AN EMPIRICAL NOTE ON THE INFLUENCE OF THE US STOCK MARKET ON AUSTRALIAN ECONOMIC ACTIVITY*

NICOLAS DE ROOS† AND BILL RUSSELL #

Abstract

This paper empirically examines the impact of the US stock market on Australian economic activity as one explanation of the strong correlation in the Australian and US business cycles. It is found that both the US and Australian share markets appear to have a significant impact on Australian activity.

Keywords: Business Cycles, Stock Markets, Cointegration.

JEL Classification: E32, F41, G15, O56

---

* †Department of Economics, Yale University. #The Department of Economic Studies, University of Dundee. We would like to especially thank Anindya Banerjee, Mono Chatterjee, Lynne Cockerell, Gordon de Brouwer, Jacqui Dwyer, Malcolm Edey, David Gruen, Jo Paisley, Alison Tarditi, participants of a Reserve Bank of Australia seminar and two anonymous referees for their helpful comments and suggestions. The paper focuses on the share market aspects of de Roos and Russell (1996) where further technical details and analysis can be found. Views expressed in this paper are those of the authors and not necessarily those of the Reserve Bank of Australia.

AN EMPIRICAL NOTE ON THE INFLUENCE OF THE US STOCK MARKET ON AUSTRALIAN ECONOMIC ACTIVITY

I. INTRODUCTION

Gruen and Shuetrim (1994) provide a powerful empirical description of the correlation in the Australian and foreign business cycles when they estimate an error correction model of the Australian business cycle.[1] The striking feature of their results is not that foreign activity affects the Australian economy but how large and immediate the impact is.[2] Furthermore they show that US activity explains Australian activity as well as or better than OECD activity, and substantial better than a model based on export markets' GDP.

Two explanations of the correlation are widely held and popular. The first focuses on the role exports play in transmitting foreign business cycles to Australia.[3] de Roos and Russell (1996) show that after allowing for the impact of domestic activity on exports, foreign activity has a significant and at times a large impact on exports and, therefore, Australian activity. Furthermore, they argue that the US has a high output elasticity of demand for Australian exports and this helps explain the strong correlation with the US business cycle compared with activity in the OECD or Australia's export markets.

The second explanation is based on the concept of integrated world financial markets that allow the rapid propagation of shocks to foreign financial prices to domestic financial prices. These shocks to financial prices may then lead to changes in real output. Furthermore, if capital markets are imperfect as many authors argue then firms with higher net worth will, other things equal, have easier access to external funding leading to a strengthening of the propagation of shocks through the financial markets.[4]

For example, Australia's share market is highly correlated with foreign share markets as shown in Table 1.[5] If foreign share markets influence Australian share markets then they can also influence Australian activity directly and / or indirectly through their effect on investment in Australia.[6] The direct effect is through the investment by foreign-owned domestic companies or subsidiaries operating in Australia. If the share price of the parent company is high because of high profits then the subsidiary may have greater access to low cost retained earnings of the parent company.[7]

Table I about here

The indirect effect of the foreign share market is via its influence on the Australian share market. This effect contains at least three inter-related transmission mechanisms. The first mechanism follows from Tobin's (1969) investment theory or '*q*' theory. This predicts that firms will invest if the replacement cost of the capital stock is less than the value of the firm.

The second is a cost of funds argument. Domestic firms find the cost of equity falls with higher general share prices leading to an expansion in investment and output. The third is an expectations argument. Expectations of greater domestic and world activity increase the valuation of domestic companies and share prices. Coincident with the expectation of greater activity is the need for greater investment to meet the expected higher demand.

This paper follows the work of Fama (1981, 1990) and Canova and De Nicolo (1995) and empirically examines whether the US share market influences Australian activity and, in part, explains the strong correlation in Australian and US activity.[8] Using a variant of the Gruen and Shuetrim (1994) model of Australian GDP, US and Australian share market variables are introduced to find that they both have a large and significant impact on Australian activity. However it appears that the Australian share market contains all the information relevant to Australian activity that is present in the US share market plus further information specifically relevant to Australian activity. This is consistent with the US share market influencing the Australian share market and indirectly Australian activity.

