An Empirical Search for Linkages between Foreign Direct and Portfolio Investment in Australia

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Paper prepared for the 8th Annual Australasian Macroeconomics Workshop

Hong Kong 2003

Version: 31/3/2003

(Draft only, please do not quote)

Abstract

This paper empirically establishes the relationship between inward foreign direct investment (FDI) and inward foreign portfolio investment (FPI) in Australia. This study is aimed to bridge the gap between the theoretical and empirical literature in that many theoretical studies argue that FDI and FPI substitute or complement each other, while most empirical studies model them independently. Our results show that FDI is cointegrated with GDP and market capitalization (CAP) and so is FPI; however, FDI and FPI are not cointegrated. Notwithstanding, FDI and FPI are found to Granger cause each other in the short run; but the strength of causality running from FDI to FPI is stronger than that running in the opposite direction.

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1. Introduction

For countries that are maneuvering to attract foreign capital in various forms, it is of paramount importance to understand whether and how different kinds of foreign capital inflows affect one another. This paper seeks to examine the relationships between foreign direct investment (FDI) and foreign portfolio investment (FPI) in Australia in the short and long run, respectively.[1]

There exists enormous literature on the determinants and impacts of FDI and FPI. While strands of theoretical literature argue that FDI and FPI substitute or complement each other, most empirical studies model these two types of capital flow independently and, thereby, implicitly assume that they are exogenous to each other. This study is set to bridge this gap between the theoretical and empirical literature.

Furthermore, most research in the area of foreign investments has been in the context of developing economies. Research using OECD data have been few in comparison. This is somewhat perplexing given that OECD economies account for bulk of the foreign investment – as sources and destinations. Research on foreign investments in Australia has been fewer still, despite the fact that the country has been a persistent net importer of foreign capital. In fact, although it has long been recognized that the economic development of Australia has been greatly aided by inflow of foreign capital (Makin 1998), it is only of late that the varying growth impacts of FDI and FPI

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[1] While the literature is crammed with varying definitions of FDI, most convey the same idea. FDI occurs when an investor based in one country acquires an asset in another country with the intent to actively manage that asset. FPI, on the other hand, is a more difficult phenomenon to define. Some authors have distinguished between equity and debt flows and considered only the former as constituting portfolio investments. The Australian Bureau of Statistics (ABS) defines FDI (FPI) as foreign capital that constitutes ownership of 10 percent or more (less than 10 percent) of the ordinary shares or voting stock of an enterprise.

have been evaluated.[2] Further, most research undertaken thus far in the Australian context fail to account for the possible endogeneity and bi-directional causality amongst variables.[3] This paper addresses those issues in a vector autoregression (VAR) framework.

Understanding the relationship (or lack of it) between FDI and FPI is also important from the policy perspective. For instance, it is not uncommon in Australia that state governments use financial incentives to compete for foreign investors. If FPI and FDI are substitutes, then any policy initiatives intended to boost one type of investment need to take into account of the crowding out effect on the other. On the other hand, if the two types of foreign capital are complements, it is equally important to understand the leveraging effect so it can be exploited optimally.

This paper makes several important contributions to the literature of foreign investment. Firstly, it pins down the cointegrating vectors that reveal the long run relationship between FDI and FPI. Secondly, it identifies the short run relationship between FDI and FPI, and offers evidence on the direction and strength of causality. To our best knowledge, this is the first study that empirically establishes the long run and short run relationships between FDI and FPI. Thirdly, the paper involves constructing an extended quarterly dataset for FDI and FPI for Australia dating back to 1973Q2, which will be instrumental to future research in this area.

The rest of the paper is organized as follows: Section 2 provides a brief background on the nature and extent of foreign investment in Australia. Section 3 reviews the literature on the relationship between different types of foreign capital and also identifies other potentially relevant variables to be included in the VAR framework. Section 4 describes data sources and explains the construction of the new dataset for

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[2] See, McLean and Shrestha (2002)

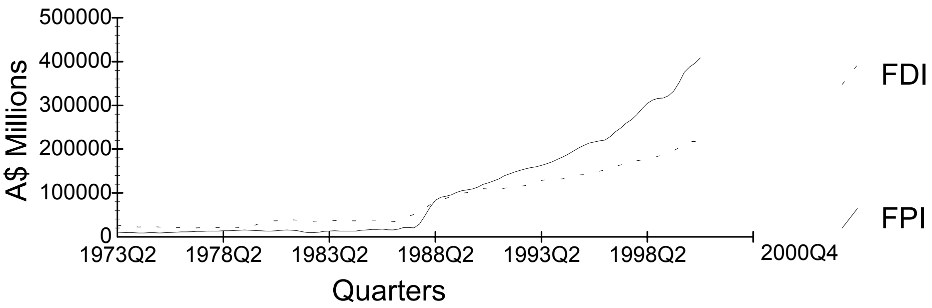
[3] For instance, see Tcha (1999), Yang et al. (2000)

inward FDI and FPI levels. Section 5 discusses the empirical results and section 6 concludes.

