Share Prices: A Comparison of Fundamental Models

Daniel Daugaard
Tom Valentine

ISSN: 1036-7373
SHARE PRICES:
A COMPARISON OF FUNDAMENTAL MODELS

D. Daugaard and T.J. Valentine
SHARE PRICES: A COMPARISON OF FUNDAMENTAL MODELS
D. Daugaard and T.J. Valentine

INDEX

1  Introduction .................................................. 1
2  Generic Returns Model ...................................... 3
3  The Profit Function Model .................................. 9
4  The International Arbitrage Model ................. 13
5  Conclusion ..................................................... 18

References .................................................. 19
Appendix A: Definitions of Variables ............... 21
Appendix B: Profit Function for a Cobb-Douglas Production Function 23
SHARE PRICES:  A COMPARISON OF FUNDAMENTAL MODELS
D. Daugaard and T.J. Valentine

1. Introduction

Most empirical analyses of share prices over the last two decades have examined their predictability and the efficiency of share markets. Ball, et. al. (1989) provide a representative collection of studies of this type. The present analysis takes a different tack. It looks at some alternative fundamental explanations of movements in aggregate share prices. Indeed, the ability of these formulations to explain aggregate share prices is compared. The only disaggregation done is to apply the theories in question to the major components of the All Ordinaries index - the All Resources and All Industrials indices. The models have not been applied to the Finance Index because it was believed that more specific models were necessary to explain movements in share prices for this sector.

The study throws some light on the fundamental determinants of Australian share prices. Special attention is paid to overseas influences on them. Deregulation of the foreign exchange market, particularly the removal of exchange controls, has led to a very high degree of integration between the Australian financial sector and global capital markets. As a result, it has become well accepted that Australian share prices are subject to significant influences from overseas markets (see Figure 1). This view is now well entrenched in media comment on the share market which closely monitors developments in overseas markets, particularly the US market. One of the aims of the present study is to identify the mechanisms producing this relationship.

Thomas James Valentine & Daniel Daugaard 1992

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means including photocopying, electronic, mechanical or otherwise, without the prior written permission of the author or other copyright owner.

The authors are grateful for comments at a seminar held at the University of New South Wales and from Johannes Jüttner.
There are a number of reasons for being interested in the way in which share prices are affected by fundamentals. First, it indicates the way in which government policies influence share prices. It shows, for example, how monetary policy, based as it is in the deregulated environment on variations in interest rates, feeds through into share prices. It also indicates the impact of exchange rate and wages policies.

Secondly, and related to the first point, share prices can be regarded as the value of existing capital. A comparison of this value with the price of new capital (in the tradition of Tobin's "q") is likely to be an important determinant of investment expenditure. An understanding of how share prices react to fundamentals therefore constitutes an element in understanding the transmission mechanism of monetary policy.

Thirdly, a study of how fundamentals affect share prices may serve as a useful offset to the view of share markets as casinos which have no true economic role. If share prices reflect fundamental influences, we can conclude that they are performing the normal role of prices in a market system. That is, they are causing funds to be
directed into the most productive areas of investment and producing an outcome which is allocationally efficient. This is the view of market efficiency which is likely to be of more interest to an economist or policymaker than to a trader.

The paper is not an attempt to answer the question of whether or not the share market is informationally efficient. Even if it can be shown that share prices are well explained by various sets of fundamental variables, this does not mean that future movements in them are predictable. Market participants may or may not recognise the impact of fundamentals and they may or may not use all the information available in forecasting those variables (and, therefore, share prices).

The models considered are:

- the generic returns model;
- the profit function model; and
- the international arbitrage model.

The first two models allow for a detailed specification of domestic fundamentals determining share prices although international influences are included. The third model involves a more systematic formulation of international influences. The variables are defined as they arise, but the data are described in greater detail in Appendix A.

2. **The Generic Returns Model**

The best known model of share prices relates them to the stream of future profits expected to be earned by the issuing companies. One version of this model is based on the assumption that investors expect a profit of $\pi$ indefinitely. Then the share price ($S$) is given by
\[ S = \frac{\pi}{r} \]

where \( r \) is the appropriate discount rate.

