, Australian Financial Review, April 3, 2003. In Australia, specialised investment funds and investment banks are known to engage in merger arbitrage. The extent of trading levels is unknown. One fund that focuses on merger arbitrage is Rubicon Partners. This fund engages in merger arbitrage selectively after an examination of the characteristics of each deal. As at November 2003 it reports a 13.9% cumulative return over 20 months since its inception.
5. This is an annualised figure based on the monthly merger arbitrage risk adjusted return of 0.6% to 0.9% reported by Baker and Savasoglu (2002).
6. To our knowledge the only study of merger arbitrage profitability outside of the United States is Karolyi and Shannon (1998) who examined merger arbitrage in the Canadian market.

merger arbitrage, we also make other contributions. We benchmark portfolio returns using a Fama and French (1993) three-factor model adopting the methodology of Faff (2001). Further, in contrast to Mitchell and Pulvino (2001) we find no evidence of a non-linear relationship between merger arbitrage returns and the market index. This suggests that merger arbitrage returns in Australia are market neutral.

This paper is organised as follows. The next section describes the data set of merger and acquisition bids used. Section 3 provides details of the merger arbitrage portfolio construction. Section 4 examines the methodology used to benchmark merger arbitrage portfolio returns. Section 5 contains the results from this study and section 6 concludes.

2. Data

This study uses merger and acquisition data drawn from the Securities Data Company (SDC) Mergers and Acquisitions database and financial data drawn from the Securities Industry Research Centre of Asia Pacific (SIRCA) Core Research Database, Datastream International, and the Reserve Bank of Australia.

2.1 Mergers and Acquisitions Data

The initial mergers and acquisitions sample comprises of 557 Australian targets from January 1991 to April 2000. To be included in the final sample, the target must be listed on the Australian Stock Exchange (ASX), the deal value must be disclosed and greater than 1,000,000 Australian dollars, the bidder aims to control the target,[7] and the announcement and completion or withdrawal dates of the bid must be recorded in the SDC database. There are 209 target companies after applying the sample selection criteria. In this sample, the method of payment for 193 of the bids was cash. The method of payment for the remaining 16 bids was stock. Given the small number of stock deals, this data is also discarded from the sample. The final sample comprises of 193 targets subject to cash deals.

2.2 Financial Data

The daily stock price data is extracted from the SIRCA database for the final sample of target companies. This data is adjusted for dividends and capitalization changes using the SIRCA dilution factors. The proxies for the risk-free rate are the 13 week Treasury bill yield (January 1991 to September 1993) and the 3 month Treasury Bill yield (October 1993 to April 2000) obtained from the Reserve Bank of Australia. The proxy for the market portfolio is the value-weighted All

7. Control is defined as an ownership stake of 50% or more in the target's equity. We also excluded bids for a host of other reasons. Our aim was to exclude stocks with insufficient price data and bids that were not of the type to be subject to merger arbitrage. Bids were excluded where: the closing price on the ASX for the target was not available or the target was not traded two days after the announcement date; more than one form of consideration was offered; the target was an investment trust, property trust or closed end fund; the target shares sold to the bidder were held solely by the target company; the target shares were offered to comply with an order of the Australian Securities and Investments Commission; the deal was a split off of a percentage of a government owned company; the deal also involved an acquisition of the target's convertible shares and/or options; the takeover was a scheme of arrangement; and the identity of the acquirer was not disclosed.

Ordinaries Accumulation Index obtained from the SIRCA database. In addition, we use four ASX/Russell Style Indices obtained from Datastream International.[8] The four style indices are ASX/Russell Small Value™ Accumulation Index, ASX/Russell Small Growth™ Accumulation Index, ASX/Russell Value 100™ Accumulation Index, and ASX/Russell Growth 100™ Accumulation Index.[9] Adopting the method of Faff (2001) these style indices are used to compute proxies for the small-firm and book-to-market effect.

3. Merger Arbitrage Portfolio

3.1 Portfolio Construction

The merger arbitrage portfolio is made up of targets, where the consideration is cash. The target is included in this portfolio two days after the announcement of the bid. This two-day gap ensures that the large abnormal return that typically accrues to target shareholders on announcement does not affect the merger arbitrage portfolio. The target remains in the merger arbitrage portfolio until the bid is completed or withdrawn. When a target is included in the merger arbitrage portfolio, the target is deemed to be 'active'.

Figure 1 shows the number of active deals in the merger arbitrage portfolio in a particular month over the sample period. There are on average 5.23 active bids per month in the merger arbitrage portfolio. The average number of active deals per month pre and post August 1995 is 3.13 and 7.34. This reflects the higher number of bids announced post August 1995.

