The Price of Asymmetric Dependence: Evidence from Australian Equities

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Abstract

Australian listed equity returns exhibit asymmetric dependence with the market. This asymmetric dependence is priced in the cross section independently of linear, market (β) risk. Lower-tail dependence attract a premium of 6.3% and upper-tail dependence yield a discount of 6.7%. This compares with 5.2% for the β-risk premium. The degree of upper-tail and lower-tail dependence has been increasing significantly over the past fifteen years. Further, the price of lower-tail dependence has remained relatively stable over the past 15 years, whilst the price of upper-tail dependence has been increasing significantly.

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1. Introduction

Asymmetric dependence (AD) is dependence that differs across regions of the joint return distribution. Rational investors may well exhibit preferences for certain types of AD. For example, consider two stocks A and B that have identical β and equal average returns. Stock A exhibits a higher correlation in the upper tail of excess returns whilst stock B is symmetric in return dependence. Under the assumptions of the CAPM, investors will be indifferent to the choice between stocks A and B as the expected returns on both stocks, as well as their βs, are equal. However, rational investors may prefer stock A over B since stock A is more likely to suffer abnormal returns during any market upturn. If investors exhibit preferences with respect to AD then we expect AD to be priced in the Australian market if, in addition, it exists and is non-diversifiable. The primary aim of this paper is to identify and quantify the price of AD in Australian listed equities.

Many authors find evidence for the existence of AD in US stock equities (Bali, Demirtas, and Levy, 2009; Bollerslev and Todorov, 2009; Hong, Tu, and Zhou, 2007; Ang, Chen, and Xing, 2006; Post and van Vliet, 2006; Hartmann, Straetmans, and de Vries, 2004; Patton, 2004; Ang and Bekaert, 2002; Ang and Chen, 2002; Butler and Joaquin, 2002; Campbell, Koedijk, and Kofman, 2002; Longin and Solnik, 2001; Ramchand and Susmel, 1998; Erb, Harvey, and Viskanta, 1994). In addition, several of these studies identify the existence of AD between well-diversified stock indices, thereby providing credible evidence that AD is not easily diversified away (Hong, Tu, and Zhou, 2007; Hartmann, Straetmans, and de Vries, 2004; Patton, 2004; Ang and Chen, 2002; Ang and Bekaert, 2002; Butler and Joaquin, 2002; Campbell, Koedijk, and Kofman, 2002; Longin and Solnik, 2001; Ramchand and Susmel, 1998; Erb, Harvey, and Viskanta, 1994).

The identification of AD amongst Australian equities is more limited, with the notable exceptions of Rong and Trueck (2014); Ignatieva and Trueck (2011); Beine, Cosma and Vermeulen (2010); Kolari and Pynnönen (2010); Hatherley and Alcock (2007); Cappiello, Engle and Sheppard (2006); Bhar (2001). The Australian market is particularly interesting in the study of AD as many risk-drivers in the Australian market contrast markedly with those of the US market. For example, Australia is a more concentrated market with lower leverage and liquidity and higher sovereign risk compared to the US market (Dempsey, 2010). Many of these previous studies have explored dependence using a single measure, thereby capturing both the symmetric, linear dependence and AD with the same metric. From an asset pricing perspective, it is important to separate these factors to identify the price of AD orthogonally to the price of linear, market (β) risk.

We employ the adjusted J-statistic (Alcock and Hatherley, 2015; Ang, Chen, and

Xing, 2006) to determine the asymmetric dependence between the returns of each equity and the market separately from the β of each equity stock. Using this metric, we find that the asymmetric dependence is significantly priced in the cross section of Australian stock returns. In our sample, average levels of lower-tail dependence attract a premium of 6.3% and average levels of upper-tail dependence yield a discount of 6.7%. This compares with 5.2% for the β risk premium.

Under a multi-asset pricing framework, non-linear premia imply that the benchmark portfolio is spanned by β, representing the linear component of dependence between stock returns and the market proxy, and a higher order component of dependence. When the higher order component of dependence is characterised by increased correlation in up or down markets, the price of an asset in an economy containing investors with state-dependent preferences will be contingent upon the state of the market. Consequently, the dependence between the rate of return on an investment and the market will also be contingent on the state of the market.

The main objective of this paper is to examine whether AD, and lower-tail dependence (LTD) and upper-tail dependence (UTD) in particular, attract a premium independent of the premium attached to β. However, we contribute to the existing literature in several ways, described as follows. First, we quantify the level of AD for Australian equity returns independently of linear market risk. Second, we find that this asymmetric dependence is priced in the cross section. Third, we quantify the price of UTD and LTD separately (and independently of β). Fourth, we find that the existence of AD predicts returns up to twelve months in advance. Fifth, we find that both the level and price of AD has changed over time. The degree of UTD and LTD has increased over the past fifteen years. The price of LTD has remained relatively constant whereas UTD becomes more heavily priced over time. Last, we note that the level and price of AD is not uniform across industry sectors. Asymmetric dependence (both UTD and LTD) is priced in returns of Financials, Health Care, Consumer Goods and Basic Materials sectors. There is no evidence of AD pricing in sectors Technology and Consumer Services.

We proceed as follows. In Section 2, we explore the theoretical justification of investor preferences for asymmetric dependence. In Section 3, we describe how we measure AD independently of market β. In Section 4, we describe the data and methods used to price AD in Australian equities. We present out results in Section 5 and conclude in Section 6.

2. Asymmetric Dependence and Disappointment

Ang, Chen, and Xing (2006) argue that the existence of a downside risk premium is consistent with an economy of investors that are averse to disappointment in the framework developed by Gul (1991). This framework deviates from the expected utility paradigm upon which traditional asset pricing theory is built via the assumption that the desirability of an act in a given state depends on not only the objective payoff associated with the act, but also the state itself. This results in a one parameter extension of the expected utility framework whereby outcomes that lie above an endogenously defined reference point (elating outcomes) are down-weighted relative to outcomes that lie below the reference point (disappointing outcomes). The disappointment-averse utility function is therefore defined as:

$$\phi(x,\nu) = \begin{cases} u(x) & \text{for } x \text{ satisfying } u(x) \leq \nu \\ \frac{u(x)+\beta\nu}{1+\beta} & \text{for } x \text{ satisfying } u(x) > \nu, \end{cases} \tag{1}$$

where u is a generic utility function, β is the coefficient of disappointment aversion, and ν is the certainty equivalent satisfying $\sum_x \phi(x,\nu)p(x) = \nu$ for probability function $p(x)$. This function inexplicably ties an agent's risk aversion to their aversion to disappointment and therefore cannot accommodate the separation of dependence driven tail risk from systematic risk[2].

An alternative framework is considered by Skiadas (1997) in which subjective consequences (disappointment, elation, regret, etc) are incorporated indirectly through the properties of the decision maker's preferences rather than through explicit inclusion among the formal primitives. For example, if an act y is considered ex ante to yield better consequences than x overall, then the subjective feeling of disappointment in having chosen y over x in the event that F occurs can lead to the situation in which x is no less desirable than y during event F. In this case, an aversion to disappointment implies that x is preferred over y in the event that F occurs. This is formally written as:

$$\big(x = y \,\text{on}\, F \,\text{and}\, y \succeq^{\Omega} x\big) \Rightarrow x \succeq^{F} y, \quad x, y \in X, \tag{2}$$

where Ω represents the set of all events, X is the set of acts, and $\succeq$ defines a complete

[2]The set of preferences (u,β) satisfying (1), are risk averse if and only if $\beta \geq 0$ and u is concave (see Gul (1991), Theorem 3 for proof). Furthermore, (u_1,β_1) is more risk averse than (u_2,β_2) if $\beta_1 \geq \beta_2$ and $R^a_{u_1}(x) \geq R^a_{u_2}(x)$ for all x, where $R^a_u(x) = -u''(x)/u'(x)$, the coefficient of absolute risk aversion (see Gul (1991), Theorem 5 for proof). It follows that if (u_1,β_1) is more risk averse than (u_2,β_2), then $\beta_1 \geq \beta_2$. Although Gul (1991) preferences improve upon traditional utility preferences in the explanation of asset return dynamics, they fail to sufficiently account for observed risk premium variability (Bekaert, Hodrick, and Marshall, 1997) and cannot accommodate the existence of counter-cyclical risk aversion (Epstein and Zin, 2001; Routledge and Zin, 2010) due to the constancy of the downside aversion parameter across states.

and transitive preference order. Disappointment is therefore defined by the agent's preference relation rather than if an outcome is worse than a certainty equivalent.

Individuals with Skiadas (1997) preferences are therefore endowed with a family of conditional preference relations, one for each event (Grant, Kajii, and Polak, 2001). Preferences are state-dependent, as in the Gul (1991) framework, and because consequences are treated implicitly through the agents preference relations, preferences can be regarded as "non-separable" in that the ranking of an act given an event may depend on subjective consequences of these acts outside of the event.

Equation (2) has two important implications for our study. First, the outcomes associated with x and y given F need not be bad outcomes. This implies that the market may display feelings of disappointment even in the absence of poor market conditions leading to the expectation of time varying tail risk premia. Second, the separation of systematic risk from excess tail risk follows directly from (2) in that an act y may be preferred over x overall given the global risk aversion properties of the individual, but may be more or less appealing during a particular event as a result of the markets attitude towards disappointment and elation. We therefore expect the market to assign a separate premium to both global (systematic) risk aversion and aversion to AD.

Although disappointment aversion reflects a divergence from von Neumann Morgenstern expected utility theory, the validity of a market price of risk continues to hold as a result of the relationship between disappointment aversion and risk aversion. Gul (1991), for example, demonstrates that risk aversion implies disappointment aversion. Conversely, Routledge and Zin (2010) argue that investor preferences exhibit more risk aversion as the penalty for disappointing outcomes increases, effectively as a result of an increase in the concavity of the utility function. This implies that an increase in downside risk is also likely to be captured by an increase in systematic risk.