Having estimated the 'Gruen and Shuetrim' model we proceed to identify separately the influences of US share market and Australian monetary policy on Australian activity. This shows the impact of the US share market on Australian activity has been in general smaller than that of Australian monetary policy and US activity but has at times been large and often leads the cycle in Australian activity. Before we proceed to the estimation of the model we first describe the share market variables used in the estimation.

II. THE US AND AUSTRALIAN SHARE MARKET VARIABLES

The appropriate share market variable to include in the estimation depends on the transmission mechanism that it represents. Share market variables reflecting the first two transmission mechanisms set out above are similar but not identical. Barro (1990) argues the ratio of the share price index to the private investment deflator is a good measure of Tobin's '*q*' for an economy. By contrast, Fama (1990) uses share market returns deflated by the consumer price index to predict output growth. Similar to Fama's approach, we construct the accumulation share price index (which incorporates dividends), deflated by the GDP deflator. The GDP deflator was chosen because it allows the share price of the firm to be expressed in terms of the firm's output price. The real share market price variable was found to be a trend stationary process and was therefore detrended. The detrending is theoretically appealing as it is expected that the cycle in the real share price and not its trend level will affect the cycle in activity.

Figure 1 shows the detrended real share price for Australia, the US and a composite world index. We see that the three series move closely together. However, the world series deviates

substantially from the Australian and US series following the 1987 sell-off in the share market due to the long lag before the Japanese share market was also sold-off in January 1990.

Figure 1 about here

III. The Impact of Foreign Share Markets on Australian Activity

The benchmark model used in the estimation is based on Gruen and Shuetrim's (1994) error correction model of the Australian business cycle:

$$\Delta y_t = \alpha + \sum_{j=1}^{5} \beta_j \Delta y_{t-j} + \sum_{j=0}^{4} \gamma_j \Delta y^{US}_{t-j} + \sum_{j=2}^{6} \delta_j R_{t-j} + \phi y_{t-1} + \varphi y^{US}_{t-1} + \varepsilon_t \qquad (1)$$

where y is Australian GDP, y^{US} is US GDP, and R is the real 'cash' interest rate.[9] The lower case variables are in logs and Δ is the change in the variable. The US model was chosen over the OECD or export-market models as it performs substantially better. The sources of the data and calculation of the series are reported in the data appendix.

Before estimating the model the time series properties of the data were investigated using ADF (Said and Dickey 1984) and KPSS (Kwiatkowski *et al.* 1992) tests. We find that Australian and US GDP are best described as I(1) variables while the change in these variables and the remaining explanatory variables ('cash' rate and share market variables) are best described as stationary. We also assume that US GDP is weakly exogenous. This assumption is supported by simple unrestricted error-correction models of US and Australian GDP that indicate that deviations from the long-run relationship between US and Australian GDP do not affect US GDP. This implies, as would be expected, that it is Australian and not US GDP which adjusts to remove the disequilibrium from the long-run relationship and that US GDP is weakly exogenous in the model.

The benchmark Gruen and Shuetrim model is reported first in Table 2. Models 1 to 3 add to the benchmark model the share market variables for Australia and the US. The models all perform better than the benchmark model in terms of increasing the explanatory power as measured by $\overline{R}^2$. In model 1 we add the Australian real share price and find it has a significant and large, positive impact on Australian activity. A 'permanent' 1 standard deviation increase in the real share price (around 17 per cent), increases GDP in the short run by around 0.32 of a percentage point and by around 1.26 percentage points in the long run.[10] The addition to the benchmark model of the US real share price in model 2 provides similar results.[11]

Table II about here

Models 1 and 2 cannot separately identify the influence of the Australian and US share markets on output. In model 3 both share market variables are included and results in the US share market variable becoming insignificant and the Australian variable significant at the 10 per cent level. However, it is evident from their joint significance that at least one of the variables is significant and that the US and Australian real share price variables jointly contain information concerning Australian activity. This suggests that the Australian variable contains all the relevant information present in the US variable plus some additional information. This result, along with the McNelis (1993) finding of 'causality' between the US and Australian share markets, is intuitively appealing. It is consistent with the idea that the US share market influences the Australian share market and, thereby, Australian activity, and that the Australian share market contains information not present in the US market which is uniquely relevant to Australian activity.