3.2 Return Measurement

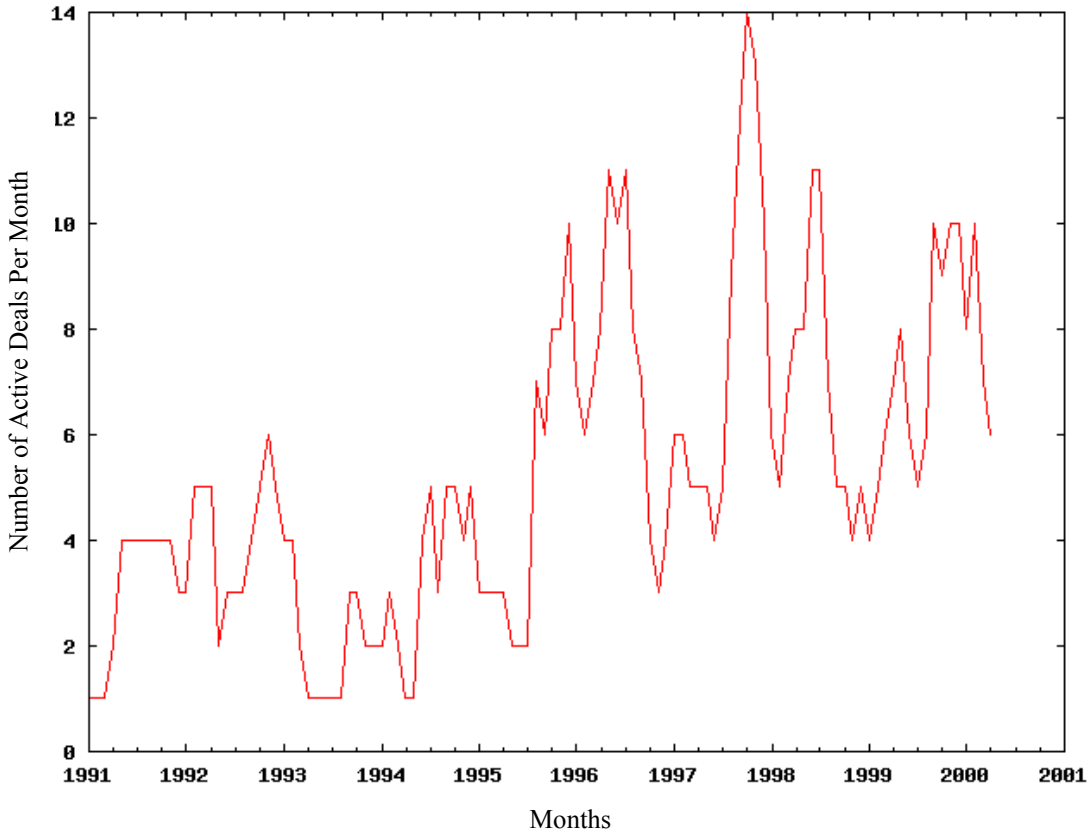
The investment holding period of the merger arbitrageur starts at the point the target stock becomes active and ends when the deal is completed or withdrawn. If the deal is successful, the merger arbitrageur will receive the final bid price from the bidder. The merger arbitrageur's return will equal the return on the target's stock from two days after the announcement to the day of the announcement of final bid completion. In this case, an implicit assumption is that the final bid and market price of the target converge at final bid completion. However, in 36% of successful bids the last recorded market price of the target prior to the announcement of deal completion does not coincide with the final bid price. Of these bids, the last price recorded is on average 5.3% below the final bid price, with a standard deviation of 4.3%. Hutson (2000) suggests that the non-convergence is due to a lack of liquidity in the market for the target as investors perceive the bid's success as increasingly likely. The lack of liquidity, especially a few days prior to the announcement of final bid success means that the recorded market price is often a stale price, and hence the observed non-convergence in the final bid and market price.[10] Since the merger arbitrageur actually receives the final bid price when a

8. The Frank Russell Company calculates these indices. They are reconstituted annually to reflect changes in the market. The Frank Russell Company ceased calculating the values of these indices in April 2000.
9. See Faff (2001) for a detailed description of the ASX/Russell Style Indices.
10. For successful bids where the last recorded market price of the target does not converge with the final bid price, we find that in the last 10 trading days prior to the announcement of bid success there are on average 2.6 days where there is no trading in the target.

deal is successful, we adjust for all successful deals the price on the day of the completion announcement to be equal to the final bid price paid by the acquirer. On the other hand, if the deal is unsuccessful, the merger arbitrageur reverses their position by selling the shares in the target on market.

Figure 1

Number of Active Deals in the Merger Arbitrage Portfolio in a Month



To compute the return on the merger arbitrage portfolio, initially we compute the simple daily return for each active deal in the merger arbitrage portfolio:

$$R_{it} = \frac{P_{it} + D_{it} - P_{i,t-1}}{P_{i,t-1}} \tag{1}$$

where R_{it} is the daily return, P_{it} is the target's stock price at the close of the market on day t, D_{it} is the dividend paid by the target on day t, and $P_{i,t-1}$ is the target's closing stock price on day t–1 (subscript i refers to the transaction number and t refers to the transaction time in days).[11]

Next, we use the simple return for each active deal to construct the equal and value-weighted daily return series on the merger arbitrage portfolio:

11. Where there is no price recorded due to lack of trading activity, it is assumed that the price remains at the previously recorded closing price.

$$R_{MAPt} = \sum_{i=1}^{Nt} w_{it} R_{it} \tag{2}$$

where R_{MAPt} is the merger arbitrage portfolio return for day t, w_{it} is the weight at any point in time of each active deal in the merger arbitrage portfolio and N_t is the total number of active deals in the arbitrage portfolio on day t.