From a risk management perspective, this induces a substitution effect between risk aversion and disappointment aversion in that the effect of risk aversion on a utility maximizing hedge portfolio decreases as disappointment aversion increases, and vice versa (Lien and Wang, 2002).

In an economy consisting of investors that are averse to disappointment in the framework developed by Gul (1991), Ang, Chen, and Xing (2006) show that investors require higher compensation to invest in stocks that are sensitive to market downturns.

3. Measuring Asymmetric Dependence

Various authors have proposed a range of measures to capture AD and/or tail risk including downside β (Ang, Chen, and Xing, 2006), Archimedian copula (Genest, Gendron, and Boureau-Brien, 2009), H-statistic (Ang and Chen, 2002) and the original version of J-statistic (Hong, Tu, and Zhou, 2007). Alcock and Hatherley (2015) note that most of these statistics are unsuitable for asset pricing purposes for various reasons, including non-monotonicity between the metric and AD and non-orthogonality between the metric and β. Alcock and Hatherley (2015) propose an adjustment to the J-statistic of Hong, Tu, and Zhou (2007) that generates a monotonic measure that is orthogonal to CAPM β and so allows for the pricing of AD independently of the price of β risk.

The Alcock and Hatherley (2015) Adjusted J-statistic (J^{Adj}) is defined by the following procedure. We unitise β in each data set before the J-statistic is estimated. That is for each set $\{R_{it}, R_{mt}\}_{t=1}^{T}$, we get $\hat{R}_{it} = R_{it} + \beta R_{mt}$, where R_{it} and R_{mt} is continuously compounded return on asset i and market, and $\beta = cov(R_{it}, R_{mt}/\sigma_{R^2_{mt}})$. The first transformation implies that $\beta_{\hat{R}_{it},R_{mt}} = 0$. This enables us to standardise the data to get identical standard deviation of the CAPM regression residuals and get R^S_{mt} and $\hat{R}^S_{it}$. The final transformation step sets the $\hat{\beta}$ to 1 by letting $\tilde{R}_{mt} = R^S_{mt}$ and $\tilde{R}_{it} = \hat{R}^S_{it} + R^S_{mt}$. After this transformation, all data sets have the same β and standard deviation of model residuals, which compels the J-statistic to be invariant to the linear dependence and the level of idiosyncratic risk.

The Adjusted J-statistic (J^{Adj}) is then defined as

$$J^{Adj} = \Big[\text{sgn}\left(\left[\tilde{\rho}^{+} - \tilde{\rho}^{-}\right] \mathbf{1}\right)\Big] T \left(\tilde{\rho}^{+} - \tilde{\rho}^{-}\right)' \hat{\Omega}^{-1}(\tilde{\rho}^{+} - \tilde{\rho}^{-}\Big), \tag{3}$$

where $\tilde{\rho}^{+} = \{\tilde{\rho}^{+}(\delta_1), \tilde{\rho}^{+}(\delta_2), ..., \tilde{\rho}^{+}(\delta_N)\}$ ans $\tilde{\rho}^{-} = \{\tilde{\rho}^{-}(\delta_1), \tilde{\rho}^{-}(\delta_2), ..., \tilde{\rho}^{-}(\delta_N)\}$, $\mathbf{1}$ is $N \times 1$ vector of ones, $\hat{\Omega}$ is an estimate of the variance-covariance matrix, (Hong, Tu, and Zhou, 2007). The correlations are defined as

$$\tilde{\rho}^{+} = \text{corr}\left(\tilde{R}_{mt}, \tilde{R}_{it} | \tilde{R}_{mt} > \delta, \tilde{R}_{it} > \delta\right) \tag{4}$$

$$\tilde{\rho}^{-} = \text{corr}\left(\tilde{R}_{mt}, \tilde{R}_{it} | \tilde{R}_{mt} < -\delta, \tilde{R}_{it} > \delta\right). \tag{5}$$

Hong, Tu, and Zhou (2007) show that $|J^{Adj}| \sim \chi^2_N$. With symmetric dependence the value of J^{Adj} will be close to zero. A significant and non-zero value of J_{Adj} provides an evidence of asymmetry between the lower and upper-tail dependence. A positive value of J^{Adj} indicates upper-tail dependence. A negative value of J^{Adj} indicates lower-tail dependence.

Consistent with Alcock and Hatherley (2015), we separate the UTD and LTD by creating $J^{Adj}+$ and $J^{Adj}-$ using indicator function $\mathbb{I}_c$, which takes value of 1 when condition c is satisfied and zero otherwise.

$$J^{Adj}+ = J^{Adj}\mathbb{I}_{J^{Adj}>0} \tag{6}$$

$$J^{Adj}- = J^{Adj}\mathbb{I}_{J^{Adj}<0} \tag{7}$$

J^{Adj} is a non-parametric measure of asymmetric dependence and separates the tail dependence from non-normal characteristics of returns (Alcock and Hatherley, 2015). It does not require multivariate normal assumptions, consistent with the recommendation of Stapleton and Subrahmanyam (1983) and Kwon (1985). Adjusting the J-statistic developed by Hong, Tu, and Zhou (2007) forces the standard deviation of model residuals to be identical for all data sets, which allows us to separate the downside risk from other firm specific risk. The idiosyncratic risk is priced when investors do not hold sufficiently diversified portfolios (Fu, 2009; Campbell, Lettau, Malkiel, and Xu, 2001; Merton, 1987). We control for idiosyncratic risk.

The estimated tail risk is based on relatively small number of positive or negative joint returns. Any measure of asymmetric dependence will suffer from high likelihood of Type II error. Consequently, our findings are conservative estimates.

4. Data and Empirical Design

We explore the price of AD using the continuously compounded daily returns of all Australian equities listed on the ASX between 1 January 1998 and 31 June 2014. The daily return index (RI), market value (MV), total book value of equity (WC03501) for all live and dead Australian listed companies (DataStream series FAUS and Deadau) and the S&P/ASX 200 market return index (RI) from ASX200I series are collected from the Thomson Reuters DataStream database on a daily basis. We use the Australian 90-day bank accepted bill rate as a proxy for the Australian risk-free rate as collected from the Reserve Bank of Australia.[3] We exclude all daily returns that exceed 50% in absolute value to control for data errors. We also apply a liquidity rule and remove stock return time series with more than 30% of zero or missing daily returns. For each month t, only stock return time series with data available in months $t-12$ to $t+12$ are included in the final data set. Our final sample comprises 1,585 distinct firms with 4,017,740 of firm-return observations.

[3]The risk-free rate is collected from the Interest Rates and Yields - Money Market - Daily - F1 Report from http://www.rba.gov.au/statistics/tables/.

For a given month t, the J^{Adj}-statistic is computed using daily excess returns from the next 12 months following the definition from equation (3) and using the following levels of exceedances $\delta = \{0, 0.2, 0.2, 0.6, 0.8, 1\}$, consistent with Hong, Tu, and Zhou (2007) and Alcock and Hatherley (2015). The CAPM β is estimated using the next 12 months of daily excess returns.

We follow Alcock and Hatherley (2015) and Ang, Chen, and Xing (2006) to provide evidence of downside risk premium on the cross section of Australian stock returns. We first look at the contemporaneous relation between asymmetric dependence and returns, whilst controlling for factors of controlling for systematic risk as well as controlling for size, book-to-market ratio, average excess monthly return from past 12 months, idiosyncratic risk, coskewness and cokurtosis. The contemporaneous method is used to avoid the errors-in-variables problem (Kim, 1995).

At each month t, the average of the next 12 monthly excess returns is regressed against the J^{Adj}, CAPM β, upside and downside β, idiosyncratic risk, size, book-to-market ratio, coskewness and cokurtosis estimated using daily returns from the same 12-month period and the average of past 12 monthly excess returns. Regressors are Winsorised at the 1% and 99% level each month to control for inefficient factor estimates. We use data on daily basis to ensure sufficient number of observations for the downside risk measure. The risk factors estimated using daily data are likely to be noisy relative to lower frequency data, the tests of significance should however have sufficient power because they are computed on a relatively long history of data (Lewellen and Nagel, 2006).

We calculate the control variables for a given month, t, in the following manner. The downside β, upside β, coskewness, cokurtosis are estimated using the next 12 months of excess daily returns. The downside and upside β are defined as $\beta^- = cov(R_i, R_m | R_m < 0)/(var(R_m | R_m < 0)$ and $\beta^+ = cov(R_i, R_m | R_m > 0)/(var(R_m | R_m > 0)$, where R_i is the excess return on asset i and R_m is the market excess return. Firm size is the average of the log value of total market capitalisation calculated over the next 12 months of daily observations. The book-to-market ratio is the average ratio of the book value of equity (WC03501) and total market capitalisation (MV) collected from DataStream from the next 12 months of daily observations. The idiosyncratic risk is measured as the standard deviation of CAPM residuals estimated using daily excess returns from the next 12 months. Monthly excess returns are calculated from the continuously compounded excess daily returns. We use daily risk-free rate to obtain the excess returns.

The risk premia for each factor is estimated using the Ang, Chen, and Xing (2006) procedure where cross-sectional regressions are computed every month rolling forward using a 12 month window to estimate the relevant factors. We use the Newey and West (1987) method to test for statistical significance with overlapping data and Newey and West (1994) for automatic lag selection. We use a short-rolling window to account for time variation in systematic risk (Blume, 1975; Bollerslev, Engle, and Wooldridge, 1988; Bos and Newbold, 1984; Fabozzi and Francis, 1978; Ferson and Harvey, 1991, 1993; Ferson and Korajczyk, 1995) and variations in downside risk (Alcock and Hatherley, 2015).

