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Fundamental determinants of the Australian price–earnings multiple

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Abstract

This paper is the first attempt to investigate the factors fundamental to the setting of the price–earnings (P–E) multiple for the Australian stock market. The quarterly P–E ratio for the ASX 200 index is used as a measure of the market wide P–E multiple. It is demonstrated that a large portion of the variation in the P–E multiple can be explained by the dividend payout ratio, interest rates and GDP growth rates. In addition, consumers' confidence—a leading indicator of future growth opportunities, the Australian–US exchange rate—a key determinant of the competitiveness of domestic companies, and volatility of domestic market returns—a risk factor, have incremental explanatory power. The results are compatible with market rationality and they suggest that unlike the US, the actual time path of the Australian P–E multiple is primarily driven by the indicated fundamentals.

JEL classification: C51; E44; G12
Keywords: Price–earnings ratio; Dividend discount model; ASX 200 Index; Prediction accuracy

1. Introduction

The price–earnings (P–E) multiple is a widely used measure of relative equity valuation. Individual stocks, and the collections of stocks reflected by market indices such as those provided by the Australian Stock Exchange (ASX), are typically evaluated

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by reference to their P–E multiples, in cross-section, and over time. Substantial departures from notionally 'normal' values typically attract attention as indicators of potential mispricing. Evidence for the latter is taken as implying a warning or opportunity according to investors' portfolio positions and strategies. What is normal is typically judged with reference to the P–E's historical average, or, perhaps, with respect to underlying fundamental factors. The focus here is to develop a fundamental model to explain the time series behaviour of the P–E multiple of the ASX 200 index.[1]

An aggregate P–E model might be expected to be of interest to investment practitioners, especially given that an increasingly common equities strategy is to adopt a position reflected by a broad market index rather than an attempt to manage performance via evaluation of individual stocks. The findings should cast light on P–Es as bases for portfolio design, in particular for broad asset allocation decisions in the Australian context. Furthermore, there appears to be a dearth of work on the local equity markets with the sort of emphasis adopted in this paper.

For fund managers and other investors following an index-based strategy, the essential decision is asset allocation, which has two dimensions. The first decision is allocation of investment funds across countries. The second decision is the allocation of funds across asset classes—equities, cash, money market securities, bonds, real estate, etc. Managers taking the view that equities are rationally priced would follow a passive approach, eschewing any attempts at market timing or market rotation. Alternatively, if misalignment of P–E with fundamentals is regarded as possible, a P–E model might provide the basis for an active approach to asset allocation.

We adopt a standard equity valuation relation, the constant-growth dividend discount model (DDM), as the base for our P–E modelling. The advantage of the DDM is that it allows identification of the fundamental determinants of P–E and provides their expected signs in the empirical model. The DDM, when transformed into a P–E determination model, takes the form:

$$\frac{P_t}{E_t} = \frac{(D_t/E_t)(1+g)}{k-g} \quad (1)$$

where P, E, D, g and k represent the stock price, periodic earnings per share, declared dividend, discount rate, and growth rate of earnings per share respectively, and the subscripting reflects the time period.

However, casting the earnings-scaled DDM as a behavioural model suitable for statistical estimation raises some problems. In particular, reinterpretation of the growth rate in terms of some form of expected value is required. Additionally, the relevant market risk-related premium needs to be measured and incorporated into the discount rate or otherwise represented in the model. The problems of adequately measuring expected

[1] This index is formally known as the S&P/ASX 200 index. It is a value-weighted price index, covering the top 200 shares listed on the ASX and representing approximately 89 percent of the Australian stock market capitalisation as of 31st August 2000. See the ASX web site: http://www.asx.com.au.

growth and of properly reflecting the risk premium in the model lead us to extend its form beyond that immediately derived from the DDM.[2]

2. Literature review

Our model presumes that relative equity prices reflect rational processing of information contained in fundamental variables. However, equity market rationality is a controversial issue. Therefore, before turning to the specific literature on the determinants of the P–E ratio, it might be useful to highlight the wider literature on equity market pricing and how the present study relates to it. In particular, three strands of the equity market literature are relevant, which are not necessarily mutually exclusive.