The weight at any point in time of each active deal in the equal-weighted portfolio is given by:

$$w_{it} = \frac{1}{N_t} \tag{3}$$

The weight of an active bid i at any point in time in the value-weighted portfolio is given by:

$$w_{it} = \frac{V_i}{\sum_{i=1}^{N_t} V_i} \tag{4}$$

where V_i the market value of the target of active bid i.

Finally, we compound the daily returns on the merger arbitrage portfolio to the monthly frequency:

$$R_{MAPj} = \prod_{t=m}^{M} (1 + R_{MAPt}) - 1 \tag{5}$$

where j indexes months between January 1991 and April 2000, t indexes trading days in a transaction month with the total number of trading days equal to m.

3.3 Descriptive Statistics

Table 1 provides some descriptive statistics on the equal and value-weighted merger arbitrage portfolios. There are 112 monthly returns on the merger arbitrage portfolios. The mean monthly return on the merger arbitrage portfolio is 21 (value-weighted 1.32%) to 57 (equally weighted 1.68%) basis points greater than the market portfolio (1.11%). The annual excess return over the market portfolio of this investment strategy is in the order of 2.52% to 6.52% per annum. Not surprisingly, the standard deviation of the merger arbitrage portfolios is greater than the market portfolio. In part, this reflects the small number of stocks in the merger arbitrage portfolios relative to the market portfolio. The graph in figure 2 shows the cumulative value of one dollar invested in the equal and value-weighted merger arbitrage portfolios and the market portfolio. It is clear from the graph and the Sharpe ratios in table 1 that the merger arbitrage portfolios outperform the market portfolio over the sample period. Consistent with the anecdotal evidence, the preliminary results suggest that merger arbitrage in Australia is highly profitable.

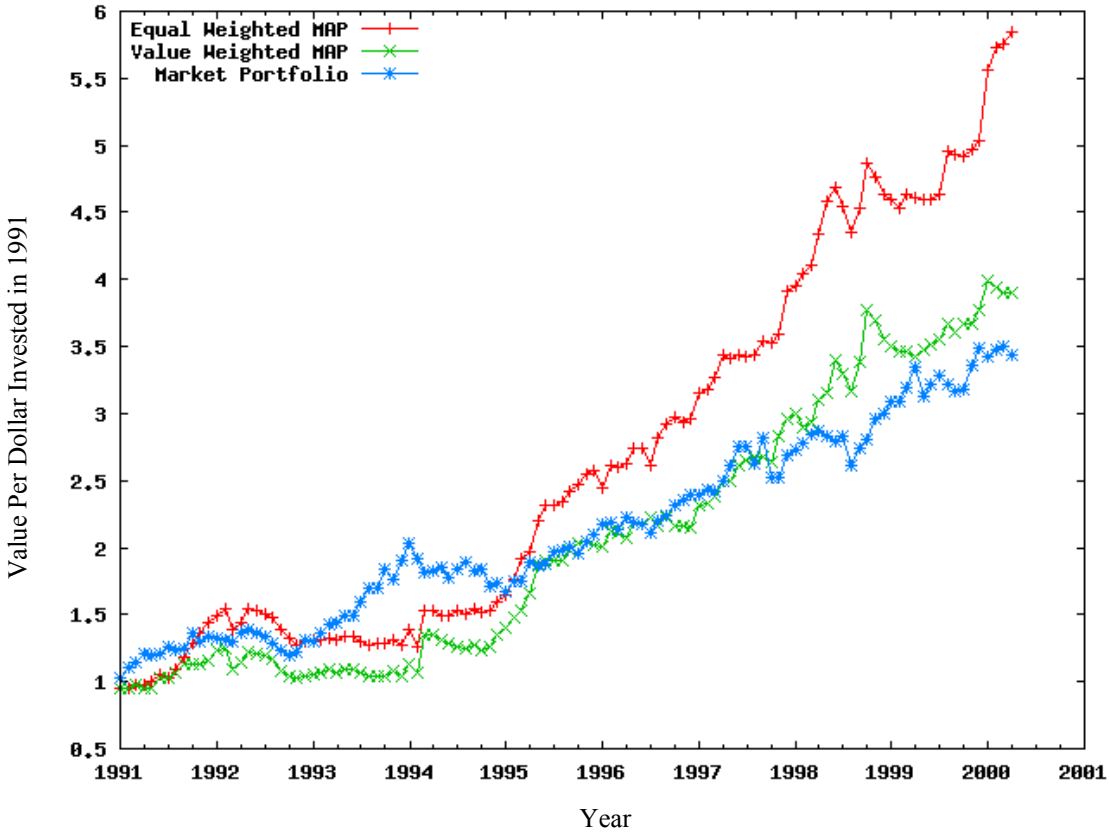
Table 1

Descriptive Statistics—Monthly Returns for Merger Arbitrage and Market Portfolios

	Equal-Weighted Merger Arbitrage	Value-Weighted Merger Arbitrage	Market Portfolio (All Ordinaries Accumulation Index)
Mean (%)	1.68	1.32	1.11
Std Dev. (%)	4.30	4.49	3.77
Sharpe Ratio	0.266	0.175	0.153
Number of Months	112	112	112

Figure 2

Merger Arbitrage Cumulative Returns (January 1991 to April 2000)



4. Benchmarking Merger Arbitrage Portfolio Returns and Transaction Costs

The preceding analysis suggests that merger arbitrage is a highly profitable investment strategy in Australia. Yet, there are two shortcomings with this analysis. The returns of the merger arbitrage portfolios are not adjusted for risk or transaction costs. In what follows, we detail the adjustments for risk and transaction costs made to the merger arbitrage portfolio.

