The Value Premium: Rational, Irrational or Random

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Abstract

Using data from the stock markets of Japan, the UK and the US, this paper examines the time series properties of a price index derived from a zero net investment strategy of buying value stocks and short selling growth stocks. We use the results of this analysis to consider implications for the validity of competing hypotheses on the source of the value premium. Overall, the results from this study indicate that the US value premium displays different characteristics to the value premiums for the UK and Japan. This has far-reaching implications for financial modelling and for the success, or otherwise, of investment strategies based on the existence of a value premium.

JEL Classification: G12, G15

Keywords: Value premium; Mean reversion; Variance ratio tests; Persistence

1. Introduction

It is now generally accepted that value stocks (stocks with low market prices relative to financial statement fundamentals) have a tendency to outperform growth stocks (stocks with high market prices relative to financial statement fundamentals).[1] Evidence of the 'value premium' (the difference between returns on value stocks and returns on growth stocks) suggests that a contrarian zero net investment strategy (short selling growth stocks and buying value stocks) will produce positive returns (see for example, DeBondt and Thaler 1985, 1987, Chan *et al.* 1991, Fama and French 1992, 1995, 1996, 1998, Lakonishok *et al.* 1994, Haugen *et al.* 1996).

There is a topical and controversial debate about the source of the value premium with current explanations falling into one of three categories; however, there is little evidence to help us decide which of these explanations is correct.[2] One explanation is that the value premium is a rational phenomenon, which is priced in equilibrium, and is compensation for systematic risk. Both Fama and French (1995) and Lakonishok *et al.* (1994) show that the value premium appears to be associated with the degree of 'relative distress' in the economy. Fama and French (1996 and 1998) build on this and argue that, in equilibrium, the value premium is priced *in addition* to the traditional CAPM-type market risk, because there is "common variation in the returns on distressed stocks that is not explained by the market return" (Fama and French, 1998, p.1975). In a weakening economy investors require a higher risk premium on firms with distress characteristics. Since distressed stocks perform poorly just when the investor least wants to hold a poorly performing stock, value stocks must offer a higher average return in reward for the extra systematic risk borne by the investor. The observed higher returns produced by value stocks are therefore justified, being compensation for the risk borne by those who invest in value stocks (see also, Ball 1978 and Berk, 1995).

Another explanation for the higher returns from a value strategy is the behavioural or irrational view. Contrarian strategies produce higher returns because they exploit the tendency of some investors to overreact to good or bad news. Overreaction means that prices adjust by more than is justified by fundamentals. Unpopular value stocks that have done badly are oversold, become under-priced, and are corrected at some point in the future when a switch in investor sentiment raises the prices of these stocks. This view can be associated with the already extensive literature dealing with different aspects of irrational investor behaviour (see, Rosenthal and Young 1990, Fama 1991, 1998, Fraser and McKaig 1998, Kothari, 2000, Lee and Swaminathan, 1999, Griffin and Lemon, 2001, Hirshleifer, 2002, Daniel *et al.* 2002, Barberis *et al.,* 1998, Hong and Stein, 1999).

For example, Daniel *et al.* (2002), Barberis *et al.* (1998) and Hong and Stein (1999) find that mistaken beliefs cause stock price momentum and reversals. These models focus on the psychology of the representative agent in terms of the dynamics of, biased self-attribution and overconfidence (Daniel *et al.,* 2002), and conservatism and representativeness (Barberis *et al.* 1998). In Daniel *et al.* (2002) agents learn about their own competence and talent in a biased, self-promoting fashion, but eventually their overconfidence is eroded by accumulative evidence on fundamentals. However, Barberis *et al.* (1998) suggests that agents mistakenly view what are actually random walks to be (rare) shifts between continuation sequences and reversal sequences: agents overreact to changes in fundamentals preceded by consistent patterns of good or bad news (representative-ness) as this trend is expected to continue, but under react to news on fundamentals preceded by many reversals, as the impact of news is likely to be reversed in the future (conservatism). Hence we witness long periods of over and under reaction of stock prices to news on fundamentals depending on which sequence is dominant.[3] In comparison, Hong and Stein (1999) focus on the interaction between heterogeneous agents, and show that initial under reaction to news on fundamentals creates overreaction by making it possible for different classes of momentum traders to enter the market, which, in turn, is exploited by contrarian strategies, and correction eventually occurs at long horizons.

The final explanation for the value premium is not because of rational or irrational investor behaviour, but because of random occurrences, which are unlikely to occur again in the future (Lo and MacKinlay 1988, Breen and Korajczyk 1995 and Kothari, Shanken and Sloan 1995). In this situation the value premium is no more than a vagary of chance, being neither reward-for-risk nor the basis for a profitable trading strategy.

The purpose of this paper is to add to the current debate on the source of the value premium by examining the time series characteristics of a price index that represents holdings in a portfolio that is long on value and short on growth. We focus on mean reversion (the tendency for prices to return to a trend path), persistence (the tendency for the impact of news on prices to diffuse slowly rather than instantaneously), and random occurrences. We use data from the stock markets of Japan, UK and US and, therefore, provide evidence across three of the largest and deepest of the worlds stock markets[4]. Our methodology begins with the Chow and Denning (1993) adaptation of the Lo and MacKinlay (1989) variance ratio tests, and we use the results of this analysis to consider implications for the validity of competing hypotheses on the source of the value premium.