Rewriting the equation in terms of logarithms gives

\[ \log S = \log \pi - \log r \quad (1) \]

Equation (1) can be modelled by assuming that expected profits \( \pi \) are determined by

- the current level of profits;
- lagged changes in the level of profits;
- variables representing current economic conditions or business sentiment; and
- variables reflecting developments in overseas markets.

It is not possible to obtain a fully satisfactory measure of the profits to which share investors react. In the present study, the gross operating surplus of companies (GC) has been used. The dependent variable in the equation reported below is the All Ordinaries Index and GC would include profits from many companies which are not listed on the stock exchange. This variable has other limitations as a representation of profits. First, it includes no allowance for the depreciation of capital equipment. Secondly, it is based on taxation statistics and since these become available with a lag of about two years, recent values are based on extrapolations from other indicators. Thirdly, no deduction is made for the interest paid by companies.

The ten year government bond rate (R10) is included as a proxy for the discount rate used by investors. While this variable does not include the risk premium appropriate for corporate investments, it does reflect inflationary expectations and we have a consistent measure for it over the sample period (in contrast to rates obtained from the relatively illiquid Australian corporate bond market).
The following equation was estimated by ordinary least squares from quarterly data. The calculations were performed on the Microfit package (see Pesaran and Pesaran (1987)). $R^2$ is the adjusted coefficient of determination and the figures under the coefficients are t-values. One asterisk indicates that the coefficient is significantly different from zero at the five percent level and two asterisks that it is significantly different from zero at the one percent level. Unless otherwise indicated, the sample period is 1980(2) to 1991(3).

$$
\log S = -2.74 + 0.206 \log S_{-1} + 0.466 \log GC - 0.497 \log RIO
$$

$$
(2.48^*) \quad (3.18^{**}) \quad (3.79^{**}) \quad (4.21^{**})
$$

$$
+ 0.0048 IT + 0.778 \log DJ - 0.0134 TME + 0.417 D_1
$$

$$
(4.94^{**}) \quad (7.00^{**}) \quad (2.65^{**}) \quad (4.18^{**})
$$

$$
+ 0.088 S_1 + 0.059 S_2 + 0.104 S_3 \quad \overline{R^2} = 0.985
$$

$$
(2.44^*) \quad (1.97) \quad (3.96^{**}) \quad d = 2.01
$$

where

- **IT** = CAI-Westpac survey of industrial trends
- **DJ** = Dow Jones index
- **TME** = time trend
- **$S_j$** = seasonal dummy variable which is equal to unity in the $j$th quarter of the calendar year and zero otherwise.
- **$D_1$** = dummy variable to take account of the stock market boom and crash in 1987.
- **d** = Durbin-Watson statistic

---

2 The Durbin-Watson statistic (d) is reported although it is a biased test statistic when the equation includes a lagged dependent variable. In fact autocorrelation coefficients for lags one and four were estimated (using the Cochrane-Orcutt procedure) as a test for the presence of autocorrelation.
This equation is quite satisfactory, with all the variables significant and having the correct sign, a high $\bar{R}^2$ and no indication of autocorrelation in the residuals.

A number of variables in the equation represent profit expectations. They include the CAI-Westpac survey of industrial trends and the Dow Jones index. In regard to the former, Fama (1990) and Schwert (1990) test the relationship of real returns on shares and future growth rates of production, the latter representing expected future returns. In the present study the impact of real output expectations has been measured by the inclusion of a single variable. A number of candidates was examined and the survey of industrial trends (IT), which is regarded as a leading indicator of economic activity, was the most successful. CAI and Westpac survey a large number of manufacturers on whether they expect their selling prices to rise or fall in the next quarter. The reported figure is the percentage by which the number of respondents expecting an increase in sales prices exceeds the number of respondents expecting a fall in sales prices. For instance, in September 1991, the respondents expecting a fall in the next quarter's sales prices exceeded the number of respondents expecting a rise by 10 percent. The reported figure was therefore -10. This variable measures investors' expectations that earnings will grow and therefore has a positive sign in the equation.