4.1 Linear Risk Adjustments

To evaluate the excess returns on the merger arbitrage portfolios adjusted for systematic risk, we first benchmark returns on the merger arbitrage portfolio using the capital asset pricing model (CAPM):

$$E(R_{MAPj} - R_{fj}) = \beta_M E(R_{Mj} - R_{fj}) \tag{6}$$

where R_{fj} is the return on the risk-free security and R_{Mj} is the return on the market portfolio in month j.

The empirical counterpart of this model is the excess returns market model:

$$(R_{MAPj} - R_{fj}) = \alpha + \beta_M(R_{Mj} - R_{fj}) + \varepsilon_j \tag{7}$$

where α (alpha) is the measure of excess risk-adjusted returns on the merger arbitrage portfolio.

We also benchmark the returns on the merger arbitrage portfolio against the Fama and French (1993) three-factor model:[12]

$$E(R_{MAPj} - R_{fj}) = \beta_M E(R_{Mj} - R_{fj}) + \beta_{SMB} E(SMB_j) + \beta_{HML} E(HML_j) \tag{8}$$

where, SMB_j is the difference in returns between a portfolio of small stocks and a portfolio of big stocks in month j and HML_j is the difference in returns between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks in month j. The empirical counterpart of this model is the excess returns market model augmented with a size and book-to-market factor:

$$(R_{MAPj} - R_{fj}) = \alpha + \beta_M(R_{Mj} - R_{fj}) + \beta_{SMB}SMB_j + \beta_{HML}HML_j + \varepsilon_j \tag{9}$$

where α (alpha) is the measure of excess risk-adjusted returns on the merger arbitrage portfolio. Like Faff (2001) we use the ASX/Russell style indices to form proxies of the SMB and HML factors in the Australian market:

$$SMB_j = \left(\frac{R_{SVj} + R_{SGj}}{2}\right) - \left(\frac{R_{V100\,j} + R_{G100\,j}}{2}\right) \tag{10}$$

$$HML_j = \left(\frac{R_{V100\,j} + R_{SVj}}{2}\right) - \left(\frac{R_{G100\,j} + R_{SGj}}{2}\right) \tag{11}$$

where R_{SVj} is the return on the ASX/Russell Small Value™ Accumulation Index in month j; R_{SGj} is the return on the ASX/Russell Small Growth™ Accumulation Index in month j; R_{V100j} is the return on the ASX/Russell Value 100™

12. See Haliwell, Heaney and Sawicki (1999) and Faff (2001) for applications of Fama and French (1993) three factor model in the Australian context.

Accumulation Index in month j; and R_{G100j} is the return on the ASX/Russell Growth 100™ Accumulation Index in month j.[13] [14]

4.2 Transaction Cost Adjustment

We examine the impact of transaction costs on the profitability of merger arbitrage. Merger arbitrageurs incur stamp duty, brokerage and market impact costs when taking a long position in the target stock. These costs are also incurred when the arbitrageur reverses the long position on market when a bid is declared unsuccessful. If the merger arbitrageur tenders the target shares to the successful bidder, only stamp duty is incurred on the transaction.

We adjust the merger arbitrage portfolio return series to account for the impact of these costs on merger arbitrage profitability. We use Montagu's (2001) estimates of transaction costs in the Australian market. We adjust each transaction where applicable for stamp duty costs (0.15% of the value of the transaction), brokerage (0.30%) and market impact (0.50%). Stamp duty costs are determined by regulation to be 0.15%. The estimates of brokerage and market impact are at the upper limit of the range of costs estimated by Montagu (2001).

4.3 Non-Linear Risk Adjustments

Mitchell and Pulvino (2001) document that merger arbitrage in the United States is not a market neutral investment strategy. In particular they find that the return on the merger arbitrage portfolio is correlated with market returns in bear markets, but uncorrelated with market returns in flat and bull markets. Since the return on the merger arbitrage portfolio is correlated with declining market returns, this investment strategy is not market neutral in the United States. Like, Mitchell and Pulvino (2001), we test whether the return on the Australian merger arbitrage portfolios is market neutral using a piecewise linear CAPM-type model:[15]

$$R_{MAPj} - R_{fj} = (1-\delta)[\alpha_{Mlow} + \beta_{Mlow}(R_{Mj} - R_{fj})] + \delta[\alpha_{Mhigh} + \beta_{Mhigh}(R_{Mj} - R_{fj})] + \varepsilon_j \quad (12)$$

$$\text{s.t} \qquad \alpha_{Mlow} + \beta_{Mlow}(\text{Threshold}) = \alpha_{Mhigh} + \beta_{Mhigh}(\text{Threshold}) \quad (13)$$