The first strand of literature is concerned with the proposition that stock prices fluctuate excessively in relation to news about fundamentals such as dividends (Shiller, 1981). Shiller attributes this finding to market irrationality. A recent paper by Zhong et al. (2003) finds a significant non-fundamental component in the levels of US equity prices, complementing Shiller's finding. In contrast, Cochrane (1991) takes the view that the inadequacy of the present value model needs to be overcome by constructing better rational models of fundamentals. Shiller (2000), however, is in favour of using psychological and popular models of irrationality in explaining residuals from fundamental models.

The second strand of literature deals with the incompatibility of the high US equity premium and the prediction of the standard neoclassical asset pricing model (Mehra and Prescott, 1985).[3] Much of the US equity premium in the last half-century is attributed by Fama and French (2002) to an unexpected capital gain arising from a decline in the relevant discount rate. Further rational justification for an equity premium anomaly can be found in the positive correlation of labour income with equity returns (Constantinides, 2002).

The third strand of literature is concerned with equity price predictability, and the role of valuation ratios in this. For example, in his seminal paper on the P–E ratio, Basu (1977) reports evidence that portfolios consisting of low P–E equities experience superior returns to those of higher P–E equities but otherwise similarly constructed. Basu's work has provoked a substantial line of follow-up studies. Investigating the predictive power of dividend yield, earnings–price ratio, and some macroeconomic indicators of business cycle variations, Pesaran and Timmermann (1995) find that US stock returns are more predictable in a volatile market than in a stable market. In a similar study on the UK stock market, Pesaran and Timmermann (2000) also find evidence of stock return predictability.

In a recent work, *Irrational Exuberance*, Shiller (2000) finds that a high P–E ratio, with earnings averaged over a decade, predicts a low real rate of return on the S&P 500 index. This finding is based on the premise that the market-wide price–earnings ratio has a

[2] Chiarella and Gao (2002) refer to empirical evidence on. the poor performance of the DDM as a model of intrinsic equity values, and point to recent theoretical reasoning and market practice indicating earnings as a more important factor than dividends in explaining equity prices.

[3] Officer (1989) also reported a high equity premium of 7.94% for Australia over the period 1982–1987.

tendency to revert to its normal or historical average value. Harney and Tower (2003), however, establish predictive superiority of Tobin's q over the P–E ratio for alternative investment horizons. The anchoring of valuation ratios such as dividend yield or price–earnings ratio to long-run 'normal' levels is questioned by Balke and Wohar (2001), who suggest that swings in these ratios can be persistent. They argues that rising US stock prices in the 1990s can be rationalised in terms of fundamental factors such as lower expected future real discount rates and higher expected future dividend growth. Evidence for structural breaks in the mean dividend yield and price–earnings ratio are reported for the US by Carlson et al. (2002), casting doubt about the mean reversion of valuation ratios and the prediction of stock prices based on such properties.

In a study on the Australian equities market, Allen et al. (1998) find that future earnings changes are randomly distributed with respect to past earnings changes, implying a lack of relevance for equity price predictability. However, their classification of equities into quintiles by P–E reveals that the value of earnings changes is consistently increasing in P–E—suggesting that investors can to a degree predict earnings changes by conditioning on this valuation ratio.

Thus, apparent stock market anomalies are well documented in the literature but there has been an ongoing debate over the causes of these anomalies. In summarising this debate, Brav and Heaton (2002) suggest that these pricing anomalies may be modelled by incomplete knowledge of the fundamental structure of the economy, or by a failure to rationally process relevant information.[4] Given plausible circumstances, the implications of the models are similar (for instance, excess volatility of equity prices), in which case the models may not be distinguishable empirically.

Our primary concern in this paper is to investigate if relative equity prices are aligned with fundamentals—that is, to discover the presence of any anomalies rather than identify whether anomalies arise from incomplete knowledge or irrational behaviour. This line of inquiry includes an examination of the determinants of P–E ratios. Cross-section modelling of firms' P–Es includes Beaver and Morse (1978), Zarowin (1990), Cho (1994) and Fairfield (1994). In these studies, earnings growth, volatility of earnings, and dividend payout ratios are identified as important factors in explaining variations in P–E across firms.