The remainder of the paper is set out as follows. Section 2 describes the empirical method employed in the study. Section 3 describes the data and provides summary statistics. Section 4 reports the results of the main analysis and section 5 concludes.

2. Empirical method

We consider investor behaviour over different return horizons by analysing the extent to which increments to a price index, that captures the relative wealth effect from a zero net investment strategy from buying value and short selling growth stocks (hereafter this price index is referred to as the value premium price index), deviate from random behaviour in terms of mean reversion and persistence. We use the heteroscedastic consistent variance ratio test proposed by Cochrane (1988), subsequently applied by Lo and MacKinlay (1989) and extended by Chow and Denning (1993) to control for the overall test size and to define relevant confidence intervals. A brief summary of the variance ratio methodology is given below followed by a discussion of how this methodology may yield insight on the source of the value premium.

Under the random walk hypothesis returns are uncorrelated at all leads and lags, and hence price innovations are unforecastable from past innovations (see Lo and MacKinlay, 1989, p. 206). In our case, denote $X_{t,}$ as the value premium price index. If incremental changes in X_t from t to q, and denoted, X_{t+q}-X_t, (which is effectively the return on the value-growth portfolio) are driven by pure chance then the variance of these random walk increments must be a linear function of the time interval. Hence the variance of two-monthly increments must be twice as large as the variance of the monthly increment, while the variance of quarterly increments must be three times as large of the variance of monthly increments, and so on. In this pure chance case, given $nq+1$ observations on the value premium price index and where q is an integer greater than 1, the ratio $1/q$ of the variance X_{t+q}-X_t to the variance of X_{t+1}-X_t would be equal to unity. Following Lo and MacKinlay (1989) if we denote q as a lag difference of X_t (where q can be any integer greater than unity) then, if the series is a random walk, the heteroscedastic consistent variance ratio estimate is calculated as:

$$\overline{M}_r(q) \equiv \left[\frac{\overline{\sigma}^2(q)}{\overline{\sigma}^2(1)}\right] - 1 \qquad (1)$$

where

$$\overline{\sigma}^2(q) \equiv \frac{1}{\omega}\sum_{i=1}^{nq}(X_1 - X_{i-q} - q\hat{\mu})^2 \qquad (2)$$

$$\overline{\sigma}^2(q) \equiv \frac{1}{\omega}\sum_{i=1}^{nq}(X_1 - X_{i-1} - q\hat{\mu})^2 \qquad (3)$$

and

$$\omega \equiv q(nq - q + 1)\left(1\frac{1}{n}\right) \qquad (4)$$

The number of available return observations is nq and $\hat{\mu}$ is the sample mean of, X_t-X_{t-1}. Equation (2) is the variance of q-period returns scaled by ω, and equation (3) is the variance of the single-period return.

If the q increments of the value premium price series, X_t, are uncorrelated, the variance ratio described by (1) will be zero, implying that q-period changes in the value premium price index are due to chance. However, if the increments are negatively autocorrelated then $\overline{\sigma}^2$(q) will be smaller than $\overline{\sigma}^2(1)$, and variances will grow slower than linearly (see Campbell, *et al.* 1997). Hence, the variance ratio statistic, $\overline{M}_r(q)$, as described by (1) will be less than zero, implying a systematic, mean reverting component in the q-period increments of X_t. Conversely, if increments in the value premium price index are positively autocorrelated then $\overline{\sigma}^2$(q) will be larger than $\overline{\sigma}^2(1)$ and variances will grow faster than linearly. In this case the variance ratio statistic will be greater than zero, indicating a persistent component in the value premium price index.

The heteroscedastic consistent Chow and Denning (1993) test statistic is based on the idea that the random walk hypothesis requires the variance ratio to be equal to zero at *all* horizons and they derive a more powerful test statistic that utilizes all the available information from *2,…,q-1*. Essentially, the insight of Chow and Denning is that failure to control the joint-test size for the variance ratio estimates results in substantial incorrect rejections of the random walk null hypothesis (Type I errors). The statistic which allows testing all the selected multiple variance ratio estimates (plus one) with unity is:

$$Z^*(q) \pm SMM(a; m; \infty) \qquad (5)$$

where $SMM(\alpha; m; \infty)$ is the asymptotic critical value of the point of the Studentised Maximum Modulus (*SMM*) distribution with parameter *m* and ∞ degrees of freedom The asymptotic SMM critical value can be calculated from the conventional standard normal distribution. Values of Z^* greater than the absolute *SMM* critical value indicates significant departures from random behaviour (see for example Poon, 1996).

An attractive feature of the variance ratio test is that this approach does not require a specific form of the return generating process and is robust to a non-linear random walk. As Lo and MacKinlay (1988) point out, the procedure "allows for quite general forms of heteroscedasticity including deterministic changes in the variance ratio (due, for example, to seasonal factors), and Engle's (1982) *ARCH* process (in which conditional variance depends on past information)" (p.49).