5. Asymmetric Dependence Risk Premium

Factor Correlations

The correlation between the J^{Adj} and other factors is described in Table 1. The J^{Adj} is largely uncorrelated with any other factor (except coskewness). The J^{Adj} is uncorrelated with the CAPM beta, consistent with the design and construction of the J^{Adj} metric. This empirically confirms that the J^{Adj} provides an AD measure that is orthogonal to β. The J^{Adj} is uncorrelated with the downside and upside β, which is not unexpected as the J^{Adj}-statistic is constructed to be β-invariant. The J^{Adj} is most highly correlated with coskewness. This is also unsurprising as the J^{Adj} is the aggregate of the economically meaningful higher order terms in the Edgeworth series expansion of the excess-return distribution, whereas the coskewness is but one of these terms.

Excess returns are more highly correlated with J^{Adj} than with any other considered risk factor. The negative sign (-0.155) suggests that the greater the LTD (UTD) the higher (lower) the excess return. In the Australian market, the downside and upside β are poorly correlated with returns, which is in contrast with Ang, Chen, and Xing (2006) findings in the US market.

[TABLE 1 ABOUT HERE]

We use the double-sorting method (Fama and French, 1992) to examine the downside β-return relation relative to the β-return relation. We sort stocks into β deciles and then into downside β decile within each β decile at each month between January 1998 and June 2014. The equally weighted average returns in the portfolios sorted by β and downside β are presented in Panel A of Table 2. The differences in returns suggest that after controlling for β, the downside β does not contain relevant information explaining return variation in Australian stocks.

[TABLE 2 ABOUT HERE]

We apply the same double-sort procedure using the J^{Adj} deciles and sort them into β, size and coskewness deciles. After controlling for market risk (β), we find a positive relationship between AD and returns across all β deciles (Panel B of Table 2). We also find a positive relation between AD and excess returns across all size deciles (Panel C of Table 2) and coskewness deciles (Panel D of Table 2).

The Price of Asymmetric Dependence

The distribution of J^{Adj} is asymmetric around zero with LTD being more frequently observed than UTD (82.2% vs. 17.8%). The J^{Adj} calculated using Australian stocks is more asymmetrically distributed than the J^{Adj} estimated on US stocks (Alcock and Hatherley, 2015) suggesting that LTD is more prevalent in the Australian market than in the US market. In the context of Bekaert and Wu (2000) it appears that the asymmetric effects of news on conditional covariance between stock and market returns is greater in Australia than in the US.

[FIGURE 1 ABOUT HERE]

We estimate the risk premia attached to J^{Adj} and other control variables in the value-weighted regressions using the Ang, Chen, and Xing (2006) coincident-return method (Regressions I to V from Table 3). As a contrast, we regress excess returns on β and other risk factors without including the AD measure in Regression I and II from Table 3. When the J^{Adj} is not included, the CAPM β, Size, Past Returns, Idiosyncratic risk and Coskewness are significantly priced in excess returns of Australian listed equities. In the absence of J^{Adj}, the market risk premium in the Australian market is 9.0% pa. Increasing β by one standard deviation leads to an increase in excess return of 4.5%. The downside β is not significant in explaining excess returns (Regressions II from Table 3), which is consistent with our results from the double-sort procedure. The market risk premium and the premia attached to the Fama and French (1992) control variables are consistent with the findings of Gray and Johnson (2011); O'Brien, Brailsford, and Gaunt (2010); Durack, Durand, and Maller (2004); Faff (2004).

[TABLE 3 ABOUT HERE]

When we include J^{Adj} into Regression III from Table 3, we find that AD is significantly priced in excess returns of Australian listed equities. The t-statistic attached to the J^{Adj} is 4.527, which not only exceeds the usual level of 1.96 but also exceeds the Harvey, Liu and Zhu (2014) level of 3.0[4]. The "typical premium" that we define to be the product of the average factor value multiplied by the factor premium is (-3.999×-0.010)=3.999%. The negative coefficient of J^{Adj} (-0.010) implies that higher levels of AD lead to a decrease in excess return.

One explanation for the negative coefficient of J^{Adj} is that LTD is associated with a premium and UTD attracts a discount. We quantify the price of LTD and UTD separately by regressing excess returns against the $J^{Adj}-$ and $J^{Adj}+$ defined in equations (6) and (7). We present these results in Regression IV and V from Table 3. The premium (discount) associated with a one-unit increase in LTD (UTD) is 1% (1.2%), which compares with 10.1% premium related to a one-unit increase in market β. The "typical premium" associated with LTD is 6.3%, whereas the "typical discount" related to UTD is 6.7%. This compares with 5.2% for the β risk premium. These values remain largely unchanged after controlling for downside and upside β in Regression V. Most of the control covariates coefficients remain qualitatively robust to the inclusion of J^{Adj}, except for Coskewness. The Coskewness changes from significant negative, when the J^{Adj} is not included, to insignificant, when the J^{Adj} is included.

Our findings regarding the AD risk premium in Australian listed equities contrast with Alcock and Hatherley (2015) findings of AD risk premium in US listed equities. The average level of J^{Adj} is considerably lower in Australian listed equities (-3.999) than in the US (-2.144). This is not due to lower average values of LTD and UTD but it is rather caused by the higher prevalence of LTD in Australia relative to the US; 82.2% of all Australian listed equities exhibit LTD compared to 67.3% in the US. The excess-return sensitivity to AD (-0.010) in Australian listed equities is 2.5 times greater than the excess-return sensitivity to AD in the US market (-0.004). That is Australian listed equities exhibit a greater frequency of LTD plus a greater sensitivity attached to this AD compared to the US.

[FIGURE 2 ABOUT HERE]

We also explore the variation of AD risk premium in time. We re-estimate the regression model IV from Table 3 using the Ang, Chen, and Xing (2006) coincident-return procedure at each month between June 1992 and June 2014, using only historical data available to the investor at that month. The factor premium at time t is then given by the median of all regression coefficients associated with that factor

[4]Harvey, Liu and Zhu (2014) suggest that a higher hurdle rate of 3.0 for the t-statistic should be used in explaining the cross section of expected returns to control for data mining, correlation among the tests and missing data.

up to and including time t. We compute the factor premia using medians to capture the trend in risk premium over time rather than an accurate portrayal of the compensation for risk. The development of factor loadings through time is illustrated in Figure 2. The time variations of risk premia attached to β, $J^{Adj}-$ and $J^{Adj}+$ are illustrated in Figure 3.

[FIGURE 3 ABOUT HERE]

The degree of LTD and UTD is increasing through time. The price of LTD has remained relatively constant whereas UTD becomes more heavily priced over time. That is, UTD in particular has become more highly valued by investors.

The median β is increasing in time. The lowest values of β were recorded around 2005, which can be explained by low volatility of market proxy, which resulted in insignificant β estimates (Gray, Hall, Klease and McCrystal, 2009). The premium for market risk is increasing since 2005.

[TABLE 4 ABOUT HERE]

We also test the ability of J^{Adj} to predict future returns using the standard Fama and MacBeth (1973) procedure. As well as being a good robustness test, this also provides an insight into whether an investor can extract information about future returns from AD measures. In Table 4, we repeat Regressions III and IV from Table 3 using 1 month, 3 month, 6 month, 9 month, 12 month and 15 month future excess returns as the dependent variable. The typical level of AD can explain 550 bp of future one month excess return. This compares with 636 bp explained by the typical level of β. The J^{Adj} is significant in predicting future returns up to twelve months in advance. Using our definition of the typical premium, we find that the J^{Adj} is more influential in predicting future returns than any other factor considered except β.

GICS Sector Analysis

We investigate the price of asymmetric dependence in different industries of Australian listed equities. We use the DataStream ICBIN classification and analyse ten industry sectors: Financials excluding A-REIT, Technology, Telecommunications, Heath Care, Industrials, Oil & Gas, Consumer Goods, Consumer Services, Basic Materials and Utilities. The regression results using the Ang, Chen, and Xing (2006) coincident-return procedure are illustrated in Table 5. We find that not all the industries exhibit a significant sensitivity to AD. In Health Care, Industrials, Consumer Goods and Basic Materials sectors, asymmetric dependence (both LTD and UTD) is priced in the cross section of stock returns. In Financials, Oil & Gas and Consumer Services sectors, only the UTD measured by the $J^{Adj}+$ is significant.

[TABLE 5 ABOUT HERE]

The level of LTD and UTD is similar to the average level of full sample. Financials and Utilities have the lowest mean value of J^{Adj} whereas the highest mean value is recorded in Technology industry. In all industries, the dominance of LTD is clearly visible. In Technology, Health Care and Oil & Gas sectors, more than 85% of all J^{Adj} are lower than zero, which implies a strong dominance of LTD. One possible explanation of the amplified level of LTD in these industries is the asymmetric response to news in the conditional covariance between stock and market returns (Bekaert and Wu, 2000), which may be stronger in these sectors.

With the exception of the low-sample size industries, the direction of the sign of AD coefficients is consistent with the full sample results. For some industries, specifically Technology and Consumer Services, the price is insignificant. The biggest industry containing 555 distinct companies in our final sample is classified as Basic Materials. Companies in the Basic Materials industry have a relatively large risk premium to asymmetric dependence.

Robustness of Results

We test the robustness of our results by exploring the regression under a variety of different assumptions.

In Table 6 in Appendix, we present the results using the equally-weighted Ang, Chen, and Xing (2006) coincident-return method. In Table 7 in Appendix, we use alternative proxies for market return and risk-free rate. The alternative proxy used for the market return is the DataStream market return index (LTOTMKAU) and the yield on 10-year Australian government bond (BMAU10Y) for the risk free rate proxy[5]. In Table 8 in Appendix, we test the robustness of our predictive regressions findings by excluding the most volatile stocks. The volatility is measured as the standard deviation of the past 12 months of daily excess returns. In Table 9 in Appendix, we apply the Vasicek bias correction (Vasicek, 1973) to increase the reliability of β estimates. This procedure is consistent with Gray, Hall, Klease and McCrystal (2009). In Table 10 in Appendix, we all exclude negative estimates of CAPM β.