In time series modelling of aggregate P–Es, researchers have attempted to investigate the factors driving fluctuations in P–E. Reilly et al. (1983) report inflation, previous-period earnings growth, and dividend payout ratios as influential factors. Kane et al. (1996) focus on the role of market volatility in determining the US aggregate P–E over February 1954 through December 1993. Their supposition that the discount rate for equities would be increasing in aggregate volatility of returns implies that P–E decreases

[4] The first feature, incomplete knowledge of fundamental economic structure, characterises a *rational structural uncertainty* model. The second feature, irrational processing of relevant information, characterises a *behavioural* or *investor irrationality* model. For example, Shiller (1981, 2000) attributes equity market anomalies to investor irrationality. This school of thought has been gaining popularity due to the apparent inability of fundamental models to explain stock market crashes such as the 1987 correction and stock market bubbles in the US, Japan and Taiwan (Ritter, 2003). Cochrane (1997) and Constantinides (2002), on the other hand, are reluctant to retreat to behavioural explanations of anomalies.

in market volatility. The results support this hypothesis. Their model also includes a set of control variables such as lagged P–E, the default premium on corporate bonds, an inflation rate and industrial production. The one-period-lagged P–E is found to be statistically significant with a coefficient close to unity, suggesting that the US monthly P–E ratio might follow a non-stationary time path. Of practical interest is the conclusion that the then-current aggregate P–E was not misaligned with the historically estimated relation when the influence of the market volatility factor is included.

In contrast, White (2000) argues that the P–E ratios of 30–35 observed in the US in late 1998 and early 1999 are substantially higher than that predicted by a fundamental model. Using US quarterly market data over 1926–1997, White presents a P–E model with dividend payout ratio, dividend yield, total return, market volatility, inflation, long-term bond yield, earnings growth and GDP growth reported as significant factors. P–E multiples of 18–23 could be justified by White's model in the late 1990s.

The above-discussed aggregate P–E determination studies identify influential factors that are broadly in line with a DDM-based approach. No studies modelling P–E determination for the Australian market, time series or cross-section, were located.

3. The P–E model

We use the dividend discount model (DDM) as the theoretical basis of our P–E model. The log-linear form of the model can be expressed as:[5]

$$\ln\left(\frac{P_t}{E_t}\right) = \alpha_0 + \alpha_1 \ln(d_t) + \alpha_2 \ln(k_t - g_t) + u_t \tag{2}$$

where P/E is price–earnings ratio of the ASX 200 index, d is dividend–payout ratio (D_t/E_t), k is required rate of return—the appropriate discount rate for the composite of ASX 200 shares, g is growth rate of earnings per share, u is an error term, capturing random deviation of the actual $\ln(P_t/E_t)$ from its model value.

Although the DDM suggests that the P–E multiple is non-linearly related to d, k and g, previous studies used a linear regression model (see Beaver and Morse, 1978; Cho, 1994; White, 2000; Park, 2000). Unlike previous studies, this paper employs a log-linear specification, compatible with the DDM. The model predicts that the P–E ratio increases as the dividend payout ratio and the growth rate increase, but decreases with an increase in the required rate of return. However, if the dividend discount model strictly holds, the hypothesised values of the parameters would be $\alpha_0 = 0$, $\alpha_1 = 1$ and $\alpha_2 = -1$. In the next section, we demonstrate that these restrictions do not hold jointly. This finding led us to identify possible reasons for results incompatible with these parametric restrictions and to explore alternative specifications of the P–E model.

[5] Imposing the restrictions $\alpha_0 = 0$, $\alpha_1 = 1$, $\alpha_2 = -1$, and recognising that the expected value of u_t is zero, and then taking anti-logs of both sides of Eq. (2), we obtain $P_t/E_t = d_t/(k_t - g_t)$, which is the familiar dividend discount model of relative valuation. Note that in the empirical implementation of Eq. (1), we have ignored the term $(1+g)$ due to high correlation between $\ln(1+g)$ and $\ln(k-g)$.

First, the dividend discount model is based on ex ante measures of the dividend payout ratio, the growth rate and the required rate of return. In our *base* model (Eq. 2), we use ex post measures of these valuation inputs. Second, the ex post valuation inputs used in our model are probably inadequate for representation of the underlying fundamental factors. More specifically, we use the growth rate of GDP as a proxy for earnings growth and the yield on a risk-free debt instrument as a proxy for the required rate of return. Since the current growth rate of GDP may not be a good indicator of future growth opportunities for companies, we include the proportional change in an index of consumers' confidence as an additional explanatory variable in our *extended* model. This index can be viewed as a leading indicator of domestic demand for goods and services in the economy.