2. Foreign Investment in Australia

For most of its history Australia's domestic investment have exceeded its domestic savings. As a result, the economy has been a net receiver of international capital. Figure 1 shows the increasing magnitudes of FDI and FPI over time. The trends in foreign capital inflows to Australia over the second half of the twentieth century can be divided into three distinct periods.

Figure 1



Source: Australian Bureau of Statistics

In the first period of the years after World War II up until the 1970's, most of the mineral resources were being discovered. More investment came by as FDI and volume of FPI was significantly lower than that of FDI. However, since world economies were relatively isolated during those years, foreign investment into Australia was not significant as a percentage of GDP.

The second period covers the early 1970's till the early 1980's. This period was characterized by a major recession in OECD countries, which shrunk the export demand for Australia's resources. The subsequent end of the "resource boom" and lack of prudent financial deregulation initiatives resulted in lower FDI and FPI, when measured as percentages of GDP.

The third period commencing from the 1980's saw Australia undertaking far-reaching financial deregulation. The floating of the Australian Dollar in 1983 and the deregulation of financial markets over the 1980's reduced impediments to international capital flows to and from Australia. As a result, there was a large increase in the magnitude of foreign investment inflows, especially the portfolio one towards the late 1980's. In l988 the level of FPI bypassed that of FDI for the first time in recent history, and the gap between the two has increasingly widened since then. By the year 2000, the level of FPI was almost double that of FDI.

3. Theories of Foreign Investment

Empirical evaluations of the economic impacts of FDI and FPI in Australia have been limited. Using time series data from Australia, McLean and Shrestha (2002) find that the coefficient of FDI was larger than that of FPI in their growth regression. This finding is consistent with the results for other countries; (for instance, see, Hecht et al. 2002). The greater impact of FDI on growth is usually attributed to spillover effects, such as higher R&D expenditures, economies of scale, better corporate governance, increased competition, transfer of knowledge-based assets, and stimulation of domestic savings (Meier 1995; Blomström and Kokko 1998; Borensztein et al. 1998) However, there are very few studies that examine the linkages between the disaggregated components of foreign capital. The literature that exists is mostly theoretical and rarely backed by concrete empirical evidence. Some others merely use case studies or anecdotal events as supporting evidence. More still, the theoretical literature offers varied, and at times even conflicting, hypotheses on the relationship between FDI and FPI. Noteworthy are:

- *The Substitution Hypothesis*. To the extent that a major motivation of cross border investment is risk diversification, investors can achieve the same objective by either investing in multinational corporations (FDI) or in foreign equities (FPI). Recently, Razin and Sadka (2001) suggest that foreign direct investors can skim the good firms at the expense of their domestic or FPI counterparts, owing to their expertise in their respective industries. Using outward FDI and FPI flows data of the US, Ruffin and Rassekh (1986) find that every US dollar FDI results in one less dollar being invested in FPI.

- *The Feedback Hypothesis*. Dunning and Dilyard (1999) assert that the activities of foreign subsidiaries can boost confidence in a sector or in the whole economy, which in turn leads to more FPI. They use the nineteenth century US and the recent experience of Asian and Latin America as examples to argue that, a greater stock of FDI and FPI indicates favorable market environment and, therefore, encourages further inflows of foreign investment.

- *The No Direct Relationship Hypothesis*. Although the co-existence of FDI and FPI is well documented (e.g. see, Wilkins 1999), the presence of a systematic relationship is not unquestionable. For instance, even if the substitution hypothesis can put down a certain relationship of FDI and FPI at the firm level, whether those relationships will uphold at the macro-level is another issue. Further, co-movement between FDI and FPI may merely be due to their simultaneous responses to some common shocks.