From models 2 and 3 we can determine the influence of the US share market on Australian activity. Model 3 could be used to identify the direct impact of the US share market on activity. However, the indirect effect via its influence on the Australian share market cannot be identified. Model 2 provides an estimate of the sum of the direct and indirect US influences.

One interpretation of the results is that the share market variables reflect the forward looking nature of the share market and therefore predict, rather than 'cause', future activity as argued in this paper. To make the distinction between 'prediction' and 'causation' is difficult. However, two points can be made. First, although it is likely that both effects are present, if we acknowledge that financial markets are imperfect then higher share prices will make it easier for firms to fund the investment necessary for future activity. This implies that on an intellectual level the share market 'causes' future activity via the cost of funds argument. Second, it is unlikely that the US share market focuses closely on future Australian activity and in this case the share market variable does not predict future activity and may be interpreted as a 'cause' of future activity. Given the similarity of the US and Australian share markets one may therefore conclude that the Australian share market also 'causes' Australian activity.

IV. The Impact of US Share Markets on Australian Activity

The contributions to Australia's cycle in GDP from the US share market, the real cash rate and foreign activity using model 2 are shown in Figures 2a and 2b. We see that at times the foreign share market has a sizeable impact on GDP growth; up to 2 percentage points on a four-quarter-ended basis. In the bottom panel, a slightly larger impact stems from the real cash rate. The top panel of Figure 2b shows the contribution due to foreign growth. It is evident that while the contribution of the US share market to the cycle in Australian GDP has

been smaller than that of the real cash rate or foreign activity, the contribution has been large at times and often leads the cycle.

Finally, we should notice that even though the inclusion of the share market variables increases the explanatory power of the benchmark model substantially, the short and long-run coefficients on foreign activity are not significantly reduced. It appears, therefore, that while the share market may help explain Australian activity and the correlation in business cycles, the foreign demand variable in the benchmark model is not simply a 'proxy' for a missing share market variable. Consequently, the 'large and immediate impact' of foreign activity on Australian activity is not explained by the share market variables alone although this does not exclude the possibility of financial markets being a facilitator and one of the causes of the correlation.

Figure 2a about here

Figure 2b about here

APPENDIX: DATA SOURCES AND DESCRIPTION

Australian Data

Data	*Source*
GDP (Average)	ABS Cat. No. 5206, Table 48.
Real cash rate	Official cash rate (RBA *Bulletin*, Table F1) less four-quarter-ended percentage change in the Treasury underlying CPI.
Real share price	Accumulation index for total share market returns, incorporating dividend yields (Datastream, TOTMKAU(RI)) deflated by the GDP(E) deflator.

Foreign Data

Data	*Source*
US GDP	Datastream, USGDP...D.
Nominal Share Prices	
US share price	Datastream, TOTMKUS(RI).
Japan share price	Datastream, TOTMKJP(RI).
World share price	Datastream, TOTMKWD(RI).
Export-markets share price	An export weighted average of accumulation indices for Australia's major trading partners. Accumulation indices obtained from Datastream.
Europe share price	Datastream, TOTMKER(RI).
Real US Share Price	Nominal US share price deflated by US GNP deflator (Datastream, USIPDGNPE.)

REFERENCES

Backus, D. and P.J. Kehoe (1992), 'International Evidence on the Historical Properties of Business Cycles', *American Economic Review*, 82(4), pp. 864-888.

Barro, R.J. (1990), 'The Stock Market and Investment', *Review of Financial Studies*, 3, pp. 115-131.

Barry, P.F. and C.W. Guille (1976), 'The Australian Business Cycle and International Linkages, 1959-1974', *Economic Record*, 152(4), pp. 137-165.

Canova, F. and G. De Nicolo (1995), 'Stock Returns and Real Activity: A Structural Approach', *European Economic Review*, 39(5), May, pp. 981-1015.

Debelle, G. and B. Preston (1995), 'Consumption, Investment and International Linkages', Reserve Bank of Australia Research Discussion Paper No. 9512.

de Roos, N. and B. Russell (1996), 'Towards an Understanding of Australia's Co-Movement with Foreign Business Cycles', Reserve Bank of Australia Research Discussion Paper No. 9607.

Dungey, M. and A. Pagan (1997), 'Towards a Structural VAR Model of the Australian Economy', Australian National University Working Paper in Economics and Econometrics, No. 319.