We now consider the implications of the variance ratio tests for the competing hypothesis about the source of the value premium. It may at first appear that if the variance ratio estimate does not reject a random walk process for X_t then this lends support to the view that the value premium is nothing more than chance. However, this would be incorrect. According to both the fundamental risk view and the behavioural view, the current expectation of the value premium, $E_t(X_{t+1} - X_t)$, which is equal to $E_t(R_{v,t+1} - R_{g,t+1})$, where R_v is the continuously compounded return from value stocks, and R_g, is the continuously compounded return from growth stocks, is positive, being either compensation for carrying a distress risk factor or the positive return for a contrarian investment strategy. If either of these views holds, then a typical formulation for the value premium price series, X_t is a random walk process such as:

$$X_{t+1} = \mu + X_t + \varepsilon_{t+1} \tag{6}$$

or

$$X_{t+1} - X_t + \varepsilon_{t+1} \tag{7}$$

where X_{t+1} is the value premium price index one period ahead, μ is positive (possibly time-varying) and ε_{t+1} is a white noise error term covering the period from t to $t+1$.[5]

A positive value for μ supports either the fundamental or the behavioural view even though the increments of the value premium price index are uncorrelated. Therefore, the random/chance view of the value premium holds only if the variance ratio statistic is zero *and* μ is equal to zero.

Evidence of temporary or mean reverting components in the value premium price index lends support to the behavioural or irrational explanation of the value premium. The behaviour models discussed earlier suggest that this can be preceded by persistence. For example, in Hong and Stein (1999) the slow diffusion of information across groups of agents can cause prices to change slowly in response to news about fundamentals, giving evidence of persistence. As deviations from fundamental value are eventually corrected there is mean reversion. So behavioural explanations for the value premium are also consistent with a significantly positive μ in equation (7), where the reward is a payoff for the implementation of a successful investment strategy. Therefore, evidence of either mean reversion or persistence and a significantly positive μ are consistent with the behavioural explanation to describe the value premium.

However, there is an alternative explanation for persistence at medium to long horizons that is consistent with the view that the value premium is an independent time-varying risk premium priced in equilibrium. This explanation is based on the notion that the observed long-term persistence in GNP (see Cochrane, 1988) is captured in the non-constant distress risk factor associated with value stocks. This is consistent with the findings presented in Fama and French (1995) that value firms have persistently low earnings and growth firms have persistently high earnings. This further suggests that the distress factor is backward looking: a streak of low output and profits drain a firms cash flows and liquidity and implies financial distress for the upcoming period.[6] We examine this issue by looking at the relationship between the value premium and cumulative growth in real GDP over the last n quarters[7],

$$X_{t+1} - X_t = \alpha + \gamma(Y_{t-1} - Y_{t-n}) + \omega_{t+1} \tag{8}$$

where $X_{t+1} - X_t$ is the upcoming quarterly value premium, and Y is (logged) real output. A negative value of γ, which is significantly different from zero, would suggest that the risk-based explanation of the value premium is valid. Positive GDP growth is associated with a decrease in the future value premium and negative GDP growth is associated with an increase in the future value premium.

The implications of the variance ratio tests and the subsequent analyses discussed in this section are summarised below in Table 1:

Table 1 **Implications of the Variance Ratio Tests**			
$\overline{M}_r(q_i)$ is the variance ratio estimate as described by equation (1). and are described in equations (7) μ and γ (8) respectively.			
Variance Ratio	**Fundamental Risk View**	**Behavioural View**	**Random Occurrence View**
$1+\overline{M}_r(q_i)=1$	$\mu>0$	$\mu>0$	$\mu>0$
$1+\overline{M}_r(q_i)<1$		$\mu>0$	
$1+\overline{M}_r(q_i)>1$	$\mu>0$	$\mu>0$	

If the variance ratio estimate plus one is equal to one, then μ should be positive for either the fundamental or the behavioural view to hold since both imply a positive value premium. The random occurrence view requires that $\mu = 0$. If $1+\overline{M}_r(q_i)<1$ then the fundamental view can be ruled out, however, the behavioural view still requires that μ is positive.[8] Finally, for $1+\overline{M}_r(q_i)>1$ the fundamental view requires that μ is positive and γ is negative. The behavioural view still requires that μ is positive. The random occurrence view cannot hold if either $1+\overline{M}_r(q_i)<1$ or $1+\overline{M}_r(q_i)>1$.

3. Data Description and Summary Statistics

3.1 Data Description

We use local and dollar return series in the analysis, inclusive of dividends, for the stock markets of Japan, UK and US over the period 1975:1 through 2000:6, from the international value and growth returns series available from the website of Kenneth French.[9] High book to market returns and low book to market returns are defined as the top and bottom 30% of stocks, respectively, ranked by their book-equity to market-equity ratio. From this data, we derive an equivalent monthly price series in order to examine the relative value and growth prices, which is effectively a price index from buying value stocks and short selling growth stocks, described earlier as the value premium price index. We construct the monthly and quarterly value premium from this index.[10] All data are presented in natural logarithms. The return data is constructed from Morgan Stanley's Capital International Perspectives (MSCI) and includes historical data for firms that disappear, but does not include historical data for newly added firms (see Fama and French, 1998, p. 1976). This means that there is no survivorship bias in the data. Real GDP data were collected from Datastream for each of the countries in the sample.

