

2004

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School of Accounting, Finance and Economics & FIMARC Working Paper Series
Edith Cowan University
October 2004
Working Paper 0404

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Abstract

This paper investigates whether current and future domestic and United States macroeconomic variables can explain long and short run stock returns in Australia. This is undertaken with a view to examining the potential implications of the Australia-United States Free Trade Agreement (AUSFTA). America is included in the analysis as a “foreign influence”. In the recent past it has been Australia’s second largest trading partner after Japan. The long run relationship tested in this study is based on the present value model of stock prices, which is tested using a range of cointegration and causality tests. These include the Johansen ML test, Long Run Structural Modelling, a Vector Error Correction Model and Variance Decomposition. A present value model based on domestic and external economic variables is estimated for the Australian market. American economic activity does not currently have a significant influence on Australian stock markets in the long run and is less influential than domestic economic activity. However, we would expect this to become more significant in the future, as a result of the dismantling of trade barriers in financial services and investments which will be associated with the implementation of AUSFTA.

Key words: Cointegration; Stock returns; Present value model; AUSFTA

1. Introduction

The relationship between economic fundamentals and stock returns in developed markets such as the United States (US) and Europe has been well researched; (Fama (1990) Schwert (1990), Nasseh and Strauss (2000), Chen, Roll and Ross (1986), Cheung and Ng (1998), Choi, Hauser and Kopecky (1999), and Chen (1991)). However the role of the economy in stock returns in the Australia market is not nearly as well documented. Attention to this issue is particularly timely, given the recently arranged Free Trade Agreement between Australia and the US. A possible implication of this agreement is that the capital markets and financial services sectors in Australia and in the US will be come more closely integrated. One of the purposes of this paper is to take stock of how things stand at the moment in terms of the linkages between the Australian and US capital markets. Bilson, Brailsford and Hooper (2001) address this general issue in an international context using the multivariate model below including local factors and global factors to explain realised returns in twenty emerging markets.

$$R_{it} = \alpha_i + \sum_{m=1}^G \beta_{im} F_{imt}^G + \sum_{j=1}^L \gamma_{ij} F_{ijt}^L + \varepsilon_{it} , \quad (1)$$

where R_{it} , F_{imt}^G , F_{ijt}^L , represent return, a set of global factors and a set of local factors, respectively. More specifically Bilson et al. (2001) selected the return on a value weighted world index and based on past evidence selected narrow money (M1), exchange rate, industrial production and the consumer price index as potential local influences to form the following model:

$$R_{it} = \beta_i + \beta_{i1} R_{Gt} + \beta_{i2} MS_{it-1} + \beta_{i3} GP_{it-1} + \beta_{i4} RA_{it-2} + \beta_{i5} ER_{it} + \varepsilon_{it} \quad (2)$$

This paper attempts to improve and extend the work of Bilson et al. (2001) in a number of ways and to apply it in an Australian context. The variables chosen to explain stock market behaviour are variables implied by the present value model. Bilson et al. (2001) use a global stock market index as the global factor, in order to prove more relevant to policy makers this paper uses the economic variables implied by historical trade patterns, and pay particular attention to the US. It is imperative that researchers and policy makers definitively establish the pass through effect US economic developments may have on the Australian economy.

Our paper examines relationships between local and foreign macroeconomic variables and share prices in an Australia context. A key question is how macroeconomic variables affect share prices in Australia. In addition, this paper explores the informational efficiency of the Australian market. It is well accepted that stock markets should be a leading indicator of economic activity. Using an aggregate proxy for cash flows such as GNP and industrial production the relationship inherent in the present value model can be tested, suggesting that if current cash flows are found to be significant causes of current prices the present value model is violated. Cheung and Ng (1998), (Canada, Germany, Italy, Japan and the US) and Nasseh and Strauss (2000), (France, Italy, Netherlands, Switzerland, and the UK) find evidence that current cash flow proxies are a significant source of stock return variation. It has been suggested (Groenwold (1997)) that the existence of cointegration and causality is a violation of the efficient market hypothesis, thus if current industrial production is found to cause stock prices stock markets may be inefficient. To qualify this assumption further, cash flows must be bisected into an expected and unexpected component. If the efficient market hypothesis holds only the unexpected component should be able to explain stock returns, and this component should be random.