Fama, E.F. (1981), 'Stock Returns, Real Activity, Inflation, and Money', *American Economic Review*, 71(1), pp. 545-565.

Fama, E.F. (1990), 'Stock Returns, Expected Returns, and Real Activity', *The Journal of Finance*, 55(4), pp. 1089-1108.

Fazzari, S., G. Hubbard and B. Petersen (1988), 'Financing Constraints and Corporate Investment', *Brookings Papers on Economic Activity*, 1(1), pp. 141-195.

Froot, K.A. and J.C. Stein (1991), 'Exchange Rate and Foreign Direct Investment: An Imperfect Capital Markets Approach', *Quarterly Journal of Economics*, 106(4), pp. 1191-1217.

Gertler, M. (1988), 'Financial Structure and Aggregate Economic Activity: An Overview', National Bureau of Economic Research Working Paper No. 2559.

Geske, R. and R. Roll (1983), 'The Fiscal and Monetary Linkage Between Stock Returns and Inflation', *Journal of Finance*, 38(1), pp. 1-33.

Gruen, D. and G. Shuetrim (1994), 'Internationalisation and the Macroeconomy', in P. Lowe and J. Dwyer (eds), *International Integration of the Australian Economy*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp. 309-363.

Haslem, S., J. Hawkins, A. Heath and A. Tarditi (1993), 'The Australian Business Cycle: Some Stylised Facts', Reserve Bank of Australia, internal mimeo.

Kaul, G. (1987), 'Stock Returns and Inflation: The Role of the Monetary Sector', *Journal of Financial Economics*, 18(2), pp. 253-276.

Kremers, J.J.M., N.R. Ericsson and J.J. Dolado (1992), 'The Power of Cointegration Tests', Board of Governors of the Federal Reserve System International Finance Discussion Paper No. 431.

Kwiatkowski, D., P.C.B. Phillips, P. Schmidt, P and Y. Shin (1992), 'Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root', *Journal of Econometrics*, 54(1/3), pp. 159-178.

Lowe, P. and T. Rohling (1993), 'Agency Costs, Balance Sheets and The Business Cycle', Reserve Bank of Australia Research Discussion Paper No. 9311.

McNelis, P.D. (1993), 'The Response of Australian Stock, Foreign Exchange and Bond Markets to Foreign Asset Returns and Volatilities', Reserve Bank of Australia Research Discussion Paper No. 9301.

McTaggart, D. and T. Hall (1993), 'Unemployment: Causes and Solutions'. Centre for Economic Policy Research Discussion Paper No. 300.

Mills, K., S. Morling and W. Tease (1994), 'The Influence of Financial Factors on Corporate Investment', Reserve Bank of Australia Research Discussion Paper No. 9402.

Phipps, A. J. and J. R. Sheen (1995), 'Macroeconomic Policy and Employment Growth in Australia', *The Australian Economic Review*, 1st Quarter, pp. 86-104.

Pitchford, J. (1992), 'Macroeconomic Policy Issues of the 1990s', Australian National University Centre of Economic Policy Research Discussion Paper No. 263.

Pitchford, J. (1993), 'The Exchange Rate and Macroeconomic Policy in Australia', in A. Blundell-Wignall (ed.), *The Exchange Rate, International Trade and the Balance of Payments*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp. 147-201.

Said, S.E. and D.A. Dickey (1984), 'Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order', *Biometrika*, 71(2), pp. 599-608.

Tobin, J. (1969), 'A General Equilibrium Approach to Monetary Theory', *Journal of Money, Credit and Banking* , 1(1), pp. 15-29, February.

1 The correlation is widely documented. For example see also Barry and Guille (1976), Backus and Kehoe (1992), McTaggart and Hall (1993), Haslem *et al.* (1993), Debelle and Preston (1995), de Roos and Russell (1996), Phipps and Sheen (1995) and Dungey and Pagan (1997). Appendix A of de Roos and Russell (1996) provides a brief survey of these references.

2 Gruen and Shuetrim estimate the contemporaneous impact of US GDP growth on the growth in Australian GDP to be between 0.4 and 0.6, depending on the model, which is consistent with McTaggart and Hall's (1993) estimate of 0.5.