In regard to the Dow Jones index, King and Wadhwani (1990) argue that "contagion" amongst share markets occurs because investors treat movements on other markets as information about future developments in their own market. Eun and Shim (1989) conclude that the US share market is "the most influential market in the world" and that "no national stock market is nearly as influential as the US in terms of its capability of accounting for the error variances of other markets". This view is in accord with casual empiricism - Australian market commentary focuses heavily on developments in the US market. This is also why the Dow Jones has been chosen although it is an industrial index. Australian financial media tend to concentrate on it as a summary of recent developments in the US market.
It might be expected that the effect of US share prices would have increased over time as the Australian economy became more integrated with the global economy. In particular, the process of integration was probably speeded up with the deregulation of the foreign exchange market. In order to test this possibility the equation (like all the equations in the study) was subjected to the Cusum of Squares test and no sign of instability was detected although it should be noted that this test is not strictly valid when there is a lagged dependent variable amongst the regressors. It appears that any shift which occurred was smooth enough to be accounted for by a linear time trend. The time trend may also correct for growth over time in the number of shares on issue.

In the context of this equation the seasonal dummy variables can also be regarded as expectational variables. Their significance could imply that investors correct for the seasonal in GC when forming their expectations.

The coefficient of the interest rate has the negative sign implied by equation (1), but the long-run coefficient (-0.626) is below unity. One explanation for this result is that the ten-year bond rate is not a perfect proxy for the discount rate actually used by investors to determine share prices.

The significance of the dummy variable for the stock market boom/crack shows that this fluctuation cannot be entirely explained by movements in the fundamental determinants of share prices (including overseas share prices - note from Figure 1 that Australian share prices went up more sharply than US share prices in 1987). It has been treated as a "speculative bubble" and its effect has been removed from the data by the inclusion of the dummy variable. This approach is evaluated at the end of the paper.

The generic returns model has also been tested on the All Industrials (SI) and All Resources (SR) components of the All Ordinaries Index. The equations are:
\[
\log SI = -0.67 + 0.354\log SI_{-1} + 0.377\log GC - 0.188\log R10 \\
(0.85) \quad (3.93^{**}) \quad (2.71^{**}) \quad (1.17)
\]
\[
+ 0.0043IT + 0.448\log DJ - 0.256\log ER + 0.456D_1 \\
(4.19^{**}) \quad (3.39^{**}) \quad (2.49^{*}) \quad (3.34^{**})
\]
\[
+ 0.090S_1 + 0.062S_2 + 0.089S_3 \\
(2.07^{*}) \quad (1.65) \quad (2.60^{**}) \\
\overline{R^2} = 0.982 \quad d = 1.56
\]

\[
\log SR = -2.50 + 0.185\log SR_{-1} + 0.199\log GC - 0.598\log R10 \\
(1.45) \quad (2.34^{*}) \quad (1.72) \quad (3.64^{**})
\]
\[
+ 0.987\log DJ + 0.713\log COMA + 0.450\log ER + 0.0030IT \\
(6.67^{**}) \quad (2.53^{*}) \quad (3.68^{**}) \quad (2.45^{*})
\]
\[
- 0.024TME + 0.499D_1 + 0.085S_2 \\
(3.94^{**}) \quad (3.45^{**}) \quad (3.30^{**}) \\
\overline{R^2} = 0.947 \quad d = 1.76
\]

where COMA is the Reserve Bank Index of Commodity Prices in Australian dollars and ER is the AUD/USD exchange rate.

Once again the equations fit the data well and all the variables have the expected signs. The Cusum of Squares test reveals no sign of instability in either equation. In the case of the All Industrials index, the interest rate is insignificant and in the case of the All Resources index, the absolute value of the long-run coefficient of the interest rate is below unity.

In the case of the All Industrials it is to be expected that an increase in the exchange rate would have a positive impact on expected profits because it would reduce the prices of inputs obtained from overseas. In the case of the All Resources the effect of an increase in the exchange rate could be expected to be negative because it would reduce the value of overseas sales. The reverse signs on the exchange rate suggest that expectations are regressive i.e. that a high value of the exchange rate creates expectations of a depreciation.
GC is not significant in the All Resources equation indicating that it is not a good proxy for the profits earned by companies in this sector. The commodity price index has been included in the model because it was believed that it might be a better measure of the returns earned in the resources industry than GC. Its significance suggests that this is the case.

3. **The Profit Function Model**

It was noted in the previous section that the gross operating surplus of companies has a number of weaknesses as a measure of the returns on the shares included in the indices being studied. This weakness was particularly evident in the case of the All Resources Index. An alternative approach is to replace income with the variables which determine it in the hope that the measures of these variables are more accurate than the measures of returns.