3.2 Summary Statistics

Figure 1 plots the log of the value premium price indices for Japan, UK and US over the sample period. The UK and US markets display an upward (although not smooth) trend over the early part of the sample (1975 through 1990), however, this trend is more pronounced for Japan and is continuous throughout the sample. After a period of relative price stability in the mid 1990s, both the UK and US markets exhibit downward movements in the prices of value relative to growth stocks. This is particularly evident in the US market and captures the popularity of growth stocks during the late 1990s.

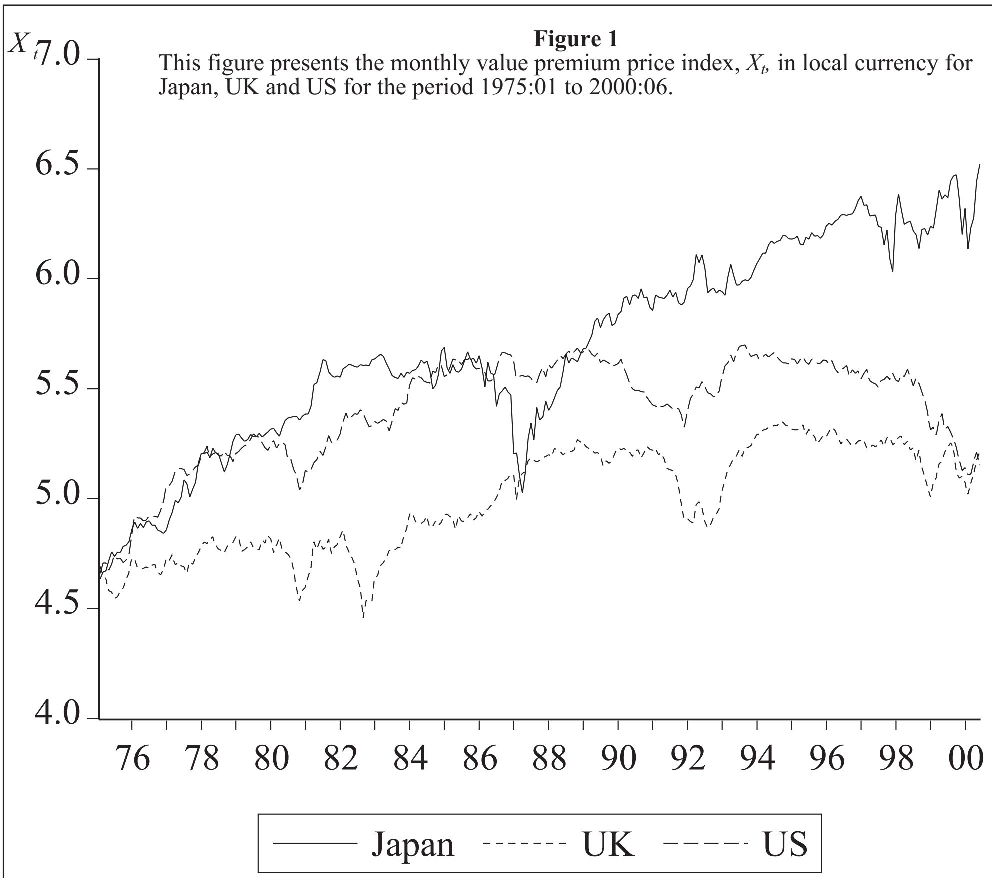


Figure 1
This figure presents the monthly value premium price index, X_t, in local currency for Japan, UK and US for the period 1975:01 to 2000:06.

Table 2 provides summary statistics and correlations of the value premium for monthly and quarterly return horizons.[11] Consistent with previous work, the value premium has a positive value over the full sample period. We estimated equation (7) over the full sample period to test the null hypothesis H_0: $\mu = 0$ against the alternative hypothesis H_1: $\mu > 0$. The null hypothesis is rejected for Japan at the five per cent level of significance but not rejected for either UK or US. Therefore, although the mean return is positive for all three markets, this is significant only for Japan.

The standard deviations indicate that the value premium is most volatile in Japan with the US market showing the least volatility. However, the volatility of the value premium in Japan is not very different from the volatility for other countries such as Finland, Norway, Spain and Singapore.[12]

Tests for unit roots were conducted using standard Phillips-Perron tests. We find that the value premium *return* series are stationary. Tests on the value premium *price index* suggest that these series are non-stationary (not reported).[13] The contemporaneous correlations show that the value premium is not highly correlated across markets. This is a feature that has been highlighted in previous studies (see for example, Hawawini and Keim, 1995).