13. See Faff (2001) for further details on the construction of these factor-mimicking portfolios.
14. During the sample period, stamp duties on the transfer of shares were regulated by state stamp duties legislation and regulations. The abolishment of stamp duties on the transfer of shares took effect from 1 July 2001. For further details, see the provisions of the following acts and associated regulations as they stood prior to 1 July 2001: *Stamp Duties Act 1920* (NSW) ss145-162; *Stamps Act 1958* (VIC) s59A, ss60A-60E; *Stamp Act 1894* (QLD) ss31B-31F, 31J; *Stamp Act 1921* (WA) ss112A-112FF, ss126A-126GG; *Stamp Duties Act 1923* (SA) ss90A-90G; *Stamp Duties Act 1931* (TAS) ss64-69, ss69B-69G, s76(7)-76(9); *Stamp Duty Act* (NT) ss62-66, s69K-69Q.
15. We model non-linearity using the CAPM model. Like Mitchell and Pulvino (2001) modeling non-linearity using the Fama and French (1993) three-factor model was judged as beyond the scope of this paper. Estimating the model in equation (12) is equivalent to estimating R_{MAPj}-R_{fj} = α_{MLow} + $ß_{MLow}$(R_{Mj} – R_{fj}) + $\delta\alpha_{MHigh}$ + $\delta\beta_{MHigh}$(R_{Mj} – R_{fj}) +ε_j Combining the restriction in equation (13) yields the following model which is estimated: R_{MAPj}-R_{fj} = α_{MHigh} + $ß_{MHigh}$(threshold) - $ß_{MLow}$(threshold) + $ß_{MLow}$ (R_{Mj} – R_{fj}) $\delta\alpha_{MHigh}$ + $\delta\beta_{MHigh}$(R_{Mj} – R_{fj}).

where δ is a dummy variable which equals one if the excess return on the market portfolio is above a predetermined threshold level and zero otherwise. β_{Mlowj} and β_{Mhighj} are the merger arbitrage CAPM beta values from estimation of the excess return market model when the excess return on the market portfolio is below and above the threshold level. α_{Mlow} and α_{Mhigh} are the measurements of excess risk-adjusted return of the merger arbitrage portfolio from estimation of the excess return market model when the excess return on the market portfolio is below and above the threshold level. The constraint, equation (13), ensures the piecewise linear model, equation (12), is continuous. The threshold level is set to minimize the sum of squared residuals in equation (12).

To evaluate whether there is significant evidence of a non-linear relationship between merger arbitrage and market returns, we use an *F*–test to test the validity of a linear restriction on the non-linear model with the chosen threshold value. The unrestricted regression equation is the non-linear CAPM equation (12). We impose the following two restrictions which identify the restricted model to be the linear CAPM given in equation (7)

$$\alpha_{Mlow} = \alpha_{Mhigh} \tag{14}$$

$$\beta_{Mlow} = \beta_{Mhigh} \tag{15}$$

5. Results

5.1 CAPM Benchmark Without Transaction Cost Adjustments

Panel A in table 2 presents the results using the CAPM benchmark for the equal and value-weighted merger arbitrage portfolios without adjustment for transaction costs. Using the complete sample period, the estimated alphas are 1.14% and 0.85% per month for the equal and value-weighted portfolios and are statistically significant from zero at the five percent level. Thus merger arbitrage, after accounting for market risk but before transaction costs is a highly profitable investment strategy in Australia. An examination of the estimated market model betas provides support for the conclusion that merger arbitrage in Australia is market neutral. The market model betas of 0.0528 and –0.0554 for the equal and value-weighted portfolios are not significantly different from zero at reasonable levels of significance. This suggests that returns on merger arbitrage positions are subject to event risk, namely the risk of deal failure, but not subject to market risk.

In panel A we also present results for the market model estimation over two sub-samples: January 1991 to August 1995 and September 1995 to April 2000. Again, the merger arbitrage portfolio return series is not adjusted for transaction costs. The estimated sub-sample alphas are similar to the complete sample alphas. However, the alphas in the first sub-sample are not significant at any reasonable level. This is most likely a result of fewer deal announcements in the first sub-sample, and hence a low number of active deals in the portfolio in that period. However, the alphas for the second sub-sample are statistically significant at the 5% level, in part reflecting the higher number of bids announced at this time.

Table 2
Benchmarking Portfolio Returns with the CAPM

The following table presents results from the following regression of monthly merger arbitrage portfolio returns:

$$(R_{MAPj} - R_{fj}) = \alpha + \beta_M(R_{Mj} - R_{fj}) + \varepsilon_j$$

Where R_{MAPj} is the return in month j on a portfolio of merger arbitrage transactions, R_{fj} is the month j risk-free rate and R_{Mj} is the month j return on the value-weighted All Ordinaries Accumulation Index. Two different time series of merger arbitrage returns are used. The first is the equal-weighted merger arbitrage portfolio where the weight of each stock in the portfolio is equal to the inverse of the number of stocks in the portfolio. The second is the value-weighted merger arbitrage portfolio where the weight of each stock in the portfolio is equal to the total market value of the stock as a proportion of the total market value of the portfolio.

Panel A of the table presents results for the merger arbitrage return series not adjusted for transaction costs. Panel B presents the results for the merger arbitrage return series after adjustment for transaction costs. Each panel presents regression results for the complete sample (January 1991 to April 2000), the first sub-sample (January 1991 to August 1995) and the second sub-sample (September 1995 to April 2000).