The starting point is the profit function:

$$\pi = f(P,W,r,ER)$$

(2)

where $P$ is the price of output, $W$ is wages, $r$ is the interest rate and $ER$ the exchange rate. Other variables affecting profits can also be added to the equation. In this section, equations are estimated which replace returns with their determinants, as set out in equation (2). A more concrete illustration of equation (2), based on the Cobb-Douglas production function, and the resulting equation for estimation, is given in Appendix B.

In this formulation interest rates and exchange rates affect share prices through at least two channels. In the case of interest rates the channels are:

- a direct effect on profits; and
- its use to discount future profits.
If only the second effect exists, the elasticity of share prices with respect to interest rates would be minus unity. To the extent that the coefficient is above unity in absolute value, the difference reflects the impact of interest rates on profits. This point is illustrated for the Cobb-Douglas production function in Appendix B.

As with the generic returns model, current profits (represented by the variables in equation (2)) are supplemented by other variables determining expected future profits. Once again the most successful measure of real activity is IT. The equation also includes some variables reflecting the effect of overseas influences on expectations in Australia. These are the Dow-Jones index and the exchange rate. The latter also has two possible effects on share prices. First, it has a direct impact on profits. Secondly, it affects the attractiveness of Australian shares to overseas investors. In this case the relevant measure is the expected change in the exchange rate. This factor is taken into account in the present section, but it is examined more rigorously in the following section.

The equation is

\[
\log S = 2.90 + 0.367\log S_{\cdot 1} + 2.796\log P - 1.837\log W
\]

\[
(2.68^{**}) \quad (4.26^{**}) \quad (4.09^{**}) \quad (2.84^{**})
\]

\[
- 0.808\log R/0 + 0.0043 IT - 0.339\log ER + 0.732D_1
\]

\[
(4.62^{**}) \quad (3.16^{**}) \quad (2.48^{*}) \quad (5.62^{**})
\]

\[\bar{R}^2 = 0.968 \quad d = 1.73\]

where

\[P = \text{implicit GDP deflator}\]

\[W = \text{index of average weekly earnings}\].

The Dow-Jones index has not been included in this equation because when it is added to it, the coefficients of P and W become insignificant. Apart from this, the equation performs well. There is no evidence of instability in the Cusum of Squares test and the \(\bar{R}^2\) is high. When seasonals are added to the equation, they are
insignificant which supports the interpretation given in the previous section i.e. that they are significant because of the seasonal variation in GC.

It is shown in Appendix B that if the production function producing the profit function is of the Cobb-Douglas form, the coefficients of log P, log W and log R10 should sum to zero. This hypothesis is most easily tested by writing the equation in the form which allows the long-run coefficients to be estimated directly\(^3\). When this is done, the sum of the coefficients is 0.656 with a t-value of 2.59 i.e. the null hypothesis that the coefficients sum to zero is rejected at the five percent level. There are two possible explanations for this outcome:

- the production function does not have the Cobb-Douglas form; or
- some inputs to the production process have been omitted from the equation.

It is quite likely that both of these explanations are valid.

One alternative measure of the impact of real economy variables on expectations of future profits tested was the unemployment rate. The resulting equation was:

\[
\begin{align*}
\log S &= 4.75 + 0.421\log S_{-1} + 2.502\log P - 1.945\log W \\
&\quad (4.71^{**}) (4.52^{**}) (3.29^{**}) (2.73^{**}) \\
&\quad - 0.709\log R10 - 0.0287UR - 0.597\log ER + 0.705D_1 \\
&\quad (3.76^{**}) (1.85) (4.13^{**}) (4.98^{**}) \\
R^2 &= 0.963 \\
d &= 1.80
\end{align*}
\]

where UR is the unemployment rate. This variable has the correct sign, but it is insignificant. Also, there are some mild signs of instability in the Cusum of Squares test.

---

\(^3\) See Bewley and Fiebig (1990).
Another real economy variable tested was the Melbourne Institute-Westpac measure of consumer inflationary expectations. This variable had the correct sign but the coefficient was not significantly different from zero.