Table 2
Summary Statistics and Correlations

This table presents summary statistics for monthly and quarterly value premium returns (in percent) in local currency calculated as

$$X_{t+1} - X_t = R_{v,t+1} - R_{g,t+1}$$

where X denotes the value premium price index, R_v denotes returns on a value portfolio and R_g denotes returns on a growth portfolio from 1975:Q2 to 2000:Q2 for Japan, UK and US. S.D. denotes standard deviation. JB denotes the Jarque-Bera test for residual normality, $JB \sim \chi^2_i$. Probability values are in parenthesis below test statistics. PP denotes the Phillips-Perron test where the null hypothesis is H_0: there is a unit root. An intercept is included and 5 lags for monthly estimates (4 lags for quarterly estimates). The 5% critical value for the PP test is –2.871.

Monthly Value Premium Returns

	Mean	S.D.	Minimum	Maximum	JB	PP
Japan	0.629	4.991	-26.932	25.696	449.081 (0.000)	-17.403
UK	0.200	3.450	-13.834	11.724	39.677 (0.000)	-16.008
US	0.142	2.861	-7.926	9.021	2.784 (0.248)	-15.176

Quarterly Value Premium Returns

	Mean	S.D.	Minimum	Maximum	JB	PP
Japan	2.004	9.075	-36.736	29.029	67.462 (0.000)	-11.552
UK	0.661	6.712	-24.925	17.416	32.307 (0.000)	-8.844
US	0.442	5.644	-14.738	16.823	3.367 (0.185)	-8.593

Monthly Correlations

	Japan	UK	US
Japan	1.000		
UK	0.134	1.000	
US	0.080	0.278	1.0

Quarterly Correlations

	Japan	UK	US
Japan	1.000		
UK	0.289	1.000	
US	0.259	0.412	1.000

4. Empirical Results

4.1 Variance Ratio Tests

Table 3 reports variance ratio statistics for the value premium price index up to 5- year horizons.[14] For the US, the statistics reveal a preponderance of ratios from the 6-monthly horizon and beyond that are significantly greater than unity, with random behaviour at shorter lags – the latter being consistent with the Phillips-Perron tests reported above. These results imply a tendency for the US value premium price index to be persistent, particularly at medium to long return horizons.

For the UK market we report statistics for return horizons up to 5-years that are consistent with uncorrelated increments in the value premium price index. While at

Table 3
Variance Ratio Tests

This table shows the variance ratios for the value price premium index, *X*. The statistics, $1+M_r(q)$, are reported in the main rows with the heteroscedasticity-robust test statistic *Z**, as described in Chow and Denning (1993) in parenthesis below the variance ratios. The critical values for the joint tests of *Z** are 3.765, 3.336, and 3.130 at the 1%, 5% and 10% level of significance respectively, calculated at sixty lag intervals on the SMM tables (Stoline and Ury, 1979). Statistically significant values at the 5% level of significance are marked with an asterisk. The value price premium index is sampled monthly for the time period January 1975 to June 2002.

	Sampling interval in months								
	3	**6**	**9**	**12**	**18**	**24**	**36**	**48**	**60**
Japan	1.02	0.96	0.86	0.81	0.89	0.98	1.12	1.23	1.37
*Z**	0.25	-0.33	-1.08	-1.36	-0.73	-0.15	0.76	1.28	2.26
UK	1.20	1.29	1.21	1.15	1.11	1.01	0.97	0.97	0.94
*Z**	2.88	3.16	2.13	1.44	0.96	0.13	-0.28	-0.29	-0.48
US	1.21	1.37*	1.45*	1.53*	1.79*	1.82*	1.75*	1.63*	1.57*
*Z**	3.03	4.10	4.71	5.21	7.20	7.23	6.57	5.14	4.55

longer horizons there is a tendency for the estimates to fall below unity (from $q = 30$), thus indicating mean reversion, these reversals are statistically insignificant. Similarly for Japan, we cannot reject the null hypothesis that the increments of the value premium price index are uncorrelated and, therefore, random. Notably however, the pattern of the variance ratios differs from those reported for the UK. While deviations from unity are insignificant, the pattern reveals a push toward mean reversion over return horizons of 6 through 18 months, and a push toward persistence at horizons beyond 18 months. In comparison, as mentioned above, the US has variance ratio statistics that are statistically significant and suggest persistence in the value premium price index at horizons $q = 6$ through $q = 60$.[15] As discussed earlier, evidence of persistence supports the view that either behavioural theories or the rational risk story explains the value premium.

Overall, the variance ratio test results suggest that for the UK and Japan, the value premium can be driven by any of the three main hypotheses, while for the US either the fundamental or the behavioural view would appear to be relevant. We turn now to an analysis of the results that attempt to distinguish between these competing hypotheses.

4.2 Time-varying elements in the value premium

As discussed above in Section 2, evidence of uncorrelated increments in the value premium price index does not in itself support the view that the value premium is random. If μ is positive, there exists a constant reward from holding the value portfolio and the random explanation of the value premium is rejected, even though the increments are uncorrelated. We discovered earlier that μ is significantly positive, over the full sample, for Japan and not UK or US. In order to capture any time-varying element in the time-path of μ, we present rolling estimates over a five year fixed horizon (including the t-statistics for each five year period). Figures 2 to 4 show the results. We can now see that the UK has a significantly positive μ over the 1987-1988 period and follows a similar pattern over the sample period to the US. Also, it is clear that μ falls quite markedly towards the end of the sample for both UK and US.