Much past research has been conducted on international globalisation and increased capital market integration. The majority of this has concluded that the US is the world's dominant economy and as a result research has generally found that US stock markets are exogenous and lead other world markets (Arshanapelli, Doukas and Lang (1995) and Masih and Masih (1999)). Given these findings it is reasonable to expect that American domestic macroeconomic variables may influence Australian stock prices because of the information these variables are likely to contain about future economic activity. For three consecutive years ending 30 June 2001, Japan was the largest Australian trading partner, followed by the USA.¹ We aim to extend the literature available on the Australian share markets by not only considering the effect of domestic macroeconomic variables but also by examining the effect of US influences.

The Australia-United States Free Trade Agreement (AUSFTA) is likely to have a significant future impact on the linkages between the US and Australian economies. It prohibits export taxes on goods and replicates World Trade Organisation protection against discriminatory taxes on goods. Beyond this the Agreement does not apply to any existing taxes (Article 22.3.4(d)), but does place limits on the ability of both Australian and United

States federal and state governments to implement discriminatory taxes in the future. The agreement features arrangements with respect to trade in services (See Chapter 10, AUSFTA Guide). It ensures that service suppliers from each Party receive national treatment or most-favoured-nation treatment (whichever is better) from the other Party. It prohibits a range of market access restrictions on service suppliers, as well as restrictions on transfers. Similar provisions apply to investments (See Chapter 11, AUSFTA Guide). There are provisions for the lifting of any restrictions on the supply of financial services:

“Article 13.4 prohibits each Party from placing limits, either on the basis of a regional subdivision or on the basis of its entire territory, on:

- the number of financial institutions;
- the value of financial service transactions or assets;
- the number of financial service operations or the quantity of financial services output; or
- the number of natural persons that may be employed in a particular financial service sector or that a financial service supplier may employ.

It also prohibits each Party from placing controls on the type of legal entity or joint venture through which a financial institution can supply a service.” (See Chapter 13, AUSFTA Guide).

The likely implication of the implementation of AUSFTA is that the financial markets and financial services sectors in the two countries, as well as many other segments of the economy will display a much greater degree of linkage in the future. This paper provides an assessment of the current degree of linkage, utilising a variety of time-series techniques.

The paper is organised as follows: Section 2 provides the research procedure used in to test the theoretical relationships. Section 3 outlines the econometric methodology used whilst section 4 describes the results. Section 5 concludes the paper.

2. Research Procedure

Three models will be utilised to test the validity of the present value model and the relationship between economic variables and the Australian stock market. The first model

uses current industrial production to test for the relationship between current economic activity and stock prices:

$$SP_t = IP_t - IR_t, \quad (3)$$

where SP denotes domestic stock prices, IP is industrial production, IR is a domestic interest rate series. The present value model will be tested using the below model:

$$SP_t = IP_{t+1} - IR_t, \quad (4)$$

where IP_{t+1} denotes domestic industrial production leading one quarter. According to the present value model, current share prices should be caused by future industrial production. As a proxy for future industrial production, share prices will be led by industrial production by one quarter. It may be the case that share prices share a significant positive relationship with industrial production more than one quarter ahead, however, the objective of the paper is to establish whether stock prices are significantly related to future industrial production, not how far ahead stock markets predict economic activity.

Using American industrial production one quarter ahead and American interest rates as the external factors most likely to influence the Australian stock market the model below will test the existence of a relationship and whether domestic or the US factors have greater influence on Australian share prices.

$$SP_t = USIP_{t+1} - USIR_t + IP_{t+1} - IR_t, \quad (5)$$

where $USIP_{t+1}$ is American industrial production leading one quarter ahead and $USIR_t$ is American interest rates.

3. Methodology and Data

To test the above relationships cointegration and Granger causality tests are employed. We commence with unit root tests, and having established that our series are I(1) proceed

with Johansen maximum likelihood (ML) tests for cointegration (Johansen and Juselius (1990)). A finding of cointegration suggests causal links between variables (Engle and Granger (1987)). We further explore these via long run structural modelling (LRSM) of the cointegrating vectors, estimate the vector error correction model (VECM) and undertake variance decomposition (VDC) analysis. After normalising share prices as the dependent variable LRSM will be used to determine the existence of a long run causal relationship by placing a restriction of zero on the variable in the cointegrating vector. The rejection of such a restriction implies the variable must enter the cointegrating vector significantly and a long run causal relationship is said to exist.