3 For example, see Pitchford (1992, 1993), Gruen and Shuetrim (1994), and Debelle and Preston (1995).

4 For example, see Gertler (1988) for a survey of the influences of financial factors on activity. See also Lowe and Rohling (1993) Mills, Morling and Tease (1994).

5 McNelis (1993) reports similarly high correlation coefficients for volatility measures of share price indexes for a number of countries.

6 While there may well be other avenues for share prices to effect Australian activity, such as a wealth effect on consumption, these other avenues appear minor and are not pursued. The propagation of foreign financial shocks to Australia may also be through the bond market. However, this avenue is not investigated due to the high correlation between the share and bond markets and the difficulties this would introduce in the subsequent estimation.

7 Fazzari, Hubbard and Petersen (1988) and Froot and Stein (1991) argue that the cost of internal funds is less than external finance and show investment is sensitive to the availability of internal funds. Froot and Stein (1991) also argue that companies with higher relative wealth are more likely to engage in foreign direct investment.

8 Fama (1981, 1990), Geske and Roll (1983), Kaul (1987) and Barro (1990) find that stock returns help predict future real activity. Canova and De Nicolo (1995) find expected US GNP growth helps predict European stock returns which in turn helps to explain future European GNP growth.

9 The 'benchmark' model differs slightly from Gruen and Shuetrim (1994). Given extra observations the Southern Oscillation Index is insignificant. After testing for individual and joint significance, the terms of trade and real exchange rate were also eliminated from the benchmark model in a stepwise fashion while a trend remains insignificant.

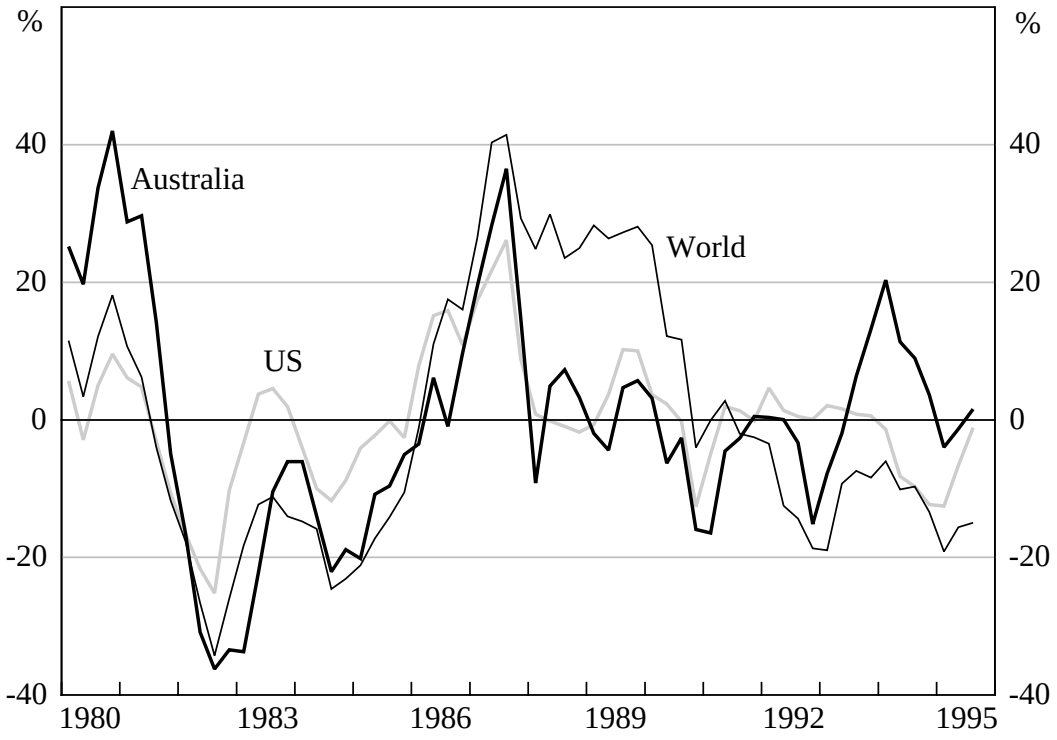
[10] Technically it is not legitimate to assume a 'permanent' change in share market prices given the variables are stationary. Consequently the long-run effect of a shock to share prices an domestic activity cannot be 'permanent' either.