Our findings are qualitatively similar across all model specifications.

[5]Alternative proxies are collected from DataStream.

6. Conclusion

We find evidence of asymmetric dependence in returns of Australian listed equities. Lower-tail dependence occurs more frequently than upper-tail dependence. This AD is priced in the cross section of stock returns. Using the β-invariant measure of AD developed by Alcock and Hatherley (2015) we show that in our sample, LTD (UTD) is associated with 6.3% (6.7%) premium (discount) compared to 5.2% premium for market β. The degree of UTD and LTD has been increasing significantly over the past fifteen years. Whilst the price of LTD has remained relatively stable, the price of UTD has been also increasing over the past fifteen years. Interestingly, AD can predict future excess returns up to twelve months ahead. Our results are consistent with state-dependent correlations and state-dependent investor preferences.

We also find significant evidence of LTD and UTD in all sectors of Australian listed equities. Whilst the significance of pricing is mixed, the regression coefficients indicate a premium attached to LTD and a discount attached to UTD for all sectors. Our results imply that important price information is contained within the relative magnitude of UTD and LTD as well as within the linear relationship between asset returns. Our findings have significant implications for asset pricing, cost of capital, financial risk management, portfolio management and portfolio performance assessment.

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Factor Correlation

Table 1: This table presents the correlation between each factor. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. At each month, t, we estimate β, β^{-}, β^{+}, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret") computed as at time t. Returns ("Ret") are estimated as the average of the next 12 monthly excess return. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All factors are Winsorised at the 1% and 99% level at each month.

	β	β^{-}	β^{+}	Log-size	BM	Past Ret	Idio	Cosk	Cokurt	J^{Adj}	Ret
β	1	0.672	0.624	0.249	-0.056	0.137	0.087	-0.208	0.440	-0.056	0.045
$\beta-$		1	0.249	0.026	-0.023	0.103	0.189	-0.477	0.339	-0.140	0.064
$\beta+$			1	0.263	-0.045	0.074	-0.072	0.187	0.356	0.123	0.004
Log-size				1	-0.130	0.137	-0.669	-0.072	0.370	0.126	0.013
BM					1	-0.074	0.072	0.023	-0.062	-0.022	0.030
Past ret						1	-0.228	-0.093	0.131	0.001	0.007
Idio							1	0.020	-0.213	-0.120	-0.147
Cosk								1	-0.453	0.271	-0.031
Cokurt									1	0.077	-0.010
J^{Adj}										1	-0.155
Ret											1

The Time Series Average Returns for Double Sorted Portfolios

Table 2: For a given month, we first sort stocks into β deciles, and then into β^- or J^{Adj} deciles within each characteristic decile in Panel A and B respectively. In Panel C and D, we first sort stocks into size or coskewness deciles respectively, and then into J^{Adj} deciles within each characteristic decile. Dependence ranges from low (group 1) to high (group 10) which implies that J_1^{Adj} consists of the stocks with high downside risk and J_{10}^{Adj} consists of stocks with high upside potential. We record and report the equal weighted average 12 monthly excess return for all stocks within each group, expressed as an effective annual rate of return. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with 90-day bank accepted bill rate. We provide the spread ("Diff") for each row and column, given by the return associated with the high risk group, less the return associated with the low risk group. We also include the average return ("Avg") for each row and column.

Panel A: β/β^- Sorted Portfolios

	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	Diff	Avg
β_1^-	-0.076	-0.033	0.011	0.044	0.022	0.064	0.048	-0.033	0.093	0.243	0.319	-0.030
β_2^-	-0.007	0.032	0.029	0.047	0.049	0.025	0.061	-0.015	-0.038	0.024	0.031	0.025
β_3^-	-0.022	0.053	0.034	0.077	0.046	0.033	0.043	-0.004	-0.033	-0.024	-0.002	0.037
β_4^-	-0.005	0.092	0.061	0.057	0.062	0.040	0.073	0.048	-0.004	0.024	0.028	0.055
β_5^-	0.042	0.087	0.081	0.091	0.082	0.043	0.050	0.043	0.081	0.040	-0.002	0.066
β_6^-	-0.002	0.097	0.093	0.079	0.067	0.062	0.065	0.074	0.064	0.069	0.070	0.069
β_7^-	-0.010	0.046	0.055	0.065	0.079	0.084	0.034	0.050	0.107	0.082	0.092	0.067
β_8^-	0.080	0.031	0.011	0.061	0.065	0.078	0.073	0.074	0.101	0.098	0.018	0.079
β_9^-	0.003	0.003	-0.029	0.049	0.048	0.084	0.047	0.064	0.081	0.074	0.071	0.064
β_{10}^-	-0.114	0.001	-0.011	0.060	0.086	0.093	0.060	0.017	0.074	0.163	0.278	0.114
Diff	0.038	-0.034	0.022	-0.017	-0.064	-0.029	-0.012	-0.050	0.019	0.079		
Avg	-0.040	0.035	0.041	0.066	0.064	0.061	0.056	0.048	0.079	0.127		

Panel B: β/J^{Adj} Sorted Portfolios

	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	Diff	Avg
J_1^{Adj}	0.024	0.101	0.174	0.190	0.153	0.151	0.164	0.140	0.163	0.390	0.366	0.176
J_2^{Adj}	0.029	0.093	0.102	0.125	0.151	0.105	0.139	0.101	0.163	0.265	0.235	0.140
J_3^{Adj}	0.044	0.118	0.095	0.122	0.110	0.104	0.108	0.086	0.123	0.241	0.197	0.127
J_4^{Adj}	0.067	0.072	0.077	0.105	0.103	0.087	0.066	0.095	0.115	0.191	0.124	0.107
J_5^{Adj}	-0.008	0.099	0.086	0.091	0.084	0.094	0.079	0.071	0.106	0.200	0.208	0.101
J_6^{Adj}	0.012	0.074	0.056	0.086	0.070	0.068	0.048	0.018	0.078	0.133	0.121	0.071
J_7^{Adj}	0.009	0.047	0.053	0.105	0.052	0.077	0.015	0.090	0.103	0.133	0.124	0.075
J_8^{Adj}	-0.056	0.028	0.020	0.034	0.054	0.053	0.022	0.055	0.065	0.073	0.129	0.040
J_9^{Adj}	-0.054	0.020	0.017	0.013	0.038	0.013	0.029	-0.002	0.063	0.014	0.069	0.016
J_{10}^{Adj}	-0.171	-0.091	-0.089	-0.062	-0.053	-0.038	-0.020	-0.054	-0.049	-0.111	0.060	-0.082
Diff	0.195	0.191	0.263	0.252	0.206	0.188	0.184	0.194	0.212	0.501		
Avg	-0.040	0.035	0.041	0.066	0.064	0.061	0.056	0.048	0.079	0.127		

The Time Series Average Returns for Double Sorted Portfolios Continued

Table 2: Continued.

Panel C: Size/J^{Adj} Sorted Portfolios

	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9	M_{10}	Diff	Avg
J_1^{Adj}	0.174	0.183	0.252	0.269	0.327	0.135	0.120	0.064	0.081	0.128	0.047	0.176
J_2^{Adj}	0.123	0.167	0.213	0.234	0.201	0.082	0.110	0.090	0.089	0.096	0.027	0.140
J_3^{Adj}	0.107	0.183	0.152	0.188	0.152	0.103	0.114	0.104	0.078	0.093	0.014	0.127
J_4^{Adj}	0.066	0.134	0.147	0.174	0.112	0.080	0.083	0.083	0.107	0.094	-0.029	0.107
J_5^{Adj}	0.042	0.102	0.139	0.080	0.088	0.121	0.125	0.133	0.101	0.087	-0.045	0.101
J_6^{Adj}	0.014	0.085	0.094	0.022	0.073	0.062	0.090	0.070	0.074	0.094	-0.081	0.071
J_7^{Adj}	-0.028	0.085	0.091	0.054	0.050	0.080	0.131	0.085	0.084	0.090	-0.117	0.075
J_8^{Adj}	-0.073	-0.010	-0.028	0.027	0.012	0.062	0.111	0.056	0.059	0.096	-0.169	0.040
J_9^{Adj}	-0.124	-0.081	-0.080	0.012	-0.023	0.020	0.077	0.050	0.062	0.089	-0.214	0.016
J_{10}^{Adj}	-0.324	-0.230	-0.165	-0.150	-0.112	-0.059	-0.046	-0.018	0.031	0.043	-0.367	-0.082
Diff	0.498	0.414	0.417	0.419	0.439	0.195	0.166	0.082	0.050	0.085		
Avg	-0.033	0.044	0.068	0.072	0.073	0.059	0.081	0.063	0.071	0.081		

Panel D: Coskewness/J^{Adj} Sorted Portfolios

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	Diff	Avg
J_1^{Adj}	0.290	0.267	0.248	0.281	0.161	0.115	0.123	0.134	0.037	-0.002	0.292	0.176
J_2^{Adj}	0.226	0.197	0.181	0.179	0.172	0.123	0.107	0.075	0.055	0.021	0.205	0.140
J_3^{Adj}	0.224	0.170	0.162	0.150	0.150	0.076	0.075	0.107	0.070	0.047	0.177	0.127
J_4^{Adj}	0.170	0.162	0.121	0.131	0.095	0.097	0.080	0.046	0.056	0.073	0.097	0.107
J_5^{Adj}	0.218	0.146	0.126	0.103	0.101	0.068	0.071	0.041	0.084	0.047	0.171	0.101
J_6^{Adj}	0.102	0.117	0.077	0.065	0.059	0.051	0.062	0.053	0.058	0.066	0.036	0.071
J_7^{Adj}	0.123	0.097	0.095	0.054	0.064	0.076	0.046	0.065	0.086	0.062	0.061	0.075
J_8^{Adj}	0.096	0.045	0.056	0.039	0.037	0.038	0.040	0.002	0.038	0.032	0.064	0.040
J_9^{Adj}	0.023	0.047	0.062	0.014	0.016	0.005	0.009	0.012	0.011	0.000	0.022	0.016
J_{10}^{Adj}	-0.069	-0.083	-0.021	-0.062	-0.063	-0.110	-0.092	-0.072	-0.096	-0.086	0.017	-0.082
Diff	0.359	0.351	0.269	0.342	0.223	0.225	0.214	0.205	0.133	0.084		
Avg	0.164	0.126	0.115	0.093	0.073	0.041	0.036	0.027	0.014	-0.010		

Ang, Chen, and Xing (2006) Value-weighted Regressions (1992-2014)

Table 3: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, β^{-}, β^{+}, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The value-weighted mean and value-weighted standard deviation (in parentheses) for each variable is provided at the last column. All coefficients are reported as effective annual rates.