Additionally, foreign exchange rate changes have impacts relevant to the P–E multiple. However, the net impact of exchange rate movements on the P–E ratio of a company is a priori indeterminate. One impact type is directly asset-market-related. For example, a depreciation of the Australian dollar may raise foreign demand for Australian equities and increase stock prices. Another impact type is directly earnings-related, working via influence on the competitiveness of domestic vis-à-vis foreign companies through differential impacts on revenue and cost structures. For example, a depreciation of domestic currency may increase earnings of companies that are net exporters of Australian goods and services. The net impact of exchange-rate-changes on the P–E multiple depends on these two opposing effects. To reflect exchange rate influences, we augment the P–E model by including the proportional change in the AUD/USD rate.

Furthermore, the required rate of return variable will ideally correspond to the rate of return required for the collection of stocks in the ASX 200 index. This condition represents an analogue to the notion that the systematic risk level of a company (reflected in a company-specific required rate of return) is a basic determinant of its P–E ratio (Litzenberger and Rao, 1971). Consistent with previous time series studies, use of a risk-free rate as a proxy for the required rate of return implies no variation in the ASX 200 risk premium over time. To avoid the last, questionable assumption, an attempt was made to calculate the required rate of return for the composite of ASX 200 stocks based on the Capital Asset Pricing Model (CAPM).[6]

Two alternative measures of the market portfolio were used: (1) the All Ordinaries Index and (2) a broad market portfolio consisting 5 percent in corporate bonds, 10% in Commonwealth government securities and 85% in the All Ordinaries Index. A returns regression of the ASX 200 index on both measures of the market portfolio yielded a *beta* close to unity. This estimate indicated that the observed return on the market portfolio is a good approximation of the required rate of return, k. However, observed quarterly returns were negative for some quarters in our sample, making the term $k-g$ a negative, unusable variable for our P–E model. Even a four-quarter moving average of returns was considered to avoid negative $(k-g)$, at the cost of introducing potential serial correlation in the error term of the regression model. The moving average of $(k-g)$ was also negative for some quarters.

[6] The CAPM suggests that the required rate of return on the ASX 200 index is: $k_{200} = \mathrm{RF} + \beta(R_m - \mathrm{RF}) + \eta$ where RF is the risk-free rate, β is the level systematic risk for the ASX 200 index, R_m is the return on the market portfolio and η is the random component of return, attributed to unsystematic risk.

Thus, we had to discard this approach of measuring the required rate of return and use a Commonwealth Treasury bond yield as a measure of k.

A final additional variable, the standard deviation of returns on the ASX 200 index, is included in the extended model as an indicator of risk. This variable serves to represent time variation in the risk premium, not otherwise captured due to the use of a risk-free rate for k.

The extended P–E model can now be expressed as:

$$\ln\left(\frac{P_t}{E_t}\right) = \alpha_0 + \alpha_1 \ln(d_t) + \alpha_2 \ln(k_t - g_t) + \alpha_3 \ln\left(\frac{e_t}{e_{t-1}}\right) + \alpha_4 \ln\left(\frac{c_{t-1}}{c_{t-2}}\right) + \alpha_5(\sigma_{R_t}) + u_t \quad (3)$$

where e is value of one Australian dollar expressed in terms of US dollars; c is Westpac-Melbourne Institute consumer sentiment index; σ_R is Standard deviation of ASX 200 monthly returns for the previous 12 months. The hypothesised signs of the parameters are: $\alpha_1 > 0$, $\alpha_2 < 0$, the sign of α_3 indeterminate, $\alpha_4 > 0$ and $\alpha_5 < 0$.