Figure 2
The average value premium as it changes over time for Japan

See notes to figure 2.

The plots below show μ from estimates of the following equation

$$X_{t+1} - X_t = \mu + \varepsilon_{it+1}$$

over a rolling fixed estimation period of five years. Student t-statistics derived from Bollerslev-Wooldridge robust standard errors for each μ are also presented. The full sample is 1975Q2 to 2000Q2 and the adjusted sample is 1980Q1 to 2000Q2. The returns are sampled quarterly in local currency where the null hypothesis is H_0: $\mu = 0$ and the alternative hypothesis is H_1: $\mu > 0$. Variables are expressed in percentages. Points above the horizontal line represent estimates where the null hypothesis is rejected at the five per cent level of significance.

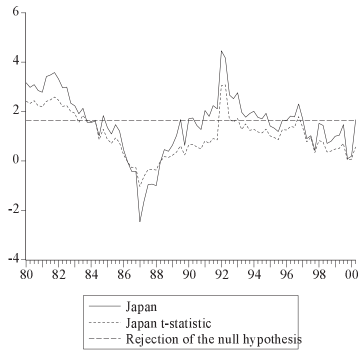


Figure 3
The average value premium as it changes over time for UK

See notes to figure 2.

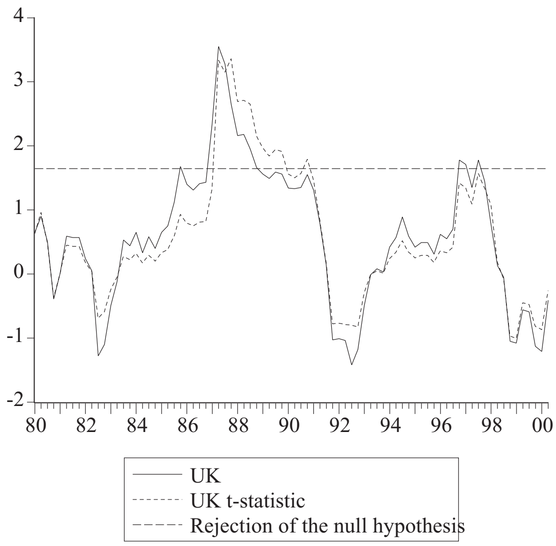
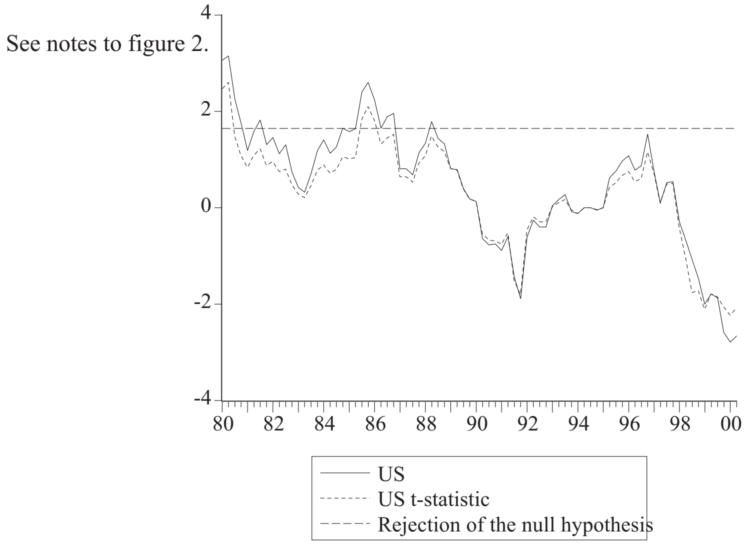


Figure 4
The average value premium as it changes over time for US



Although the variance ratio tests tell us that the increments in the value premium price index are uncorrelated for Japan, the random view is not relevant since μ is significant. Therefore, either the fundamental or the behavioural view explains the value premium in Japan. The value premium in the UK may be driven by either fundamental or behavioural reasons or given the evidence for μ it could be random.

For the US, the finding of persistence in the value premium price index rules out the random occurrence view. Persistence, along with the existence of significant 'reward' factors, as measured by μ, points to either the fundamental or behavioural explanations for the value premium.[16] We note that is not significantly positive for the US, however, it may be difficult to pick up a positive μ statistically. Therefore, we attempt to discriminate between the relevance of the rational and irrational hypotheses for the US by estimating equation (8), where a significant negative relationship between the value premium and past cumulative GDP growth would indicate a risk-based explanation of the value premium.

4.3 The Value Premium and GDP Growth

In Table 4 we present the results from regressing the US value premium on the past change in the log of real US GDP growth.[17] The results show that there is a significant negative relationship with past cumulative GDP growth when we include information on the past two, three, four and five years of GDP growth. Also, the values for the adjusted R^2 suggest that including more information on past GDP growth offers more explanatory power. The results can be interpreted to say that for every one per cent increase in cumulative real GDP growth (over a period around two years or greater) the value premium in the US falls by approximately 0.34%. Similarly, when real GDP growth falls by one per cent the upcoming value premium in the US rises by around 0.34%. This appears to support the view that long periods of falling GDP growth are likely to be followed by an increase in the value premium.