	I	II	III	IV	V	mean (std)
Int	0.301	0.057	0.265	0.268	0.256	
	[3.882]	[1.885]	[3.718]	[3.717]	[3.343]	
β	0.090		0.076	0.077		0.675
	[2.095]		[1.833]	[1.828]		(0.503)
$\beta-$		0.036			0.067	0.857
		[1.539]			[2.956]	(0.812)
$\beta+$		-0.011			-0.030	0.552
		[1.001]			[1.528]	(0.776)
Log-size	-0.031		-0.030	-0.030	-0.027	5.589
	[3.891]		[3.834]	[3.804]	[3.590]	(0.551)
BM	0.009		0.009	0.009	0.009	0.778
	[0.654]		[0.673]	[0.708]	[0.675]	(2.025)
Past ret	0.466		0.460	0.447	0.463	0.010
	[2.413]		[2.404]	[2.350]	[2.364]	(0.047)
Idio	-4.375		-4.431	-4.457	-4.475	0.030
	[3.042]		[3.081]	[3.093]	[2.864]	(0.019)
Cosk	-0.190		-0.006	-0.011	0.250	-0.104
	[3.152]		[0.151]	[0.272]	[3.118]	(0.162)
Cokurt	-0.009		0.006	0.004	0.027	1.307
	[0.612]		[0.397]	[0.312]	[2.273]	(1.398)
J^{Adj}			-0.010			-3.999
			[4.527]			(7.909)
$J^{Adj}-$				-0.010	-0.011	-6.249
				[4.096]	[4.260]	(3.674)
$J^{Adj}+$				-0.013	-0.013	5.543
				[3.540]	[3.587]	(3.246)

Fama and MacBeth (1973) Regression Specifications (1992-2014)

Table 4: We measure risk premia using the Fama and MacBeth (1973) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the mean of the next 1, 3, 6, 9, 12 and 15 months of excess monthly returns is regressed against β, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt"), $J^{Adj}-$ and $J^{Adj}+$ estimated using the past 12 months of daily excess return data. We also include the average past 12-monthly excess return ("Past Ret"). The relevant book-to-market ratio ("BM") at time t for a given stock is computed using the last available (most recent) book value entry. Size ("Log-size") is computed at the same date that Book-to-market ratio is computed. We proxy the market portfolio with the the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. All coefficients are reported as effective annual rates.

	1 month		3 months		6 months		9 months		12 months		15 months	
	III'	IV'	III'	IV'	III'	IV'	III'	IV'	III'	IV'	III'	IV'
Int	0.005	0.015	0.094	0.098	0.083	0.078	0.091	0.087	0.088	0.086	0.100	0.096
	[0.115]	[0.319]	[1.756]	[1.760]	[1.538]	[1.390]	[1.715]	[1.586]	[1.740]	[1.670]	[2.073]	[1.962]
β	-0.094	-0.096	-0.106	-0.107	-0.108	-0.107	-0.107	-0.109	-0.102	-0.103	-0.090	-0.091
	[1.999]	[2.067]	[2.691]	[2.690]	[2.913]	[2.870]	[3.039]	[3.071]	[3.091]	[3.122]	[3.012]	[3.048]
Log-size	-0.001	0.000	-0.014	-0.014	-0.011	-0.010	-0.012	-0.012	-0.011	-0.011	-0.011	-0.011
	[0.096]	[0.026]	[2.158]	[2.169]	[1.659]	[1.417]	[1.840]	[1.874]	[1.843]	[1.873]	[2.072]	[2.061]
BM	0.067	0.066	0.065	0.065	0.067	0.067	0.058	0.057	0.053	0.053	0.047	0.047
	[4.777]	[4.763]	[4.108]	[4.102]	[3.945]	[3.956]	[3.668]	[3.655]	[3.601]	[3.581]	[3.492]	[3.489]
Past ret	2.219	2.182	2.241	2.233	1.775	1.762	1.376	1.384	1.049	1.064	0.790	0.793
	[5.543]	[5.535]	[4.892]	[4.904]	[4.398]	[4.413]	[4.304]	[4.313]	[4.067]	[4.067]	[3.593]	[3.629]
Idio	-1.985	-2.026	-1.711	-1.710	-1.332	-1.304	-0.838	-0.781	-0.573	-0.548	-0.553	-0.516
	[1.738]	[1.768]	[1.811]	[1.799]	[1.502]	[1.464]	[1.075]	[1.001]	[0.796]	[0.763]	[0.800]	[0.752]
Cosk	0.178	0.176	0.061	0.064	0.046	0.073	0.017	0.018	0.022	0.014	-0.003	0.001
	[1.650]	[1.629]	[0.995]	[1.034]	[1.159]	[1.434]	[0.511]	[0.551]	[0.546]	[0.404]	[0.077]	[0.016]
Cokurt	0.055	0.053	0.071	0.072	0.062	0.061	0.061	0.064	0.060	0.061	0.053	0.055
	[2.034]	[1.902]	[3.281]	[3.231]	[3.021]	[2.737]	[3.183]	[3.168]	[3.111]	[3.076]	[2.999]	[2.975]
J^{Adj}	-0.014		-0.005		-0.003		-0.002		-0.002		-0.001	
	[6.576]		[3.906]		[3.700]		[3.284]		[2.769]		[2.308]	
$J^{Adj}-$		-0.012		-0.004		-0.003		-0.003		-0.002		-0.002
		[5.906]		[3.107]		[2.499]		[2.483]		[2.043]		[1.940]
$J^{Adj}+$		-0.020		-0.008		-0.004		-0.001		-0.001		-0.0004
		[5.114]		[3.112]		[1.974]		[0.766]		[0.579]		[0.276]

Industry Regressions

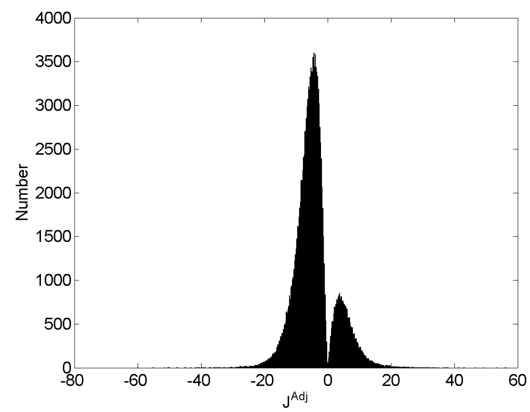
Table 5: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward in each industry. We use the DataStream ICBIN Industry Classification. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt"), $J^{Adj}-$ and $J^{Adj}+$ estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The value-weighted mean and value-weighted standard deviation (in parentheses) for each variable is provided at the last column. All coefficients are reported as effective annual rates.