The VECM is a vector autoregressive (VAR) model where the non-stationary variables have been transformed into a stationary series by first differencing. Such tests can allow the researcher to examine the relative exogeneity and endogeneity of each variable in the system over the short run as well as examining the significance of the long run adjustment to the short run dynamics of the system. A VDC can further enhance the above tests of causality by estimating the relative exogeneity and endogeneity of a system of variables in an out of sample test. Furthermore a VDC can demonstrate the relative significance of each individual variable thus assisting comparison between domestic and international economic variables in this current paper.

Our sample of quarterly data runs from 1974 Q1 to 2000 Q4. The total return share market indexes comprising eighty percent of the market capitalisation used for Australia were sourced from the Datastream International finance database. Interest rates, consumer price index (CPI) and industrial production indexes were sourced from International Financial Statistics publication compiled by the International Monetary Fund. The interest rate selected was a Government Bond rate in both cases. The data was deflated using the quarterly CPI, and all data apart from interest rates was examined in natural logarithmic form.

4. Results

4.1 Unit Root Tests

We applied tests of data stationarity using Augmented Dickey-Fuller (ADF) tests supplemented by Phillips-Perron tests. When the results obtained from the ADF tests were

ambiguous the Phillips-Perron test was then applied. For the sake of brevity the results of the ADF tests are not presented but are available upon request. The null hypothesis that each time series contains a unit root could not be rejected for all variables.

4.2 Tests for Cointegration

The presence of cointegration in our data set provides strong preliminary evidence in favour of the present value model. The model implies that a stationary long run relationship must exist between share prices, interest rates and industrial production. The existence of cointegration implies that at least uni direction causality must exist. Following Pesaran and Pesaran (1997) unrestricted intercepts and restricted trends were included as exogenous variables in the cointegrating VAR. It is a strong prior that one cointegrating relationship exists in one of the three models outlined in Section 2, based on the fact that domestic share prices must be caused by the variables that make up either the domestic or foreign present value models. In the case that more than one cointegrating vector is found then a priori information is used to determine the correct present value model. The results of the Johansen ML test for cointegration are presented in Table 1. It can be seen from the results that a finding of cointegration is accepted.

Table 1: Johnson ML Cointegration Test

This table shows the results from the Johansen ML cointegration tests for the number of stationary linear relationships present in the group of variables including industrial production, interest rates and share prices. A finding of cointegration in this paper provides preliminary evidence in support of the present value model of share prices, which defines a long run relationship between cash flows (aggregate industrial production), interest rates (Government bond rate) and share prices (total return indexes). The cointegrating vector tested for *current economic activity* includes only domestic economic variables and takes the form $\{SP_t, IP_t, IR_t\}$, while the tests for *future economic activity* includes industrial production leading domestic share prices by one quarter, the cointegrating vector takes the form $\{SP_t, IP_{t+1}, IR_t\}$. The cointegration test for *external factors* includes domestic industrial production leading domestic share prices by one quarter, the external factors used in this test are economic variables from the US including industrial production one quarter ahead, the external factor cointegrating vector is given as $\{SP_t, IP_{t+1}, IR_t, USIP_{t+1}, USIR\}$. r indicates the number of cointegrating relationships found in the Johansen ML cointegration tests, significant at the 5% level. To ascertain the existence of cointegration both the maximal eigenvalue (ME) statistic and the trace statistic were considered and are reported in the below table.

	Current Economic Activity		Future Economic Activity		External Factors	
	ME	Trace	ME	Trace	ME	Trace
Australia	$r = 2$	$r = 1$	$r = 2$	$r = 2$	$r = 1$	$r = 1$

4.3 Causality Tests

4.3.1 Long Run Structural Modelling

Table 2 shows the results of the LRSM test, which are used in this paper to examine for the presence of long run causality. It can be seen from Panel A that current industrial production is a significant cause of share prices in Australia, whilst interest rates also significantly cause share prices in Australia. The significance of current industrial production violates the present value model and indicates that there is an unexpected portion of industrial production that influences share prices. Panel B indicates that future industrial production significantly causes share prices in Australia.