[11] The short and long-run impact on the level of Australian GDP of a permanent 1 standard deviation increase (around 9 per cent) in the US real share price are 0.27 and 1.31 percentage points.

Table I Correlation Between Australian and Foreign Nominal Share Market Returns, 1980:Q1-1995:Q3

	US	Japan	Europe	Export markets	World
Correlation	0.62	0.42	0.65	0.61	0.69

Notes: Correlation between the quarterly percentage change in the share market accumulation indexes. Export markets index is calculated as the export weighted average of the accumulation indexes for Japan, US, NZ, South Korea, UK, Singapore, Taiwan and Hong Kong.



Note: The world real share price is the nominal world accumulation share price index deflated by the G7 deflator.

Figure 1 Detrended Real Share Prices

Table II The Real Share Price and Australian Activity[(a)]
(1981:Q3-1995:Q3)

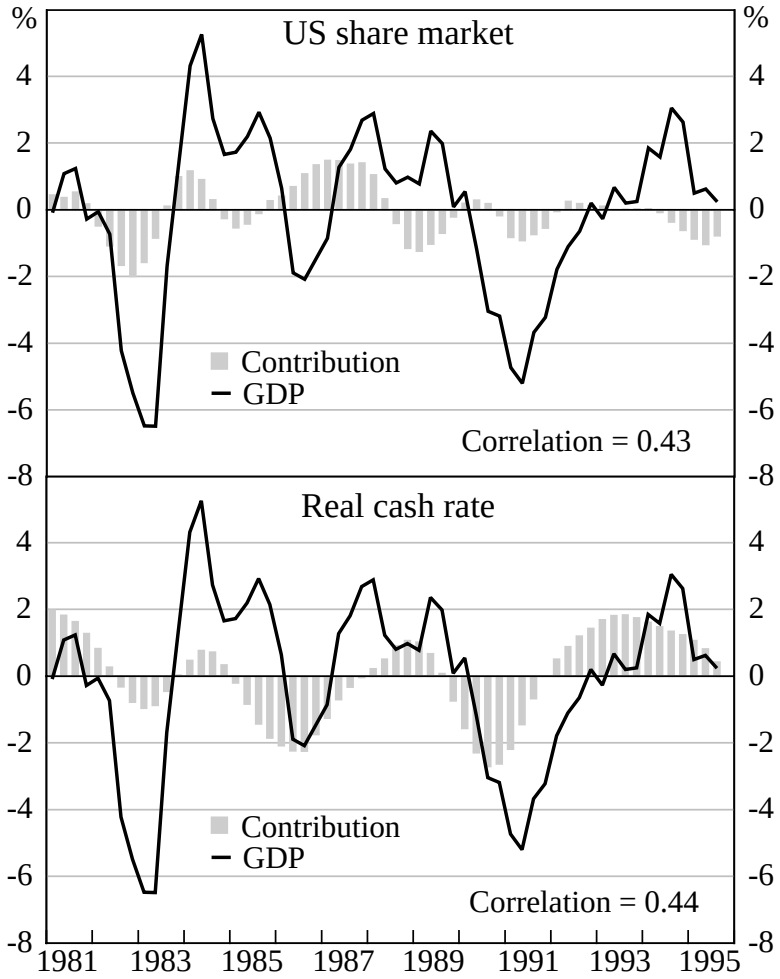
Dependent variable: Log change in Australian GDP

	Lag	Benchmark model	(1)	(2)	(3)
Constant		0.286*	0.331**	0.149	0.303#
		(2.18)	(2.73)	(1.11)	(1.90)
Australian GDP	1	-0.287**	-0.257**	-0.205**	-0.246**
		(-4.21)	(-4.07)	(-2.87)	(-3.33)
US GDP	1	0.345**	0.300**	0.254**	0.289**
		(4.44)	(4.13)	(3.12)	(3.52)
Real cash rate[(b)]	2 to 6	-0.157**	-0.149**	-0.193**	-0.156*
		{0.009}	{0.006}	{0.001}	{0.034}
US GDP (log change)	0	0.452**	0.440**	0.375**	0.428**
		(3.17)	(3.36)	(2.72)	(3.09)
Real share price					
Australia	1		0.019**		0.017#
			(3.17)		(1.74)
United States	1			0.030*	0.005
				(2.58)	(0.28)
Long-run relationship					
US GDP		1.203	1.169	1.237	1.177
Joint significance of US and Australian share markets variables					4.97* {0.011}
Diagnostics of residuals					
$\overline{R}^2$		0.527	0.603	0.577	0.595
LM (1) [(c)]		2.61	0.253	0.101	0.194
		{0.106}	{0.615}	{0.750}	{0.659}
Standard error of equation		0.006	0.006	0.006	0.006
DW		1.59	1.85	1.90	1.87