	Financials (Excl. A-REIT)			Technology			Telecommunications			Health Care			Industrials		
	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)
Int	0.206	0.200		-0.216	0.103		0.408	0.078		-0.012	-0.199		0.462	0.446	
	[3.459]	[3.320]		-[0.612]	[0.570]		[1.359]	[0.227]		[0.077]	[0.772]		[4.078]	[3.908]	
β	0.110	0.112	0.560	-0.146	0.033	0.529	-0.111	-0.081	0.605	0.269	-0.063	0.585	0.094	0.075	0.605
	[2.296]	[2.470]	(0.409)	[0.910]	[0.346]	(0.518)	[0.604]	[0.492]	(0.505)	[2.665]	[0.648]	(0.421)	[1.844]	[1.452]	(0.431)
Log-size	-0.008	-0.008	6.265	-0.018	-0.027	4.512	-0.032	-0.054	6.697	0.001	0.019	5.133	-0.052	-0.050	5.791
	[1.322]	[1.296]	(0.525)	[0.429]	[1.008]	(0.480)	[1.132]	[2.107]	(1.889)	[0.065]	[0.629]	(0.468)	[4.187]	[4.082]	(0.484)
BM	-0.021	-0.019	0.897	0.181	0.056	0.597	0.086	0.096	0.384	0.070	0.092	0.483	0.031	0.013	0.744
	[1.099]	[1.001]	(2.150)	[1.660]	[0.854]	(1.171)	[0.657]	[0.804]	(2.776)	[0.948]	[1.009]	(1.886)	[0.906]	[0.314]	(1.781)
Past ret	1.329	1.317	0.008	0.426	-0.227	0.012	-1.073	1.339	0.010	0.860	0.046	0.008	0.552	0.935	0.010
	[2.708]	[2.747]	(0.030)	[0.480]	[0.787]	(0.061)	[0.662]	[1.550]	(0.051)	[1.717]	[0.090]	(0.050)	[1.793]	[1.750]	(0.040)
Idio	-4.421	-4.713	0.019	1.177	-2.381	0.036	-1.380	1.540	0.029	-4.074	-0.896	0.036	-7.922	-8.149	0.026
	[2.633]	[2.788]	(0.013)	[0.320]	[1.125]	(0.018)	[0.225]	[0.269]	(0.018)	[2.121]	[0.294]	(0.019)	[3.320]	[3.517]	(0.014)
Cosk	-0.130	-0.025	-0.109	-1.495	-0.583	-0.115	0.741	0.310	-0.123	-0.808	-0.477	-0.092	-0.163	-0.212	-0.107
	[2.018]	[0.394]	(0.181)	[2.077]	[1.173]	(0.165)	[1.428]	[0.736]	(0.181)	[3.338]	[1.681]	(0.156)	[2.281]	[1.453]	(0.174)
Cokurt	-0.042	-0.041	1.609	0.212	-0.078	0.873	0.146	0.201	1.285	-0.128	-0.042	1.064	0.021	0.012	1.353
	[1.954]	[2.114]	(1.628)	[1.193]	[0.774]	(1.112)	[0.806]	[1.215]	(1.448)	[1.953]	[0.943]	(1.261)	[0.934]	[0.403]	(1.542)
$J^{Adj}-$		-0.005	-6.015		-0.008	-6.811		-0.032	-6.320		-0.035	-6.343		-0.008	-6.191
		[2.881]	(3.738)		[0.794]	(3.781)		[1.254]	(3.784)		[2.639]	(3.623)		[2.127]	(3.617)
$J^{Adj}+$		-0.009	5.541		-0.017	6.278		0.016	5.988		-0.059	5.429		-0.010	5.730
		[2.727]	(3.519)		[1.509]	(3.493)		[0.683]	(3.449)		[1.939]	(2.946)		[1.798]	(3.412)
Total number of firms			235 firms			79 firms			27 firms			105 firms			208 firms
Excluded due to liquidity rule			24 firms			12 firms			2 firms			13 firms			21 firms
Final sample size			211 firms			67 firms			25 firms			92 firms			187 firms

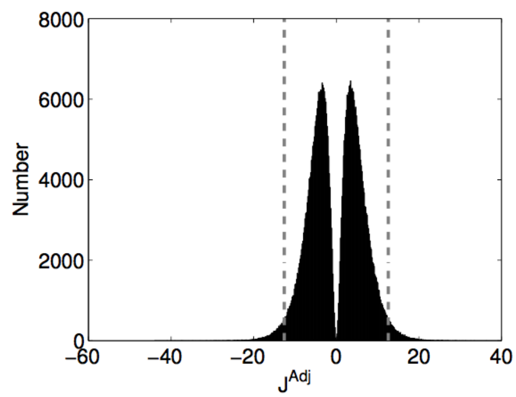
Industry Regressions Continued

Table 5: Continued.

	Oil & Gas			Consumer Goods			Consumer Services			Basic Materials			Utilities		
	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)
Int	0.008	-0.671		0.440	0.331		0.378	0.577		0.113	0.081		0.244	0.019	
	[0.020]	[1.636]		[4.166]	[3.341]		[3.674]	[2.670]		[0.887]	[0.631]		[1.027]	[0.104]	
β	0.031	0.137	0.819	0.009	0.002	0.482	-0.032	0.000	0.592	0.133	0.114	0.875	-0.191	-0.150	0.677
	[0.129]	[1.834]	(0.504)	[0.174]	[0.039]	(0.374)	[0.764]	[0.001]	(0.403)	[2.417]	[2.130]	(0.606)	[1.430]	[0.772]	(0.412)
Log-size	-0.009	0.071	4.985	-0.042	-0.033	5.682	-0.044	-0.088	6.535	-0.020	-0.018	4.852	-0.038	-0.003	6.594
	[0.155]	[2.401]	(0.451)	[3.288]	[2.907]	(0.626)	[3.549]	[1.887]	(0.475)	[1.440]	[1.316]	(0.560)	[1.064]	[0.075]	(0.802)
BM	0.064	0.166	0.758	-0.025	-0.018	0.842	-0.044	-0.067	0.654	0.047	0.048	0.763	0.046	0.047	0.747
	[0.468]	[2.368]	(1.930)	[0.905]	[0.697]	(1.690)	[2.115]	[2.679]	(1.833)	[2.044]	[2.028]	(1.971)	[0.430]	[0.395]	(1.788)
Past ret	1.801	3.044	0.014	0.939	1.010	0.009	0.755	0.020	0.010	0.045	0.004	0.013	0.631	-0.685	0.004
	[0.751]	[1.286]	(0.055)	[2.064]	[2.302]	(0.034)	[1.910]	[0.025]	(0.035)	[0.204]	[0.019]	(0.062)	[0.607]	[0.932]	(0.035)
Idio	4.213	11.150	0.039	-6.623	-5.812	0.023	-0.939	-3.422	0.021	-2.612	-2.593	0.042	-5.013	-4.860	0.026
	[0.693]	[1.394]	(0.019)	[2.823]	[2.355]	(0.012)	[0.401]	[1.485]	(0.012)	[1.258]	[1.266]	(0.020)	[2.162]	[1.832]	(0.017)
Cosk	0.128	0.693	-0.111	0.068	0.301	-0.088	-0.289	-0.082	-0.103	-0.184	-0.003	-0.107	-0.282	-0.374	-0.100
	[0.268]	[1.780]	(0.144)	[0.846]	[3.333]	(0.163)	[2.471]	[1.113]	(0.171)	[1.793]	[0.029]	(0.152)	[1.082]	[1.218]	(0.172)
Cokurt	0.016	-0.058	1.217	0.044	0.060	1.216	0.039	0.079	1.499	-0.014	0.007	1.182	0.282	0.124	1.616
	[0.098]	[0.704]	(1.099)	[1.338]	[1.813]	(1.681)	[1.379]	[1.978]	(1.679)	[0.375]	[0.198]	(1.184)	[1.669]	[1.109]	(1.543)
$J^{Adj}-$		-0.008	-6.335		-0.012	-6.297		-0.021	-5.952		-0.010	-6.499		-0.013	-5.842
		[0.687]	(3.559)		[3.925]	(3.946)		[1.626]	(3.642)		[3.369]	(3.706)		[0.839]	(3.359)
$J^{Adj}+$		-0.037	5.331		-0.022	5.788		-0.003	5.523		-0.014	5.562		-0.005	5.374
		[3.344]	(2.950)		[3.326]	(3.439)		[0.122]	(3.425)		[2.062]	(3.088)		[0.269]	(3.051)
Total number of firms			152 firms			98 firms			154 firms			584 firms			24 firms
Excluded due to liquidity rule			8 firms			11 firms			24 firms			29 firms			4 firms
Final sample size			144 firms			87 firms			130 firms			555 firms			20 firms



(a) Actual distribution



(b) Distribution under Normality

Figure 1: Actual and hypothetical distribution under multivariate normality of the J^{Adj}. Plot (a) depicts the actual distribution is estimated on ASX stocks listed between June 1992 and June 2014. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with 90-day bank accepted bill rate. In plot (b), we present the simulated distribution of J^{Adj} based on multivariate normal data.

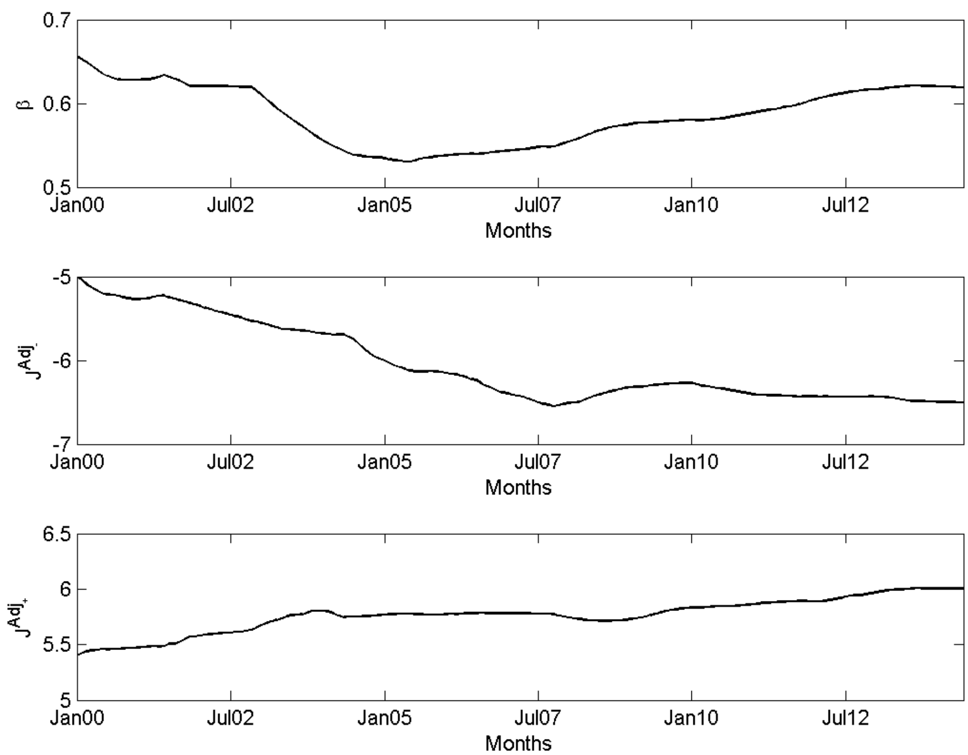


Figure 2: This figure depicts the median factor loading for β, $J^{Adj}-$ and $J^{Adj}+$ at a given month, t, between January 2000 and June 2014 using the past 12 months of daily excess returns. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with 90-day bank accepted bill rate. The estimate is calculated using all historical data up to and including time t.