4. Empirical results

This study uses quarterly time series data for the period 1983-1 through 2001-3. Data were collected from the "Statistical Tables" compiled by the Reserve Bank of Australia.[7] An investigation of the ordinary least squares results suggests that the error term u_t in the P–E model follows a stationary AR(1) process. That is:

$$u_t = \rho u_{t-1} + \varepsilon_t,\ \ \varepsilon_t \sim N(0, \sigma^2), \qquad t = 1, 2, \ldots, n \text{ and } 0 < |\rho| < 1. \quad (4)$$

Thus, the base P–E model (Eq. (2)) and the extended version (Eq. (3)) are re-estimated using the exact maximum-likelihood procedure under the restriction that the error term follows an AR(1) process, as described in Eq. (4).[8]

The results for P–E models are presented in Table 1 for the useable sample, spanning 1984-1 through 2001-3. The base model explains 91% of the variation in the natural log of the P–E ratio, as indicated by the adjusted R^2. The F-statistic is highly significant and the D–W statistic indicates absence of any serial correlation problem

[7] See http://www.rba.gov.au/statistics/ for further details. The dividend payout ratio was not directly available from the RBA. This variable was obtained by multiplying the P–E ratio by dividend yield.

[8] The maximum likelihood estimators are computed by maximising the following log-likelihood function: $LL = -\frac{n}{2}\ln(2\pi\sigma_\varepsilon^2) + \frac{1}{2}\ln(1-\rho^2) - \frac{1}{2\sigma_\varepsilon^2}\left[\sum_{t=2}^{n}(u_t - \rho u_{t-1})^2 + (1-\rho^2)u_1^2\right]$ A concise discussion of the exact maximum-likelihood procedure can be found in Pesaran and Pesaran (1997, pp. 366–371). A vector autoregressive model would be useful for testing Granger causality and understanding the dynamics of the system, however this is beyond the scope of the current study.

Table 1
Exact maximum likelihood estimates of P–E models, 1984-1 to 2001-3

	Base model		Extended model	
	Coefficient	p-value	Coefficient	p-value
Explanatory variables[a]				
Constant	−0.8433	0.15	−0.4671	0.37
$\ln(d_t)$	0.9272	0.00	0.8699	0.00
$\ln(k_t-g_t)$	−0.1144	0.13	−0.1241	0.07
$\ln(e_t/e_{t-1})$			0.4457	0.02
$\ln(c_{t-1}/c_{t-2})$			0.1694	0.10
σ_{Rt}			−0.0238	0.00
Diagnostic tests[b]				
u_{t-1}	0.7618	0.00	0.8137	0.00
LR-statistic	44.48	0.00	58.70	0.00
Adjusted R^2	0.91		0.93	
D–W statistic	2.24		2.15	
F-Statistic	F (3, 67) = 223		F (6, 64) = 156	
Log-likelihood	51.76		64.26	

Dependent variable: $\ln(P_t/E_t)$.

[a] $\ln(d_t)$is the natural log of the dividend payout ratio for the ASX 200 index; $\ln(k_t-g_t)$ is the natural log of the difference between the 10 year Commonwealth Treasury bond yield and the growth rate of GDP; $\ln(e_t/e_{t-1})$ is the relative change in the value of the Australian dollar, expressed in terms of the US dollar; $\ln(c_{t-1}/c_{t-2})$ is the relative change in consumers' confidence index in quarter $t-1$; σ_{Rt} is the standard deviation of ASX 200 monthly returns for the previous 12 months.

[b] The adjusted R^2 and the D–W statistic are computed using the residuals, corrected for serial correlation (see Pesaran and Slater, 1980, pp. 49–136). The coefficient of μ_{t-1} represents the estimated value of ρ, the first-order autoregressive coefficient. The LR-statistic for the test of AR(1) against non-autocorrelated errors is computed as: $LR = 2(LL_{AR1} - LL_{OLS})$, where LL_{AR1} and LL_{OLS} represent maximised values of the log-likelihood functions under autocorrelated and non-autocorrelated errors hypotheses, respectively. The LR-statistic follows a χ^2 distribution with 1 degree of freedom.

after allowing the error term to follow an AR(1) process. The coefficient of the lagged error term, u_{t-1}, is positive but less than 1, implying that u_t follows a stationary AR(1) process. A likelihood ratio test for the null hypothesis of non-autocorrelated errors provides justification for the inclusion of an AR (1) error process in the model. As shown in Table 1, the LR-statistic for the base model is 44.48 and its p-value is approximately zero.