Panel C of Table 2 illustrates share price causality stemming from domestic and external economic factors. The inclusion of US economic factors does not alter the composition of the Australian model, indicating that the domestic economy has greater importance for share prices than the US economy.

Table 2: Summary of LRSM

The table below summarises the results obtained from the LRSM analysis, which is used in to determine the existence of long run causal relationships from economic variables to the domestic share market. Each cointegrating equation was normalised on share prices so that the estimated equations be identified as $SP_t = IP_t - IR_t$ for the current economic activity model; $SP_t = IP_{t+1} - IR_t$ for the future economic activity model that is treated as the proxy for the present value model and $SP_t = IP_{t+1} - IR_t + USIP_{t+1} - USIR_t$ for the external factor model, which uses the US as a foreign influence. Uni-directional causality could then be examined by placing a restriction of zero on each variable in question. If that restriction could not be rejected then the restriction remained in the long run cointegrating vector, therefore the variables that appear as zero in the table below are insignificant in causing share prices in the long run. IP refers to current industrial production while IP_{t+1} refers to industrial production leading share prices by a quarter; IR refers to the domestic interest rates used; while $USIP_{t+1}$ and $USIR$ refers to the future US industrial production and US interest rates, respectively.

Country Share Returns	Variables in the Cointegrating Vector				
Panel A: Current Economic Activity					
	IP	IR	Trend		
Australia	5.26	0.046	0.00		
Panel B: Future Economic Activity					
	IP_{t+1}	IR	Trend		
Australia	1.00	0.00	0.00		
Panel C: External Factors					
	IP_{t+1}	IR	$USIP_{t+1}$	USIR	Trend
Australia	1.00	0.00	0.00	0.00	0.00

4.3.2 Vector Error Correction Model

Once the cointegrating vectors have been modelled via LRSM, thus eliminating insignificant variables, a vector error correction model (VECM) can be estimated. A VECM provides evidence of short-term causality as well as indicating the significance and speed of the long run error adjustment via the error correction term. The results of the VECM are presented in Table 3. It was expected that the error correction terms in the current activity model would not be significant as this model does not represent the present value model, it is expected that in the future economic activity model the error correction terms will be significant to represent the correction to the long run relationship implied by the present value model.

Evidence of significant short-term causality in the model for future economic activity is also rare. Past share prices are surprisingly a significant short-term cause of future share prices in Australia. As expected the majority of error correction terms are significant in the future economic activity models. As displayed in Panel C, US future industrial production and interest rate in the VECM have a short-term causal relationship with Australia, while there is little change to the significance or size of the error correction terms.

4.3.3. Variance Decomposition

A VDC analysis of current economic activity, future economic activity and external factor models was undertaken, (the full results are available from the authors on request) whilst a summary is provided in Table 4. VDC analysis can be useful in deciphering the relative importance of each variable in explaining the error variance of the dependent variable: share prices. As expected the influence of future industrial production is significantly more prominent than current industrial production, which suggests that at a domestic level the present value model is upheld. Australian investors look forward to domestic future economic activity to explain share prices.

Table 3: Summary of Error Correction Models

In the table below Panel A summarises the results for the error correction model including current economic activity, Panel B meanwhile includes the results for the error correction model including future economic activity. Panel C summarises the error correction models that include US influences. The respective structure of the VECM for the current economic activity model, the future economic activity model (the proxy for the present value model) and external factor model are estimated as:

$$\Delta SP_t = a_1 Z_{t-1} + \beta_{SPi} \Delta SP_{t-1} + \beta_{PRi} \Delta IP_{t-1} + \beta_{IRi} IR_{t-1} + \varepsilon_t;$$

$$\Delta SP_t = a_1 Z_{t-1} + \beta_{SPi} \Delta SP_{t-1} + \beta_{PRi} \Delta IP_{t+1} + \beta_{IRi} IR_{t-1} + \varepsilon_t;$$

$$\Delta SP_t = a_1 Z_{t-1} + \beta_{SPi} \Delta SP_{t-1} + \beta_{PRi} \Delta IP_{t-1} + \beta_{IRi} \Delta IR_{t-1} + \beta_{USIP_{t+i}} \Delta USIP_{t+1} + \beta_{USIRi} \Delta USIR_{t-1} + \varepsilon_t.$$