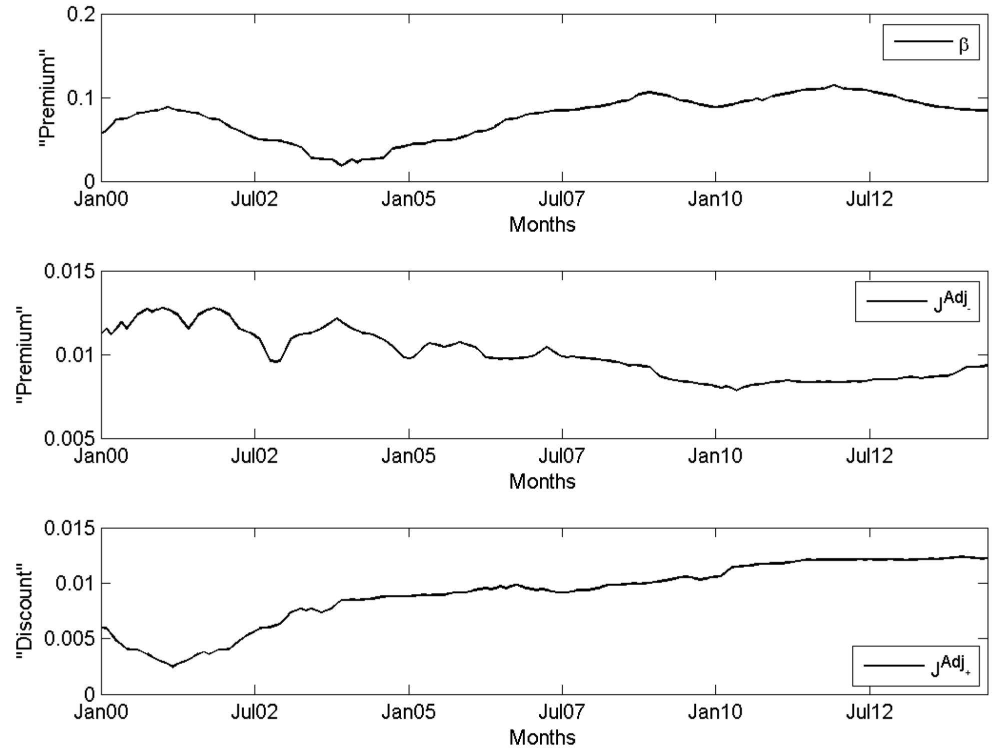


Figure 3: This figure depicts the factor sensitivity using the Ang, Chen, and Xing (2006) asset pricing procedure where cross-sectional regressions are computed every month rolling forward. At a given month t, the average of the next 12 excess monthly returns is regressed against β, idiosyncratic risk, coskewness, cokurtosis, $J^{Adj}-$ and $J^{Adj}+$ estimated using the next 12 months of daily excess return data, and size (Log-size), book-to-market ratio (BM) and the average past 12-monthly excess return (Past Ret), computed as at time t. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. The Premium for β and for $J^{Adj}-$ and the Discount for $J^{Adj}+$ between January 2000 and June 2014 is given by the time series median factor sensitivity using all historical sensitivity estimates up to and including time t.

Ang, Chen, and Xing (2006) Equally-weighted Regressions (1992-2014)

Table 6: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where equally-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, β^{-}, β^{+}, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The equally-weighted mean and equally-weighted standard deviation (in parentheses) for each variable is provided at the last column. All coefficients are reported as effective annual rates.

	I	II	III	IV	V	mean (std)
Int	0.282	0.030	0.243	0.251	0.230	
	[3.648]	[0.956]	[3.409]	[3.401]	[2.985]	
β	0.117		0.099	0.100		0.783
	[2.675]		[2.388]	[2.379]		(0.283)
$\beta-$		0.038			0.060	0.842
		[1.796]			[2.918]	(0.838)
$\beta+$		-0.001			-0.020	0.461
		[0.061]			[1.028]	(0.787)
Log-size	-0.030		-0.029	-0.029	-0.026	4.781
	[3.624]		[3.561]	[3.545]	[3.361]	(0.611)
BM	0.023		0.022	0.022	0.021	0.834
	[1.705]		[1.669]	[1.701]	[1.619]	(1.978)
Past ret	0.385		0.371	0.357	0.381	0.006
	[2.225]		[2.165]	[2.098]	[2.130]	(0.052)
Idio	-4.883		-4.946	-4.991	-4.746	0.037
	[3.226]		[3.258]	[3.266]	[2.955]	(0.021)
Cosk	-0.220		-0.010	-0.017	0.227	-0.099
	[3.428]		[0.245]	[0.400]	[2.658]	(0.157)
Cokurt	-0.022		-0.002	-0.003	0.028	1.080
	[1.359]		[0.145]	[0.218]	[2.362]	(1.308)
J^{Adj}			-0.012			-4.285
			[4.545]			(5.951)
$J^{Adj}-$				-0.012	-0.013	-6.458
				[4.198]	[4.367]	(3.750)
$J^{Adj}+$				-0.015	-0.015	5.770
				[3.610]	[3.589]	(3.358)

Alternative proxies: Ang, Chen, and Xing (2006) Regression Specifications (1992-2014)

Table 7: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, β^{-}, β^{+}, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. In Version 2, we proxy the market portfolio with the DataStream market return index for Australia and the risk free rate with the 90-day bank accepted bill rate. In Version 3, we proxy the market portfolio with the S&P ASX 200 market return index and the risk free rate with the 10-year Australian government bond yield. In Version 4, we proxy the market portfolio with the DataStream market return index for Australia and the risk free rate with the 10-year Australian government bond yield. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. All coefficients are reported as effective annual rates.

Panel A: Regression Results

	Version 2					Version 3					Version 4				
	I'	II'	III'	IV'	V'	I'	II'	III'	IV'	V'	I'	II'	III	IV	V
Int	0.302	0.058	0.273	0.284	0.274	0.281	0.063	0.236	0.237	0.210	0.286	0.060	0.250	0.252	0.231
	[3.880]	[1.883]	[3.740]	[3.792]	[3.437]	[3.776]	[2.021]	[3.471]	[3.454]	[3.105]	[3.817]	[1.956]	[3.598]	[3.567]	[3.146]
β	0.094		0.082	0.084	0	0.094		0.078	0.078		0.094		0.081	0.081	
	[2.148]		[1.949]	[1.984]	0	[2.141]		[1.863]	[1.835]		[2.152]		[1.916]	[1.914]	
$\beta-$		0.039			0.066		0.020			0.018		0.024			0.035
		[1.720]			[2.797]		[0.817]			[0.624]		[0.992]			[1.612]
$\beta+$		-0.006			-0.014		-0.006			-0.005		0.003			0.003
		[0.547]			[0.828]		[0.526]			[0.231]		[0.319]			[0.186]
Log-size	-0.032		-0.031	-0.031	-0.029	-0.029		-0.027	-0.027	-0.026	-0.031		-0.029	-0.029	-0.027
	[3.904]		[3.870]	[3.877]	[3.746]	[3.741]		[3.521]	[3.562]	[3.831]	[3.825]		[3.732]	[3.723]	[3.690]
BM	0.010		0.009	0.010	0.010	0.011		0.012	0.013	0.014	0.012		0.012	0.013	0.013
	[0.732]		[0.729]	[0.788]	[0.787]	[0.852]		[0.986]	[1.001]	[1.098]	[0.923]		[0.988]	[1.047]	[1.039]
Past ret	0.449		0.442	0.441	0.443	0.462		0.465	0.450	0.519	0.425		0.417	0.421	0.447
	[2.421]		[2.404]	[2.388]	[2.278]	[2.327]		[2.341]	[2.309]	[2.564]	[2.277]		[2.260]	[2.274]	[2.294]
Idio	-4.005		-4.100	-4.143	-4.132	-4.364		-4.419	-4.433	-3.559	-3.949		-4.048	-4.073	-3.637
	[2.802]		[2.861]	[2.877]	[2.590]	[2.960]		[2.995]	[2.998]	[2.441]	[2.701]		[2.754]	[2.761]	[2.293]
Cosk	-0.193		-0.023	-0.019	0.186	-0.145		0.054	0.057	0.104	-0.139		0.047	0.052	0.104
	[3.251]		[0.522]	[0.437]	[2.568]	[2.818]		[1.251]	[1.309]	[0.979]	[2.794]		[1.090]	[1.170]	[1.662]
Cokurt	-0.008		0.006	0.004	0.022	-0.013		0.003	0.005	0.042	-0.008		0.008	0.008	0.028
	[0.529]		[0.475]	[0.317]	[2.143]	[0.904]		[0.229]	[0.380]	[3.416]	[0.587]		[0.637]	[0.640]	[2.465]
J^{Adj}			-0.010					-0.011					-0.010		
			[4.482]					[4.522]					[4.512]		
$J^{Adj}-$				-0.008	-0.009				-0.011	-0.012				-0.010	-0.011
				[4.003]	[4.068]				[3.995]	[4.171]				[3.949]	[4.045]
$J^{Adj}+$				-0.014	-0.015				-0.012	-0.012				-0.012	-0.011
				[3.801]	[3.781]				[3.737]	[3.873]				[3.683]	[3.641]

Alternative proxies: Ang, Chen, and Xing (2006) Regression Specifications (1992-2014) Continued

Table 7: Continued.