Dependent Variable	α	β_M	Sample Size
Panel A: No Transaction Cost Adjustment			
Complete Sample: January 1991 to April 2000			
Equal-weighted R_{MAP}	0.011378	0.052826	112
	(0.004454)**	(0.106727)	
Value-weighted R_{MAP}	0.008508	–0.055413	112
	(0.004277)**	(0.118833)	
First Sub-Sample: January 1991 to August 1995			
Equal-weighted R_{MAP}	0.011295	–0.016072	56
	(0.008053)	(0.155736)	
Value-weighted R_{MAP}	0.008251	–0.094625	56
	(0.008015)	(0.175292)	
Second Sub-Sample: September 1995 to April 2000			
Equal-weighted R_{MAP}	0.011431	0.150265	56
	(0.003672)***	(0.127173)	
Value-weighted R_{MAP}	0.008745	0.000391	56
	(0.003308)**	(0.131575)	
Panel B: Adjusted for Transaction Costs			
Complete Sample – January 1991 to April 2000			
Equal-weighted R_{MAP}	0.007579	0.049100	112
	(0.004440)*	(0.105685)	
Value-weighted R_{MAP}	0.004905	–0.054086	112
	(0.004242)	(0.118507)	
First Sub-Sample: January 1991 to August 1995			
Equal-weighted R_{MAP}	0.007755	–0.022324	56
	(0.008052)	(0.155173)	
Value-weighted R_{MAP}	0.004758	–0.091564	56
	(0.008082)	(0.176449)	
Second Sub-Sample: September 1995 to April 2000			
Equal-weighted R_{MAP}	0.007375	0.149674	56
	(0.003722)*	(0.123870)	
Value-weighted R_{MAP}	0.005035	–0.000912	56
	(0.003244)	(0.127592)	

Note: *, **,*** indicate significance at the 0.1, 0.05 and 0.01 levels, respectively; and Newey-West HAC standard errors are reported in parentheses.

5.2 CAPM Benchmark With Transaction Cost Adjustments

In panel B of table 2, we present the results of the market model estimation for the merger arbitrage portfolio after adjustment for transaction costs. The impact of transaction costs is evident in lower estimates of alpha in the full sample (0.76% and 0.49% per month for the equal and value-weighted portfolios) and the two sub-samples (0.78% and 0.48% for the first sub-sample and 0.74% and 0.50% for the second sub-sample). In addition, only the alpha of the equal-weighted portfolio is significant from zero at the 10% level in the full sample and second sub-sample. Our results suggest that merger arbitrage profitability is constrained by the direct and indirect costs of trading.

5.3 Fama and French (1993) Benchmark Without Transaction Cost Adjustments

In panel A of table 3 we benchmark the merger arbitrage portfolio using the Fama and French (1993) three factor model without making adjustments for transaction costs. Using the complete sample period the estimated Fama and French (1993) alphas are economically significant at 1.20% and 0.84% per month for the equal and value-weighted portfolios. The alpha for the equal-weighted portfolio is significant at the 5% level but the alpha of the value-weighted portfolio is only significant at the 10% level. A comparison of the estimation over the two sub-samples reveals that the estimated Fama and French (1993) alphas are larger in the first sub-sample but not significantly different from zero at reasonable levels of significance. On the other hand, in the second sub-sample, the estimated Fama and French (1993) alphas of 1.16% and 0.79% per month for the equal and value-weighted portfolios and are significantly different from zero at the five percent level. Again, we believe this is due to the greater number of active deals in the merger arbitrage portfolio in the second sub-sample period.

5.4 Fama and French (1993) Benchmark with Transaction Cost Adjustments

The impact of transaction costs on estimated Fama and French (1993) alphas is similar to the impact of transaction costs on estimated CAPM alphas. As expected, the estimated Fama and French (1993) alphas in the full sample and both sub-samples are lower after the adjustment for transaction costs. We also find that the only significant estimated alpha values (at the 10% level) are the alphas for the equal-weighted portfolio in the full sample and second sub-sample. Again, these results suggest that the costs of trading have a significant impact on merger arbitrage profitability.

Interestingly, we find that for all estimation periods with and without transaction cost adjustments, the estimates for the $\beta_{Mkt,}$ β_{SMB} and β_{HML} coefficients for both merger arbitrage portfolios are not significantly different from zero at reasonable levels of significance. This result suggests that the returns on the merger arbitrage portfolios are insensitive to both market and the Fama and French (1993) factors.

Table 3
Benchmarking Portfolio Returns with the Fama and French (1993) Three Factor Model

This table presents results from the following regression of monthly merger arbitrage returns:

$$(R_{MAPj} - R_{fj}) = \alpha + \beta_M(R_{Mj} - R_{fj}) + \beta_{SMB}SMB_j + \beta_{HML}HML_j + \varepsilon_j$$

Where R_{MAPj} is the month j return on a portfolio of merger arbitrage transactions; R_{fj} is the month j risk-free rate; R_{Mj} is the month j return on the value-weighted all ordinaries accumulation index; SMB_j is a factor calculated using equation (10) which proxies for the difference in returns between a portfolio of small market value stocks and a portfolio of big market value stocks in month j; and HML_j is a factor calculated using equation (11) which proxies for the difference in returns between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks in month j.