The dependent variable in each model is change in domestic share prices, ΔSP_{t-1} , while ΔIR_{t-1} , ΔIP_{t-1} , $\Delta USIP_{t+1}$ and $\Delta USIR_{t-1}$ are the differenced temporary lagged explanatory variables for domestic share prices, domestic industrial production, domestic interest rates, US industrial production and the US government bond rate, denoted by dSP1, dIP1, dIR1, dUSIP1 and dUSIR1 in the table below, the significance of these variables describe a short-term causal relationship with share price return. The error correction term is taken from the cointegrating VAR and highlights $a_1 Z_{t-1}$ influence of the speed and significance of the long run adjustment on domestic share returns; it is denoted by ECT(1) in the table below. The symbol * denotes significant at the 5% level.

Panel A: Current Economic Activity	
Explanatory Variable	<i>Australia</i>
Intercept	0.996
dSP1	-0.043
dIP1	-0.021
dIR1	-0.031
ECT(1)	0.056
Panel B: Future Economic Activity	
	<i>Australia</i>
Intercept	-0.029*
dSP1 _{t+1}	0.065*
dIP1	-0.046
dIR1	0.001
ECT(1)	-1.060*
Panel C: External Factors	
	<i>Australia</i>
Intercept	-0.025*
dSP1	0.051*
dIP1 _{t+1}	-0.085
dIR1	0.002
dUSIP1 _{t+1}	0.361*
USIR1	-0.003
ECT(1)	-1.091*

Table 4: Summary of VDC Results for Current and Future Industrial Production

The table shows the results of the generalised forecast error variance decomposition for the cointegrating vectors $\{SP_t, IP_t, IR_t\}$ and $\{SP_t, IP_{t+1}, IR_t\}$ with unrestricted intercepts and restricted trends in the VAR for each country for the variable used to proxy cash flow in the present value model, industrial production. The restrictions placed on the cointegrating vector via LRSM hold, such that share prices have been normalised and the coefficient for insignificant variables remains at zero. The variable to be shocked is SP_t . By comparing the relative influence of current and future industrial production allows us comment on the level of market in formational efficiency, as previously mentioned an efficient market should predict future economic activity, hence future economic activity should more influential than current industrial production. The percentages given are taken from the VDC for current economic activity and future economic activity after a one-year time period. In Australia; current industrial production explains 0.80% of the share price error variance, while future industrial production explains 93.41%, it may be said that the market processes information efficiently.

Country	Current Industrial Production	Future Industrial Production
Australia	0.80%	93.41%

In Table 4 Australia appears to be highly efficient at processing information, in that current industrial production explains less than 1% of the share prices forecast error variance while future industrial production explains approximately 93% of share price forecast error variance.

5. Conclusion

This paper has attempted to model Australia share markets in terms of a domestic or external present value model for share prices. A current economic activity model, a future economic activity model and an external factor model were estimated using various time-series techniques and applied to the Australian market. The prior that the Australian share market should adhere to either a domestic or external present value model (as tested via the presence of cointegration) was upheld. As expected economic variables were generally a significant cause of share prices as shown via LRSM, generally domestic industrial production was more prominent than domestic interest rates, while US interest rates were more prominent than US industrial production. Furthermore a number of short run causal relationships were also found giving different implications for policy makers interested in long run and short run contagion. The VDC test uncovered the surprising finding that generally Australian share markets do not look to future economic developments in the US as guide to future domestic economic performance, instead domestic factors are generally more

important. This finding is consistent with the findings of Bilson et al. (2001). The findings in this paper also suggest that the previous research concentrating on perfect segmentation or perfect integration is unrealistic and both domestic and external factors need to be considered when setting policy. The implementation of free trade policies under the auspices of AUSFTA is likely to lead to more pronounced linkage in future between Australian and US financial markets and to an increase in the impact of US macroeconomic variables on Australian markets.

Notes

1. The largest trading partner is defined in terms of volume of export and imports of the external trade for the Australian economy.

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