Panel B: Statistics						
	Version 2		Version 3		Version 4	
	mean	std	mean	std	mean	std
β	0.683	(0.510)	0.678	(0.498)	0.685	(0.504)
$\beta-$	0.866	(0.817)	0.841	(0.760)	0.851	(0.770)
$\beta+$	0.563	(0.783)	0.556	(0.754)	0.572	(0.751)
Log-size	5.593	(0.551)	5.632	(0.546)	5.635	(0.546)
BM	0.778	(2.022)	0.777	(2.019)	0.777	(2.015)
Past ret	0.010	(0.047)	0.010	(0.047)	0.010	(0.047)
Idio	0.030	(0.019)	0.030	(0.018)	0.030	(0.018)
Cosk	-0.108	(0.165)	-0.108	(0.165)	-0.111	(0.168)
Cokurt	1.309	(1.381)	1.380	(1.459)	1.380	(1.443)
J^{Adj}	-3.971	(7.896)	-4.266	(8.243)	-4.196	(8.234)
$J^{Adj}-$	-6.263	(3.661)	-6.494	(3.786)	-6.513	(3.782)
$J^{Adj}+$	5.501	(3.175)	5.785	(3.276)	5.761	(3.282)

Fama and MacBeth (1973) Regression Specifications (1992-2014)

Table 8: We measure risk premia using the Fama and MacBeth (1973) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next excess monthly return is regressed against β, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt"), $J^{Adj}-$ and $J^{Adj}+$ estimated using the past 12 months of daily excess return data. We also include the average past 12-monthly excess return ("Past Ret"). The relevant book-to-market ratio ("BM") at time t for a given stock is computed using the last available (most recent) book value entry. Size ("Log-size") is computed at the same date that Book-to-market ratio is computed. We provide regression results using all available observations, as well as a series of regressions excluding the top quintile, top decile and top vigintile of volatile stocks, where volatility is measured as the standard deviation of the past 12 months of daily excess returns. We proxy the market portfolio with the the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The value-weighted mean and value-weighted standard deviation (in parentheses) for each variable is provided. All coefficients are reported as effective annual rates.

	All			Excl Top Quintile			Excl Top Decile			Excl Top Vigintile		
	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)	I'	IV'	Mean (Std)
Int	0.051	0.015		0.045	0.010		0.044	0.009		0.042	0.008	
	[1.063]	[0.319]		[0.957]	[0.217]		[0.926]	[0.189]		[0.891]	[0.159]	
β	-0.077	-0.096	0.676	-0.076	-0.095	0.675	-0.077	-0.0959	0.675	-0.080	-0.098	0.675
	[1.654]	[2.067]	(0.503)	[1.635]	[2.047]	(0.501)	[1.661]	[2.072]	(0.501)	[1.714]	[2.122]	(0.502)
Log-size	-0.002	0.000	5.589	-0.001	0.001	5.614	-0.001	0.001	5.612	-0.001	0.001	5.610
	[0.291]	[0.026]	(0.550)	[0.216]	[0.100]	(0.543)	[0.213]	[0.105]	(0.544)	[0.205]	[0.111]	(0.544)
BM	0.066	0.066	0.777	0.066	0.066	0.775	0.067	0.067	0.775	0.066	0.067	0.775
	[4.650]	[4.763]	(2.026)	[4.629]	[4.742]	(2.016)	[4.642]	[4.752]	(2.017)	[4.639]	[4.749]	(2.017)
Past ret	2.433	2.182	0.007	2.445	2.195	0.007	2.441	2.192	0.007	2.447	2.198	0.007
	[5.813]	[5.535]	(0.046)	[5.821]	[5.552]	(0.046)	[5.819]	[5.549]	(0.046)	[5.836]	[5.567]	(0.046)
Idio	-1.853	-2.026	0.030	-1.796	-1.965	0.030	-1.758	-1.927	0.030	-1.692	-1.862	0.030
	[1.596]	[1.768]	(0.019)	[1.532]	[1.698]	(0.018)	[1.493]	[1.657]	(0.018)	[1.431]	[1.596]	(0.018)
Cosk	-0.054	0.176	-0.105	-0.057	0.172	-0.105	-0.056	0.172	-0.105	-0.056	0.172	-0.105
	[0.523]	[1.629]	(0.162)	[0.555]	[1.599]	(0.163)	[0.553]	[1.601]	(0.163)	[0.552]	[1.596]	(0.163)
Cokurt	0.034	0.053	1.310	0.033	0.052	1.318	0.034	0.053	1.317	0.036	0.055	1.317
	[1.258]	[1.902]	(1.401)	[1.230]	[1.876]	(1.408)	[1.258]	[1.895]	(1.407)	[1.319]	[1.943]	(1.407)
$J^{Adj}-$		-0.012	-6.247		-0.012	-6.242		-0.012	-6.242		-0.012	-6.243
		[5.906]	(3.673)		[5.888]	(3.673)		[5.893]	(3.672)		[5.885]	(3.672)
$J^{Adj}+$		-0.020	5.541		-0.020	5.537		-0.020	5.538		-0.020	5.537
		[5.114]	(3.245)		[5.068]	(3.241)		[5.081]	(3.242)		[5.079]	(3.241)

Ang, Chen, and Xing (2006) Regressions with Vasicek correction for β (1992-2014)

Table 9: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, β^-, β^+, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. We apply the Vasicek correction on all β estimates (Vasicek, 1973). We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The value-weighted mean and value-weighted standard deviation (in parentheses) for each variable is provided at the last column. All coefficients are reported as effective annual rates.

	I	II	III	IV	V	mean (std)
Int	0.262	0.057	0.233	0.234	0.256	
	[3.221]	[1.885]	[3.029]	[3.007]	[3.343]	
β	0.130		0.101	0.101		0.800
	[2.272]		[1.873]	[1.851]		(0.293)
$\beta-$		0.036			0.067	0.857
		[1.539]			[2.956]	(0.812)
$\beta+$		-0.011			-0.030	0.552
		[1.001]			[1.528]	(0.776)
Log-size	-0.033		-0.031	-0.031	-0.027	5.589
	[4.019]		[3.963]	[3.913]	[3.590]	(0.551)
BM	0.009		0.010	0.010	0.009	0.778
	[0.707]		[0.726]	[0.762]	[0.675]	(2.025)
Past ret	0.497		0.493	0.477	0.463	0.010
	[2.471]		[2.466]	[2.407]	[2.364]	(0.047)
Idio	-4.597		-4.515	-4.533	-4.475	0.030
	[3.040]		[3.017]	[3.024]	[2.864]	(0.019)
Cosk	-0.179		0.008	0.001	0.250	-0.104
	[2.967]		[0.191]	[0.028]	[3.118]	(0.162)
Cokurt	-0.001		0.016	0.015	0.027	1.307
	[0.108]		[1.271]	[1.201]	[2.273]	(1.398)
J^{Adj}			-0.010			-3.999
			[4.537]			(7.909)
$J^{Adj}-$				-0.010	-0.011	-6.249
				[4.164]	[4.260]	(3.674)
$J^{Adj}+$				-0.012	-0.013	5.543
				[3.406]	[3.587]	(3.246)

Ang, Chen, and Xing (2006) Regressions Excluding Negative β (1992-2014)

Table 10: We measure risk premia using the Ang, Chen, and Xing (2006) asset pricing procedure where value-weighted cross-sectional regressions are computed every month rolling forward. At a given month, t, the average of the next 12 excess monthly returns is regressed against β, β^-, β^+, idiosyncratic risk ("Idio"), coskewness ("Cosk"), cokurtosis ("Cokurt") and J^{Adj} estimated using the next 12 months of daily excess return data, and size ("Log-size"), book-to-market ratio ("BM") and the average past 12-monthly excess return ("Past Ret"), computed as at time t. We exclude all observations with negative β estimates to control for data issue. We proxy the market portfolio with the S&P ASX 200 index and the risk free rate with the 90-day bank accepted bill rate. All regressors are Winsorised at the 1% and 99% level at each month. We restrict our attention to stocks listed on the ASX between June 1992 and June 2014. Statistical significance is determined using Newey and West (1987) adjusted t-statistics, given in parentheses, to control for overlapping data using the Newey and West (1994) automatic lag selection method to determine the lag length. The value-weighted mean and value-weighted standard deviation (in parentheses) for each variable is provided at the last column. All coefficients are reported as effective annual rates.

	I	II	III	IV	V	mean (std)
Int	0.287	0.069	0.249	0.250	0.237	
	[3.859]	[2.169]	[3.659]	[3.682]	[3.314]	
β	0.079		0.064	0.065		0.732
	[1.748]		[1.465]	[1.458]		(0.466)
$\beta-$		0.034			0.069	0.916
		[1.326]			[2.813]	(0.776)
$\beta+$		-0.023			-0.042	0.612
		[1.751]			[2.037]	(0.735)
Log-size	-0.030		-0.028	-0.028	-0.025	5.709
	[3.963]		[3.930]	[3.881]	[3.550]	(0.534)
BM	0.006		0.007	0.007	0.009	0.768
	[0.465]		[0.491]	[0.520]	[0.688]	(2.010)
Past ret	0.509		0.506	0.495	0.510	0.011
	[2.466]		[2.470]	[2.428]	[2.520]	(0.047)
Idio	-3.794		-3.813	-3.822	-3.937	0.030
	[2.642]		[2.668]	[2.680]	[2.574]	(0.018)
Cosk	-0.184		0.006	0.001	0.287	-0.110
	[3.045]		[0.130]	[0.028]	[3.269]	(0.164)
Cokurt	-0.005		0.010	0.009	0.031	1.404
	[0.349]		[0.727]	[0.628]	[2.536]	(1.415)
J^{Adj}			-0.010			-4.013
			[4.532]			(7.910)
$J^{Adj}-$				-0.010	-0.011	-6.205
				[4.116]	[4.433]	(3.632)
$J^{Adj}+$				-0.012	-0.013	5.427
				[3.496]	[3.830]	(3.114)