Panel A of the table presents results for the merger arbitrage return series before adjustment for transaction costs. Panel B of the table presents results for the merger arbitrage return series adjusted for transaction costs. Each panel presents results for regressions over three sample periods: the complete sample (January 1991 to April 2000), the first sub-sample (January 1991 to August 1995) and the second sub-sample (September 1995 to April 2000).

Dependent Variable	α	β_{Mkt}	β_{SMB}	β_{HML}	Sample
Panel A: No Transaction Cost Adjustment					
Complete Sample: January 1991 – April 2000					
Equal-weighted R_{MAP}	0.012010	0.028518	–0.060246	–0.172437	112
	(0.004696)**	(0.117109)	(0.127577)	(0.163666)	
Value-weighted R_{MAP}	0.008405	–0.071545	–0.080283	–0.016924	112
	(0.004548)*	(0.123002)	(0.127402)	(0.167580)	
First Sub-Sample: January 1991 – August 1995					
Equal-weighted R_{MAP}	0.013111	–0.054991	–0.348220	–0.033120	56
	(0.009184)	(0.180364)	(0.236684)	(0.495407)	
Value-weighted R_{MAP}	0.013111	–0.054991	–0.348220	–0.033120	56
	(0.009184)	(0.180364)	(0.236684)	(0.495407)	
Second Sub-Sample: September 1995 – April 2000					
Equal-weighted R_{MAP}	0.011554	0.138837	–0.116355	–0.144633	56
	(0.003833)***	(0.139885)	(0.150086)	(0.188961)	
Value-weighted R_{MAP}	0.007871	0.004111	–0.171195	0.083337	56
	(0.003122)**	(0.144944)	(0.178960)	(0.213682)	
Panel B: Adjusted for Transaction Costs					
Complete Sample: January 1991 – April 2000					
Equal-weighted R_{MAP}	0.008244	0.021272	–0.073559	–0.186296	112
	(0.004669)*	(0.116409)	(0.126815)	(0.165096)	
Value-weighted R_{MAP}	0.004838	–0.074959	–0.098840	–0.034092	112
	(0.004537)	(0.121802)	(0.122666)	(0.165565)	
First Sub-Sample: January 1991 – August 1995					
Equal-weighted R_{MAP}	0.009731	–0.069465	–0.050803	–0.381782	56
	(0.009164)	(0.178097)	(0.231512)	(0.501509)	
Value-weighted R_{MAP}	0.007628	–0.130144	0.018105	–0.535850	56
	(0.010329)	(0.187917)	(0.240384)	(0.551400)	
Second Sub-Sample: September 1995 – April 2000					
Equal-weighted R_{MAP}	0.007488	0.137487	–0.128459	–0.153478	56
	(0.003861)*	(0.137120)	(0.151844)	(0.189328)	
Value-weighted R_{MAP}	0.004139	0.002412	–0.181923	0.079476	56
	(0.003118)	(0.140172)	(0.172627)	(0.207800)	

Note: *, **,*** indicate significance at the 0.1, 0.05 and 0.01 levels, respectively; and Newey-West HAC standard errors are reported in parentheses.

5.5 Non-Linear Risk Adjustment

The preceding analysis suggests that merger arbitrage is a market neutral investment strategy in Australia. We formally test whether merger arbitrage is market neutral by benchmarking the returns on the merger arbitrage portfolio using a piecewise linear CAPM given by equations (12) and (13). This specification is valid if the return on the merger arbitrage portfolio is correlated with markets returns in depreciating markets, but uncorrelated with market returns in flat and appreciating markets. Since, the piecewise linear CAPM nests the standard linear CAPM, an F-test can be used to compare the unrestricted piecewise linear model with the restricted model which under the restrictions given by equations (14) and (15) is the standard linear CAPM.

Table 4
F–Test of Linear Restrictions

This table presents results of the *F*–test of the validity of linear restrictions on the following unrestricted model model:

$$R_{MAPj} - R_{fj} = (1-\delta)[\alpha_{Mlow} + \beta_{Mlow}(R_{Mj} - R_{fj})] + \delta[\alpha_{Mhigh} + \beta_{Mhigh}(R_{Mj} - R_{fj})] + \varepsilon_j$$
$$\text{s.t} \quad \alpha_{Mlow} + \beta_{Mlow}(\text{Threshold}) = \alpha_{Mhigh} + \beta_{Mhigh}(\text{Threshold})$$

where δ is a dummy variable which equals one if the excess return on the market portfolio is above a predetermined threshold level and zero otherwise. β_{Mlowj} and β_{Mhighj} are the merger arbitrage CAPM beta values from estimation of the excess return market model when the excess return on the market portfolio is below and above the threshold level. α_{Mlow} and α_{Mhigh} are the measurements of excess risk-adjusted return of the merger arbitrage portfolio from estimation of the excess return market model when the excess return on the market portfolio is below and above the threshold level. The constraint ensures the piecewise linear model is continuous. The threshold level is set to minimize the sum of squared residuals.