The impact of expectations about the exchange rate was tested by including the change in this variable both on a one quarter and one year basis. These variables were insignificant. A typical example follows. ERCHG4 is the four quarter change in the exchange rate.

\[
\log S = 4.75 + 0.269 \log S_{-1} + 3.234 \log P - 2.492 \log W \\
(3.98^{**}) (2.41^{*}) (4.04^{**}) (3.37^{**})
\]

\[
- 0.499 \log R10 - 0.847 \log ER - 0.027 UR \\
(2.32^{**}) (4.84^{**}) (1.75)
\]

\[
+ 0.406 \text{ERCHG4} + 0.689D_1 \\
(1.85) (5.06^{**}) \\
R^2 = 0.967 \\
d = 1.63
\]

The positive coefficient on the exchange rate once again suggests regressive exchange rate expectations. In this case the equation passes the Cusum of Squares test.

The equations for the subgroups are as follows:

**All Resources**

\[
\log SR = 4.26 + 0.378 \log SR_{-1} + 2.229 \log P \\
(2.84^{**}) (4.11^{**}) (2.77^{**})
\]

\[
- 1.925 \log W - 0.817 \log R10 + 0.639 \log COMA \\
(2.72^{**}) (3.60^{**}) (1.81)
\]

\[
+ 0.0016 IT + 0.908D_1 \\
(1.02) (5.76^{**}) \\
R^2 = 0.892 \\
d = 1.56
\]
All Industrials

\[ \log SI = 2.96 + 0.379\log SI_{-1} + 3.023\log P \]
\[ (1.82) \quad (3.93**) \quad (3.79**) \]

\[-1.517\log W - 0.527\log R10 + 0.522\log COMA \]
\[ (2.19*) \quad (3.11**) \quad (1.74) \]

\[ + 0.0058IT - 0.508\log ER + 0.638D_1 \]
\[ (3.83**) \quad (3.32**) \quad (4.57**) \]
\[ \bar{R}^2 = 0.980 \quad d = 1.73 \]

The coefficients of the commodity price index makes sense. In the case of All Resources it is positive because it is related to sales whereas for All Industrials, where it represents the price of inputs, it has a negative coefficient. Industrial trends are insignificant in the All Resources equation which is not surprising - domestic economic activity is less relevant for this sector. Perhaps more surprising is the lack of significance of the exchange rate in the first equation. The very strong effect of wages and prices on the All Industrials Index is also somewhat questionable.

4. **The International Arbitrage Model**

This approach follows that of Gordon (1984) and it adopts her first model which is based on a parity relationship similar to those often used in international finance, in particular the uncovered interest rate parity relationship. It allows a more rigorous analysis to be made of international influences on Australian share prices.

Deregulation of foreign exchange markets, involving the removal of exchange controls, has promoted a very high level of integration between international capital and funds markets. Given this integration, expected returns on assets in different countries will be equalised. In the case of Australian share prices,
\[ \text{EXPECTED CAPITAL} + \text{EXPECTED DIVIDEND} = \text{SHARES (CGAS)} \]
\[ \text{GAIN ON AUSTRALIAN} + \text{YIELD ON AUSTRALIAN} = \text{SHARES (DYAS)} \]

\[ \text{EXPECTED CAPITAL} + \text{EXPECTED DIVIDEND} + \text{EXPECTED DEPRECIATION} = \text{SHARES (CGUS)} + \text{SHARES (DYUS)} + \text{USD (DER)} \]

or in symbols:

\[ \text{CGAS} + \text{DYAS} = \text{CGUS} + \text{DYUS} + \text{DER} \]

One factor which might prevent this relationship from being established is the presence of a risk premium arising from different levels of uncertainty concerning Australian and US variables. Additional causes of deviations from "uncovered share price parity" are:

- lags in the adjustment of portfolios; and
- transactions costs.

Equation (3) in itself says nothing about how the relationship is reestablished when one of the variables changes. Assume, for example, that the expected dividend yield on US shares increases. The expected return on Australian shares must also adjust up to maintain (3) and this could happen in a number of ways. For example, an outflow of funds from the Australian share market could cause a depreciation of the AUD, creating expectations of a later appreciation. Alternatively, Australian share prices could adjust to create an expectation of larger capital gains. Under the static expectations model adopted below, Australian share prices would need to increase to produce this outcome. It is likely that most of the adjustment will occur via Australian share prices.