In general, the results for the base model are qualitatively compatible with the theoretical predictions. More specifically, the P–E ratio increases by approximately 0.93% for a 1% increase in the dividend payout ratio. As the market interest rate increases by 1%, the P–E ratio falls by 0.11%. The growth rate of GDP has an opposite impact on the P–E ratio. As noted earlier, if the dividend discount model strictly holds, the coefficients of the base model would be: $\alpha_0 = 0$, $\alpha_1 = 1$ and $\alpha_2 = -1$. The Wald statistic for this joint null hypothesis is 269.96. This statistic has χ^2 distribution with 3 degrees of freedom and a p-value of zero. Thus, the restrictions can be rejected. This finding may be due to the substitution of ex post valuation inputs for ex ante valuation inputs and/or the use of imperfect indicators for the required rate of return and growth opportunities. To address these issues, we extend the base model by including three explanatory variables. The three variables are the relative change in the value of Australian dollar in terms of the US dollar, the one quarter lagged relative change in a consumers' confidence index, and the standard deviation of returns on the ASX 200 index.

The results for the extended model are presented in the last two columns of Table 1. The coefficients of $\ln(d_t)$ and $\ln(k_t - g_t)$ are approximately 0.87 and -0.12, respectively. Thus, the impacts of the dividend payout ratio, interest rate and the growth rate of GDP are not highly sensitive to the addition of new explanatory variables to the model. An appreciation of the Australian dollar against the US dollar increases the P–E ratio. An increase in consumers' confidence in the last quarter increases the current P–E ratio. Thus, the consumers' confidence index can be viewed as a leading indicator of relative share prices. Finally, an increase in the volatility of past returns reduces the P–E ratio, or, put differently, as the level of risk increases, share prices per dollar of earnings fall. The adjusted R^2 for the extended model is 0.93, indicating a slightly better explanatory power compared to the base model. Other statistical criteria, such as the F-statistic and the log-likelihood statistic, also confirm the adequacy of the extended model in explaining the P–E ratio. A joint null hypothesis of $\alpha_3 = \alpha_4 = \alpha_5 = 0$ is rejected by the

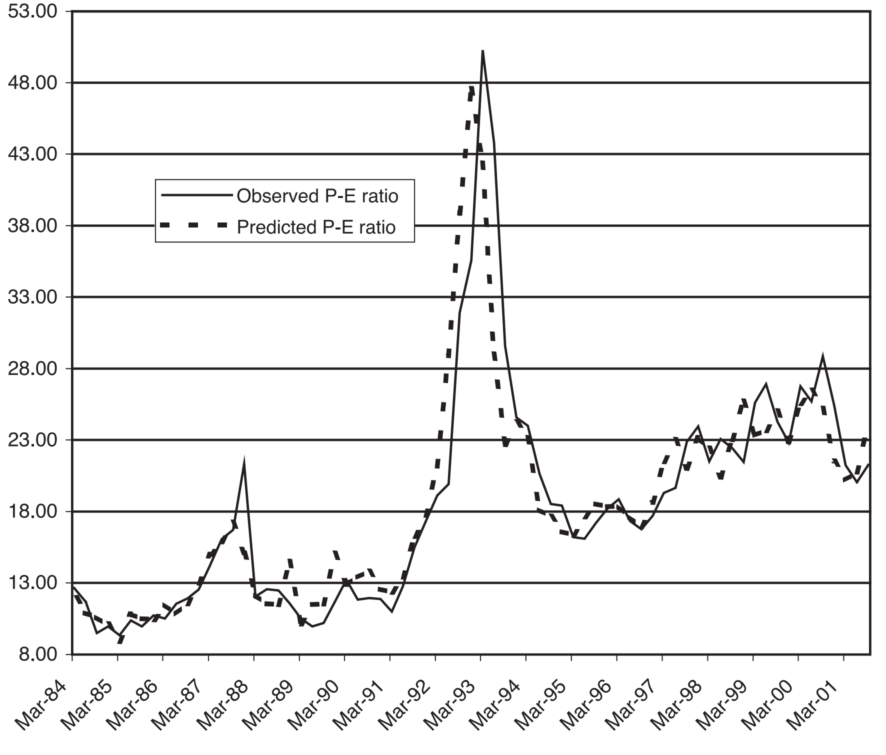

Fig. 1. Observed and predicted price–earning ratio for the ASX 200 index, 1984-1 to 2001-3.