The linear restrictions imposed are as follows:

$$\alpha_{\text{MLow}} = \alpha_{\text{MHigh}}$$
$$\beta_{\text{MLow}} = \beta_{\text{MktHigh}}$$

Imposing the linear restrictions gives the following restricted linear CAPM model:

$$(R_{MAPj} - R_{fj}) = \alpha + \beta_M(R_{Mj} - R_{fj}) + \varepsilon_j$$

Portfolio	Threshold R_{Mj}–R_f	Calculated *F*–Statistic
Panel A: No Transaction Cost Adjustment		
Equal-weighted R_{MAP}	–2.0%	0.853182
		(0.4289)
Value-weighted R_{MAP}	–2.0%	0.722114
		(0.4880)
Panel B: Adjusted for Transaction Costs		
Equal-weighted R_{MAP}	–2.0%	0.787921
		(0.4574)
Value-weighted R_{MAP}	–2.0%	0.633745
		(0.5325)

Note: Probability values are reported in parentheses.

In table 4 presents the results of the *F*–test for the equal and value-weighted portfolios before and after the adjustment for transaction costs. In the table we also report that for all portfolios, the threshold excess market return chosen to minimise

the sum of squared residuals in estimation of equation (12) is –2.0%.[16] The probability values of the calculated *F*–statistics are reported in parentheses. In all four cases, the probability values suggest that at all reasonable levels of significance, we fail to reject the null hypothesis that the linear restrictions in equation (13) and (14) are valid. This suggests that modelling merger arbitrage returns using a non-linear specification is unnecessary. We interpret this as evidence that in Australia, the returns on a merger arbitrage investment strategy are market neutral. In contrast to Mitchell and Pulvino (2001), benchmarking merger arbitrage portfolio returns with the linear CAPM model is valid.[17]

6. Conclusion

In this paper, we examine the risk-adjusted profitability of merger arbitrage in Australia. Using a sample of 193 merger and acquisition bids from January 1991 to April 2001, like Mitchell and Pulvino (2001) and Baker and Savasoglu (2002) we construct a time series of returns on merger arbitrage portfolios. Benchmarking the returns on the merger arbitrage portfolios against the CAPM and Fama and French (1993) three-factor models, we find that merger arbitrage generates statistically and economically significant excess risk-adjusted returns before transaction costs, ranging from 0.84% to 1.20% per month. However, our analysis also shows that merger arbitrage profitability is significantly constrained by transaction costs. Incorporating Montagu's (2001) upper limit estimates of direct and indirect trading costs, we find that in most cases transaction costs render merger arbitrage abnormal returns insignificant. Further, in contrast to Mitchell and Pulvino (2001) our evidence indicates that merger arbitrage in Australia is a market neutral investment strategy. Indeed, the results from our estimations of the linear CAPM and Fama and French (1993) three-factor models suggest that merger arbitrage returns are not significantly sensitive to market-wide factors.

(Date of receipt of final transcript: September 29, 2004.
Accepted by Garry Twite and Doug Foster, Area Editors.)

References

Baker, M. & Savasoglu, S. 2002, 'Limited arbitrage in mergers and acquisitions', *Journal of Financial Economics,* vol. 64, pp. 91–115.

Boesky, I, 1985. *Merger Mania*, Holt, Rinehart and Winston, New York.

Brown, K. & Raymond, M. 1986, 'Risk arbitrage and the prediction of successful corporate takeovers', *Financial Management*, vol. 15, no. 3, pp. 54–63

Clegg, B. 2003, 'Arbitrage plays increasing role in takeovers', *Australian Financial Review*, April 3.

16. We estimate the piecewise linear CAPM using threshold excess market returns ranging from -5.0% to 0% in increments of 0.5% to determine what threshold level minimises the sum of squared residuals. The results from these regressions are available upon request.
17. We do not test whether the relationship between portfolio returns and Fama and French (1993) SMB and HML factors is non-linear and hence cannot come to the same conclusion for the Fama and French (1993) three-factor model.

Dukes, W.P., Frolich, C.J. & Ma, C.K. 1992, 'Risk arbitrage in tender offers', *Journal of Portfolio Management*, vol. 18, pp. 47–55.

Faff, R. 2001, 'An examination of the Fama and French three-factor model using commercially available factors', *Australian Journal of Management*, vol. 26, pp. 1–17.

Fama, E. & French, K. 1993, 'Common risk factors in the returns on stocks and bonds', *Journal of Financial Economics*, vol. 33, pp. 3–56.

Halliwell, J., Heaney, R. & Sawicki, J. 1999, 'Size and book to market effects in Australian share markets: A time series analysis', *Accounting Research Journal*, vol. 12, pp. 122–37.

Hutson, E. 2000, 'Takeover targets and the probability of bid success: Evidence from the Australian market', *International Review of Financial Analysis*, vol. 9, no, 1, pp. 45–65.

Karolyi, G.A, & Shannon, J. 1998. 'Where's the risk in risk arbitrage?' Working Paper, University of Western Ontario.

Larker, D. & Lys, T. 1987, 'An empirical analysis of the incentives to engage in costly information acquisition: The case of risk arbitrage', *Journal of Financial Economics*, vol. 18, pp. 111–26.

Mitchell, M. & Pulvino, T. 2001, 'Characteristics of risk and return in risk arbitrage', *Journal of Finance*, vol. 56, pp. 2135–75.

Montagu, C. 2001, *Pre Trade,* ITG Advance, pp. 3–14

Samuelson, W. & Rosenthal, L. 1986, 'Price movements as indicators of tender offer success', *Journal of Finance*, vol. 41, pp. 481–99.