It will have been noted that all the variables in equation (3) are not directly observable - they are expectations. It is therefore necessary to model these expectations. The approach adopted here is to assume that expectations are static in
the sense that future changes in the variable in question are expected to be equal to a fraction of the most recent change. For example, it is assumed that CGAS is given by

\[ CGAS = \theta \text{CHGS} \] (3)

where \( \theta \) is an expectations parameter and CHGS is the most recent change in Australian share prices. The value of the \( \theta \) parameter will vary from variable to variable. In the case of share prices, which change by large percentages, the relevant fraction is likely to be well below unity. The equation reported below therefore represents a test of the joint hypothesis that equation (3) holds and that expectations are generated by the particular expectations generating mechanism adopted.

Equation (3) can be rewritten as

\[ CGAS = CGUS - DYAS + DYUS + DER \]

The following equation is an empirical version of this rewritten equation.

\[ CHGS4 = 0.056 + 0.730CHGDJ4 - 11.084ADY \]
\[ (0.41) \quad (7.12**) \quad (6.16**) \]

\[ + 12.592DJDY + 0.353ERCHG1 + 0.0332D_2 \]
\[ (4.83**) \quad (1.33) \quad (4.54**) \]

\[ R^2 = 0.913 \quad d = 1.25 \]

\textit{Sample Period} 1984 (1) to 1991 (3)

where

- \( \text{CHGS4} \) = four quarter change in All Ordinaries index (%)
- \( \text{CHGDJ4} \) = four quarter change in Dow Jones index (%)
- \( \text{ADY} \) = Australian dividend yield (%)
- \( \text{DJDY} \) = US dividend yield (%)
- \( \text{ERCHG1} \) = one quarter change in the exchange rate (%)
- \( \text{D}_2 \) = dummy variable for 1987 stock market crash - based on four quarter percentage changes.
This equation provides considerable support for the International Arbitrage Model. The variables have the correct sign and are all significant except for the exchange rate variable. This variable is a one quarter change which suggests that the formation of exchange rate expectations depends on more recent data than share price expectations. The four quarter change is much less significant. On the other hand, if the whole equation is written in terms of one quarter changes, the US dividend yield is insignificant. The positive coefficient of the exchange rate variable suggests once again that exchange rate expectations are regressive.

Another way of measuring exchange rate expectations is to use the forward points, in effect assuming that the uncovered interest rate parity theory holds. In fact, this variable is very insignificant when it is added to the equation. This result may arise because of the presence of a risk premium in the uncovered interest rate parity relationship or because share investors are not typical of the foreign exchange market as a whole.

The Durbin-Watson statistic suggests that autocorrelation may be present in this equation. Estimation of a first-order autocorrelation coefficient, however, produced an insignificant result. The equation also passes the Cusum of Squares test. Seasonal dummy variables are insignificant when they are added to the equation.

It is also possible to test this hypothesis on monthly data because all the relevant variables are available on this basis. The following equation was estimated by the Maximum Likelihood technique, using a first and twelfth order autoregressive process to model the error term. Seasonal dummy variables are not significant when they are added to the equation.
\[ CHGS12 = 0.162 + 0.725 \text{CHGDJ12} - 11.580 \text{ADY} \]
\[
(2.16^*) \quad (16.30^{**}) \quad (21.72^{**})
\]
\[ + 10.610 \text{DY} + 0.109 \text{ERCHG12} + 0.023D_3 \]
\[
(6.21^{**}) \quad (1.17) \quad (5.18^{**})
\]
\[ \bar{R}^2 = 0.942 \quad d = 2.04 \]

Sample Period 1984(1) to 1991(11)

where
- CHGS12 = twelve month change in All Ordinaries index (%)
- CHGDJ12 = twelve month change in Dow Jones index (%)
- ERCHG12 = twelve month change in the exchange rate (%)
- \(D_3\) = monthly dummy variable for the 1987 stock market crash

ADY and DJDY are monthly dividend yields (%).

These results provide considerable support for the International Arbitrage Model and illustrate the importance of US share market variables in determining Australian share prices. The empirical results obtained are much better than those of Gordon (1984). There are probably two reasons for this improvement. First, Gordon’s statistical analysis was done for the period 1979 to 1983 i.e. for the pre-deregulation period. Secondly, she combined the capital gain and dividend yield components of the return. Given the high volatility of the capital gains component, it is likely that market participants adopt a mechanism for generating expectations about this variable which is different from the one used for the dividend yield. The results support this expectation.