Table 2
Prediction errors for the quarterly P–E model, 1984-1 to 2001-3[a] (Mean P–E is 18.62)

Mean absolute error (MAE)	2.001
Mean absolute percent error (MAPE)	0.095
Root mean squared error (RMSE)	3.371
Root mean squared percent error (RMSPE)	0.131
Theil's inequality coefficient (U)	0.084

[a] Prediction errors are calculated from observed (y_t^a) and predicted (y_t^s) P–E ratios. Predicted P–E ratios are obtained from the extended model. Measures of prediction errors are defined as:

$$\mathrm{MAE} = \frac{1}{T}\sum_{t=1}^{T} |y_t^s - y_t^a|, \quad \mathrm{MAPE} = \frac{1}{T}\sum_{t=1}^{T}\left|\frac{y_t^s - y_t^a}{y_t^a}\right|, \quad \mathrm{RMSE} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t^s - y_t^a)^2},$$

$$\mathrm{RMSPE} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\frac{y_t^s - y_t^a}{y_t^a}\right)^2} \quad \text{and} \quad U = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t^s - y_t^a)^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t^s)^2} + \sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t^a)^2}}, \quad \text{where} \quad 0 \leq U \leq 1.$$

Wald test at the one percent level of significance, providing a statistical justification for extending the base model.

5. Implications

The P–E ratio for ASX 200 stocks fluctuates between 8 and 50 over the period 1984-1 through 2001-3. The average P–E ratio during this period was 18.62. Security analysts often compare the P–E multiple at a particular moment with its historical average in an attempt to determine whether the stock market is undervalued or overvalued. Our empirical results suggest that a substantial deviation of the P–E ratio from its historical average can be justified by deviations of the underlying fundamentals from their historical averages. Fig. 1 shows that the observed P–E ratio moves closely with the P–E ratio predicted by fundamental variables. The predicted series is derived from the extended P–E model. The model performs well in predicting the turning points, and can be used to identify any misalignment of the ASX 200 P–E multiple with its fundamental determinants.

Table 2 presents some widely used statistics to evaluate the prediction accuracy of our model. Each of these statistics is a particular measure of the deviation of the predicted variable from its actual path. The mean absolute error and root mean squared error for the P–E ratio are 2 and 3.37, respectively. The Theil Inequality Coefficient is also very low (0.08), reflecting adequate predictive ability for our model.

6. Conclusion and limitations

This study contributes to the literature on the fundamental determinants of the P–E ratio, the most commonly used relative valuation tool. While a significant number of studies attempt to model the P–E ratio for the US stock market (see White, 2000; Park, 2000; Kane et al., 1996; Cho, 1994; Beaver and Morse, 1978), no such academic research has been identified for the Australian stock market. Our study fills the gap in the literature by modelling the P–E ratio for the ASX 200 index. This index comprised 89% of the Australian stock market capitalisation and is an important vehicle of equity investment for institutional investors and retail investors in index funds. Based on the theoretical insights of the dividend discount model, a P–E model is specified. The model explains the end-of-quarter P–E ratio in terms of the dividend payout ratio, interest rates, indicators of growth opportunities and market-wide risk. Analysing quarterly time series data for the period 1984-1 through 2001-3, we conclude that the time path of the Australian P–E multiple over the last 18 years can be adequately simulated by its underlying fundamentals. The results suggest that the P–E multiple increases with a rise in the dividend payout ratio, a higher growth rate of GDP, appreciation of the Australian dollar, or an improvement in consumers' confidence. An increase in interest rates or a rise in market volatility reduce the P–E multiple.

These empirical findings suggest the Australian P–E ratio is primarily driven by the identified fundamentals—a finding not inconsistent with the notion of market rationality. However, caution should be used in interpreting the results. First, the findings of this paper may not hold under alternative data frequencies. In particular, high-frequency data may exhibit a significant non-fundamental component in the P–E multiple. Second, the sensitivity of our results to variation in model specifications needs to be examined. An alternative specification would be the multivariate co-integrating framework proposed by Zhong et al. (2003), which might be used to decompose the P–E multiple into fundamental and non-fundamental components. Third, this paper uses ex post rather than ex ante measures of the discount rate, growth opportunities, risk factors, and the payout ratio. Cho (1994) observes that ex post measures of risk and growth do not adequately explain cross-sectional differences in earnings–price ratios in the US stock market. Future studies are warranted using ex ante measures of explanatory variables to evaluate the robustness of the findings presented in this paper.

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