Table 4
Regressions of the Value Premium on past GDP growth for the US

Ordinary Least Squares estimation results are reported for the future value of the value premium on the past change in real GDP growth. The model is specified as

$$X_{t+1} - X_t = \alpha + \gamma(Y_{t-1} - Y_{t-n}) + \omega_{t+1}$$

where X denotes the value price premium index and $X_{t+1} - X_t$ is equal to the value premium, $R_{v,t+1} - R_{g,t+1}$ where $R_{v,t+1}$ is the local quarterly return on a value portfolio and $R_{g,t+1}$ is the quarterly return on a growth portfolio. Y is the log of real GDP, which is sampled quarterly over n quarters. The null hypothesis is H_O: $\gamma = 0$ and the alternative hypothesis is H_1: $\gamma < 0$. Student t-statistics derived from Bollerslev-Wooldridge robust standard errors are in parentheses below coefficient estimates. A statistically significant coefficient at the 5 percent level is denoted by an asterisk. $\overline{R}^2$ is the adjusted coefficient of determination. A_i denotes an i-th order ARCH LM test, $A_i \sim \chi_i^2$, denotes an i-th order Ljung-Box test for residual serial dependency, $Q_i \sim \chi_i^2$, and JB denotes the Jarque-Bera test for residual normality, $JB \sim \chi_i^2$. Probability values are in parenthesis below test statistics. The adjusted sample period is 1975:Q4 to 2000:Q2. The number of observations depends on the horizon for n, for n=8 the observations are 92. Variables are expressed in percentages and continuously compounded. The explanatory variable is in the first column.

	α	γ	$\overline{R}^2$	Q_1	A_1	JB
$Y_{t-1} - Y_{t-2}$	-0.337 (1.26)	0.933 (1.26)	0.017	1.366 (0.242)	0.022 (0.881)	4.844 (0.088)
$Y_{t-1} - Y_{t-3}$	-0.332 (0.332)	0.360 (0.787)	0.007	2.221 (0.136)	0.101 (0.751)	2.179 (0.336)
$Y_{t-1} - Y_{t-4}$	-0.057 (0.051)	0.132 (0.380)	0.001	2.460 (0.117)	0.034 (0.852)	1.523 (0.466)
$Y_{t-1} - Y_{t-5}$	0.482 (0.383)	-0.073 (0.239)	0.000	2.318 (0.128)	0.005 (0.944)	0.804 (0.668)
$Y_{t-1} - Y_{t-6}$	-0.692 (0.179)	0.027 (0.03)	0.000	0.406 (0.524)	1.400 (0.252)	1.376 (0.502)
$Y_{t-1} - Y_{t-7}$	2.700 (0.845)	-0.635 (1.013)	0.014	0.452 (0.501)	1.358 (0.259)	1.987 (0.370)
$Y_{t-1} - Y_{t-8}$	2.456 (1.777)	-0.441* (2.09)	0.058	0.639 (0.424)	0.054 (0.816)	0.627 (0.730)
$Y_{t-1} - Y_{t-12}$	2.958 (1.77)	-0.354* (1.96)	0.060	0.441 (0.507)	0.095 (0.757)	1.003 (0.605)
$Y_{t-1} - Y_{t-16}$	3.553* (1.996)	-0.324* (2.230)	0.063	0.483 (0.487)	0.063 (0.802)	1.089 (0.580)
$Y_{t-1} - Y_{t-20}$	4.748* (2.327)	-0.344* (2.42)	0.065	0.982 (0.322)	0.081 (0.775)	0.944 (0.623)

We summarise the main results using the schema of Table 1 based on the variance ratio test results, and report these in Table 5:

As discussed above, the evidence suggests that both the behavioural or fundamental explanations for the value premium are relevant for Japan and we cannot rule out either the behavioural, fundamental or random explanations for the UK. The variance ratio tests indicate that there is persistence in the US value premium price index and the results from estimating equation (8) suggests that there is a negative relationship between cumulative real GDP and the US value premium. Therefore, it seems most likely that the fundamental risk story appears to fit the empirical findings for the US. This suggests that the

US value premium exists because it is a reward for non-diversifiable aggregate risk associated with financial distress.

Table 5
Summary of Test Results

$\overline{M}_r(q_i)$ is the variance ratio estimate as described by equation (1).

Variance Ratio	Fundamental Risk View	Behavioural View	Random Occurrence View
$1+\overline{M}_r(q_{i)} = 1$	**Japan** **UK**	**Japan** **UK**	**UK**
$1+\overline{M}_r(q_{i)} < 1$			
$1+\overline{M}_r(q_{i)} > 1$	**US**		

5. Conclusions

This study differs from prior research in that we examine the time series properties of a price index derived from a zero net investment strategy of buying value stocks and short selling growth stocks, which we call the value premium price index. Subsequently, we use the results of this analysis to consider implications for the validity of competing hypotheses on the source of the value premium.