Some final comments need to be made about the dummy variable which is significant in all the equations. Its significance suggests that share prices cannot be entirely explained by fundamentals. One problem in interpreting this result, however, is that the dummy corrects for the effect of the stock market boom/bust in 1987 in full. That is, it does not allow any of that effect to be attributed to movements in the US share price. It may therefore lead to an underestimation of the influence of overseas
variables on Australian share prices although these variables remain significant in all cases.

In all cases omission of the dummy variable does not lead to a marked change in the results. For example, estimating the quarterly International Arbitrage model without it gives

\[
CHGS4 = 0.323 + 0.773CHGDJ4 - 14.33ADY + \\
(2.94**) (8.45**) (11.37**)
\]

\[
9.95DJDY + 0.190ERCHG4 \\
(3.80**) (1.40)
\]

\[\bar{R}^2 = 0.925 \quad d = 1.84\]

*Sample Period* 1984(1) to 1991(3)

Omitting the dummy variable has caused a slight reduction in the $\bar{R}^2$ and a small increase in the coefficient of the change in the Dow-Jones index.

An attempt was made to find economic variables which could be substituted for the dummy variable. It has been suggested that the strong boom in the Australia share market in 1987 resulted in part from the sharp depreciation of the Australian dollar over 1985 and 1986 which can be viewed alternatively as making Australian assets appear cheaper to overseas investors or as creating expectations of an appreciation of the Australian dollar. Unfortunately, the results already reported give little support for this hypothesis.

Another variable tested was the rate of monetary growth which was very high in Australia at the time of the stockmarket boom. However, the quarterly and annual rates of growth of M3 and broad money are insignificant when they are added to the equations.
5. Conclusion

The results reported in this paper provide considerable support for some fundamental explanations of movements in share prices. The first model tested was the generic returns model. The equations based on this model are quite good, but suffer somewhat from the need to use the gross operating surplus of companies as a proxy for the relevant returns variable. Variables representing developments in the real economy, acting as proxies for expected future movements in returns, provide the most significant coefficients in this equation. Good results are also obtained by replacing the return measure with the variables which presumably determine it (product prices, wages, interest rates, etc), thereby getting around the measurement problems. All of these variables are highly significant.

One conclusion coming out of the first and second approaches is the importance of international influences on Australian share prices in the nineteen eighties. The exchange rate and the Dow Jones index were found to have significant coefficients. These international influences are considered in a more systematic way in the third model examined in the paper - the International Arbitrage Model. An equation based on this model and an assumption of static expectations about future rates of change and dividend yields gave excellent results. This equation provides some further statistical evidence on the high degree of integration of the Australian financial sector with global capital markets.

The equations reported in this paper show that share prices can be well explained by models based on fundamentals i.e. the variables which economic theory tells us determine share prices. In all equations, however, a dummy variable representing the share price fluctuation of 1987 was highly significant, suggesting that this fluctuation cannot be explained in terms of changes in fundamentals. This means that share prices are to some extent at least irrational in the sense that their level does not always conform to economic fundamentals. It should be noted, however, that the dummy variable is picking up some of the effect of movements in US share prices over 1986/87. The result does raise some doubts about the full allocative (as
opposed to the informational efficiency of the share market although the overall picture produced by this study is of a market in which prices reflect underlying values.