Notes: (a) Each model was initially estimated with 4 lags of the short-run variables. Insignificant variables were then eliminated following individual exclusion tests. Finally, all the eliminated variables were tested for joint significance and rejected. Numbers in parentheses () are t-statistics and numbers in brackets {} are probability values for the joint test that all the lags can be excluded. The distribution of the t-statistics on the level variables in the models lies between a N(0, 1) and a Dickey Fuller distribution (see Kremers *et al*. 1992). **, *, and # denote significance at the 1%, 5%, and 10% levels respectively.

(b) Real cash rate reported as the sum of the coefficients multiplied by 100.

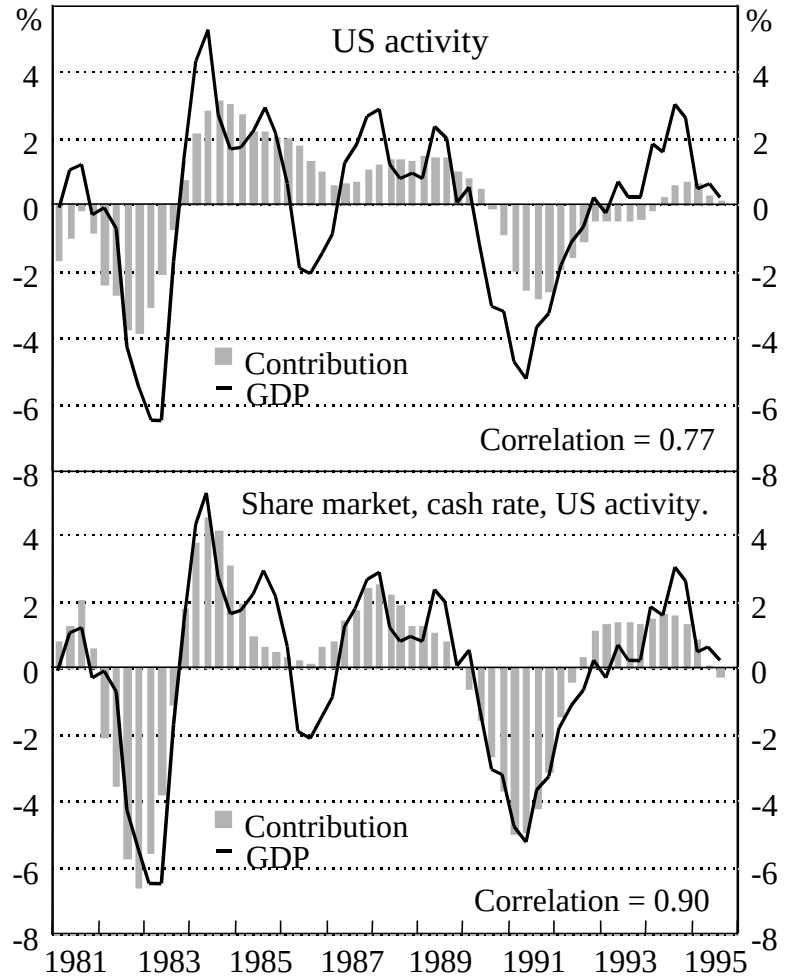
(c) LM (1) is a Lagrange multiplier test for first order autocorrelation.



Notes: The GDP growth rate is the de-meaned four-quarter-ended growth in GDP. The contributions are calculated as follows. Predicted values for GDP growth are calculated using the actual values of the exogenous variables and the predicted level of GDP. Predicted values are also calculated holding a particular exogenous variable to its sample average growth rate or level over the entire sample. The contribution of that exogenous variable is then the difference between these predicted values.

Figure 2a Contributions to Australian Activity

Four-quarter-ended percentage change



Notes: See notes to Table 2a.

Figure 2b Contributions to the Business Cycles

Four-quarter-ended percentage change