Using variance ratio tests we find evidence that the increments to the value premium price indices of Japan and the UK are uncorrelated. However, we also find that the average return to a value strategy is positive over the sample period for both countries and is significantly positive at various points in time. This result is stronger for Japan than for the UK. In the framework that has been adopted we cannot tell whether the positive return to a value strategy in Japan is due to irrational investor behaviour as described by behavioural theories or whether it results from a source of non-diversifiable risk as suggested by the rational explanations of the value premium. The results for the UK suggest that the UK value premium may fit into either of the fundamental, behavioural or random categories. Further analysis may shed more light on this issue.

On the other hand, we find strong evidence of persistence in the value premium price index for the US, implying that the source of the value premium is due to a factor that diffuses slowly over time. Again, this could be due to irrational investor behaviour, where information about fundamentals is diffused slowly or it could be due to the fundamental risk story where persistence in real GDP is reflected in persistence in the value premium price index. We report strong evidence that the upcoming value premium is negatively related to past GDP growth over quite long periods of time, two to five years. This lends support to the view that the value premium in the US is a reward for non-diversifiable risk associated with financial distress. Value stocks are risky because they are in distress when investors least want to hold a distressed stock, that is, in a recession. Therefore, investors only hold value stocks in a recession for a higher required return (and will hold growth stocks despite a lower required return). The value premium then varies over time, rising when value stocks are very distressed after periods of low or even negative growth and low profitability and falling after periods of high growth and high profitability when value stocks are less distressed. Subsequently, persistence in real GDP is reflected in persistence in the value premium price index.

Overall, the results from this study indicate that the US value premium displays different characteristics to the UK and Japan markets, which, in turn, has far-reaching implications for financial modelling and the success, or otherwise, of investment strategies based on the existence of a value premium. The apparent differences between Japan, UK, and US suggests that we could add more to our knowledge about the source of the value premium from a global perspective by extending the analysis described in this paper to cover many other international countries. Applying tests such as those described here and incorporating more powerful panel data studies (see for example, Balvers, *et al.* 2000) could provide us with a rich source of further information and is firmly placed on our research agenda.

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Endnotes

1. It is worth noting that evidence of higher average returns on value stocks compared to average returns on growth stocks has not been constant over time and there have been time periods, such as 1992-1995 and 1998-2000 when value stocks did not outperform growth stocks for most stock markets (see, Siegel, 1989 and statistics presented in this paper).

2. A series of recent papers by Liew and Vassalou (2000), Vassalou (2003) and Cooper, Gulen and Vassalou (2001) provide some evidence that links the value premium to variables such as Gross Domestic Product that captures aggregate macroeconomic risk, however, they do not distinguish between competing hypothesis about the source of the value premium.

3. While the investor would eventually learn the true random walk model for fundamentals, this would be a very slow process with agents finding it difficult to dispose of pervasive biases such as conservatism and representative-ness (Barberis *et al.,* 1998, p. 320).

4. In 1999 these markets accounted for 12.62% (Japan), 8.14% (UK) and 46.17% (US) of total world stock market capitalisation and, in terms of percentage of national GDP, the market capitalisations were 98.2% (Japan), 203.4% (UK) and 181% (US). The turnover ratio (value of shares traded as a percentage of capitalisation) was 52.5% (Japan), 51.9% (UK) and 125% (US) compared to 87.6% for the world as a whole (2001 World Bank Development Indicators).

5. This is not to say however, that equations (6) and (7) are the only formulation consistent with the value premium being positive.

6. We are grateful to the editor for emphasising this point.

7. We use quarterly returns since GDP is observed at quarterly frequency.

8. It is difficult to see how the fundamental view could hold if there were evidence of mean reversion, since this would imply an expected future negative value for the value premium.

9. The data is available from the site http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

10. The change in the log of the value premium price index is a close approximation to the value premium derived directly from the returns data. Correlations between the two variables, our derived value premium from the value premium price index and the value premium constructed from the returns data are in the region of 0.99.

11. We report the results in local currency since the regressions in Table 4 require measures of local GDP. This also means that we can compare the value strategy in terms of the home investor and there is no external influence from exchange rates. However, we compare the results with dollar currency for each country and there is no significant difference in the results, these are available upon request from the authors.

12. The descriptive properties of the value premium for other international countries are not examined here but can be seen in Black, (2002).

13. The finding of a unit root in the value premium price series suggests that over monthly horizons it exhibits random behaviour and that the two price series underlying the value premium series are not cointegrated.

14. The variance ratio tests discussed below were conducted with returns valued in US dollars. For completeness however, we also conducted the variance ratio tests in local currencies, the results of which were qualitatively similar to those reported in Table 3.

15. These findings of course could be particular to the sample period analysed where we are picking up the effects of high persistent levels of overvaluation in the U.S. stock market during the 1997-2000 time period resulting from the e-commerce bubble (see Black *et al.* 2002).

16. An interesting observation is that when μ is positive and there is evidence of persistence then this suggests that both a contrarian (value) strategy and momentum can be exploited together, in other words, increasing the investment in the value strategy when it has recently done well and decreasing the investment when it has recently done poorly.

17. We also estimated the same regression for Japan and the UK even though these markets did not exhibit persistence. There were no significant results and these estimates are not reported here but they are available upon request from the authors.

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