References


# Appendix A: Definitions of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADY</td>
<td>Index linked dividend yield series from the <em>Monthly Index Analysis</em>, published by the Australian Stock Exchange.</td>
</tr>
<tr>
<td>COMA</td>
<td>Reserve Bank of Australia index of Commodity Prices in Australian Dollars with 1984/85 (average) as base period.</td>
</tr>
<tr>
<td>$D_1$</td>
<td>Dummy variable to take account of the stock market boom and crash in 1987. It was calculated using the log of the relevant stock market index over the quarters - December 1986 to December 1987.</td>
</tr>
<tr>
<td>$D_2$</td>
<td>Dummy variable for the stock market boom and crash in 1987. It was calculated using the four quarter percentage change.</td>
</tr>
<tr>
<td>$D_3$</td>
<td>Dummy variable for the stock market boom and crash in 1987. It was calculated using the monthly percentage change.</td>
</tr>
<tr>
<td>DJ</td>
<td>Index (1 January 1985 = 100) of United States' Dow Jones Industrial Average Share Price Series.</td>
</tr>
<tr>
<td>DJDY</td>
<td>Dividend yield on Dow Jones Industrial index.</td>
</tr>
<tr>
<td>ER</td>
<td>$$/US exchange rate determined by the Reserve Bank on the basis of market quotations at 4 p.m. Eastern Australian time at end of the month.</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>IT</td>
<td>CAI-Westpac Survey of Industrial Trends.</td>
</tr>
<tr>
<td>P</td>
<td>Implicit Gross Domestic Product (GDP) deflator based on nominal and real GDP from the National Accounts.</td>
</tr>
<tr>
<td>R10</td>
<td>Yields on 10 year Commonwealth Government Securities</td>
</tr>
<tr>
<td>S</td>
<td>Australian Stock Exchange All Ordinaries Share Price index 31 January 1985 = 100.</td>
</tr>
<tr>
<td>SI</td>
<td>Australian Stock Exchange All Industrials Share Price index 31 December 1979 = 500.</td>
</tr>
<tr>
<td>SR</td>
<td>Australian Stock Exchange All Resources Share Price index 31 December 1979 = 500.</td>
</tr>
<tr>
<td>UR</td>
<td>Unemployed persons as a percentage of labour force.</td>
</tr>
<tr>
<td>W</td>
<td>Average weekly earnings for all male employees for all industries.</td>
</tr>
</tbody>
</table>
Appendix B: Profit Function for a Cobb-Douglas Production Function

Consider a Cobb-Douglas production function:

\[ Q = KL^\alpha F^\beta \]  \hspace{1cm} (B.1)

where \( Q \) is the output of the firm, \( L \) is labour input, \( F \) is finance and \( K, \alpha \) and \( \beta \) are constants. The profit of the firm (\( \pi \)) is given by

\[ \pi = P.Q - W.L - r.F \]  \hspace{1cm} (B.2)

where \( P \) is the price of the product.

Differentiating with respect to \( L \) and \( F \) and setting the results equal to zero, we obtain the equations:

\[ L = \frac{\alpha PQ}{W}, \hspace{1cm} F = \frac{\beta PQ}{r} \]  \hspace{1cm} (B.3)

Substituting into (B.2), this gives

\[ \pi = (1 - \alpha - \beta)P.Q \quad \text{or} \quad \log\pi = \log(1 - \alpha - \beta) + \log P + \log Q \]  \hspace{1cm} (B.4)

Now substituting (B.3) into (B.1), we obtain

\[ Q^{1-\alpha-\beta} = K\alpha^\alpha\beta^\beta P^\alpha W^{-1-\beta} \]

That is,

\[ \log Q = C + \frac{(\alpha+\beta)}{1-\alpha-\beta} \log P - \frac{\alpha}{1-\alpha-\beta} \log W - \frac{\beta}{1-\alpha-\beta} \log r \]  \hspace{1cm} (B.5)

where

\[ C = \frac{1}{1-\alpha-\beta} \log K\alpha^\alpha\beta^\beta \]
Substituting (B.5) into (B.4), we obtain

\[
\log \pi = c^1 + \frac{1}{1-\alpha-\beta} \log P - \frac{\alpha}{1-\alpha-\beta} \log W - \frac{\beta}{1-\alpha-\beta} \log r
\]  

(B.6)

where

\[
C^1 = C + \log(1-\alpha-\beta)
\]

If we substitute (B.6) into equation (1) in the text, we obtain

\[
\log S = C^1 + \frac{1}{1-\alpha-\beta} \log P - \frac{\alpha}{1-\alpha-\beta} \log W - \left(1 + \frac{\beta}{1-\alpha-\beta}\right) \log r
\]  

(B.7)

It should be noted that equation (B.7) implies a linear restriction on the coefficients of the estimated equation. Specifically, if the equation estimated is

\[
\log S = \beta_0 + \beta_1 \log P + \beta_2 \log W + \beta_3 \log r
\]

then

\[
\beta_1 + \beta_2 + \beta_3 = 0
\]

SHARE.PRI
3.9.92