In the sections that follow, we try to find out which of the stated hypotheses is supported by the data. The long run relationships are estimated using the cointegration methodology, whereas the short run relationships are identified using Granger non-causality tests and innovation accounting methods. As stated previously, it is possible that both FDI and FPI move together in response to some common shocks. To avoid detecting a spurious relationship between the two types of investments, we include some macroeconomic control variables in the VAR framework:

- *Real Trade Weighted Exchange Rate (TWI)*. There exists sizable empirical evidence that exchange rates matter in explaining capital flows. Nevertheless, the expected sign of the coefficient for TWI is not clear. Some studies show that FDI inflow is facilitated by depreciation of local currency because it will make local assets cheaper for foreign investors (Aliber 1970; 1971; Cushman 1985; Froot and Stein 1991; Klein and Rosengren 1994). On the opposite, some other studies find that FDI inflow is stimulated by appreciation of local currency because it reflects higher expected future profit (Campa 1993; Graham and Krugman 1995).

- *Real Gross Domestic Product (GDP)*. In addition to being an indicator of investment opportunities, GDP indirectly reflects the size of the domestic market. Thus, a larger GDP will attract more *market seeking FDI*. Bajo-Rubio and Sosvilla-rivero (1994) and Razin (2002), amongst others, report a positive and significant coefficient for real GDP. However, Yang et al. (2000), using Australian data, find real GDP to be insignificant in their model of FDI.

- *Total Market Capitalization (CAP).* Market capitalization reflects the capacity of the host economy in absorbing and allocating investment funds. And it is well established that deeper capital markets are more attractive to all types of foreign investments, (e.g. see, Brennan and Cao 1997). The argument is particular applicable to *resource seeking FDI*.

4. The Data

Over time, the flows of FDI and FPI accumulate as FDI and FPI stocks respectively. Changes in the stocks of investments give a clearer picture of underlying trends by eliminating the year-to-year volatility associated with flows. Therefore, we choose to analyze the levels, rather than flows of inward foreign investments. Annual data on levels of FDI and FPI in Australia are available from ABS only from 1980 onwards. The Reserve Bank of Australia (1997) (RBA) has published annual data on FDI and

FPI flows from 1950 to 1996[4]. These two data sources have been combined to compile an annual data set for the years 1972 – 2001. We have used the Lisman and Sandee (1965) (LS) procedure to derive quarterly figures from the compiled annual data.

LS observe that when nothing is known about the pattern and fluctuations of the quarterly figures, one may assume the quarterly figures to be situated on a smooth trend. Determining such a trend is different from an ordinary interpolation problem, because the original figures covering a year do not themselves belong to the trend of quarterly figures. Instead, for each year t, the value of the quarterly figure is considered as a weighted average of the total of the years $t - 1$, t and $t + 1$. We assume the trend a sinusoid and obtain the weighting coefficients accordingly. To test the quality of the LS procedure, we compare the *actual* quarterly data, which are available from 1988Q2 onwards, with the *constructed* one. The coefficients of correlation for FDI and FPI series were 0.9988 and 0.9981 respectively. The levels of the data are also similar. In the following estimations, the constructed figures are used for the period of 1973Q2 to 1988Q1, and actual observations are used for the subsequent quarters. Finally, the two series, which were originally in current prices, are deflated with the deflator for gross private capital formation.

The quarterly GDP expenditure at current prices is sourced from ABS. This series is deflated by the deflator for GDP expenditure to generate real GDP. The real TWI series is constructed by RBA. The total market value of domestically listed equities, deflated with the deflator for gross private capital formation, is used as a proxy of CAP. These data are also sourced from RBA.

Since annual data prior to 1980 are obtained from RBA and those after from ABS, a dummy variable is added to accommodate for the change in data sources. Another dummy variable is included to distinguish the periods prior to the significant upsurge

[4] Australian Economic Statistics 1949–50 to 1996–97**,** Occasional Paper No. 8.

in foreign investment flows (pre-1988) from those after it. Two other dummies are included to account for outliers. Finally, seasonal dummies are incorporated in the VAR to accommodate for the seasonality of GDP.

The final data set used in this study covers the period 1973Q2 to 2000Q4.[5]

5. The Econometric Model and Empirical Results

The empirical framework of this paper is to allow for the endogenity of all considered variables. VAR model has been proved to generate more reliable estimates in an endogenous context (Gujarati 1995). However, the use of VAR is not free from controversies. The concerns mainly focus on the lag length, the problem of being atheoretic and the difficulty of ensuring (jointly) stationarity of all variables included (Shan 2002). The issue with greater lag lengths is that it uses up the degree of freedom. In the present case, this issue has been averted by construction of quarterly figures from annual data. The optimal lag structure of the VAR model is usually determined using some selection criterion such as AIC or SBC. But selection criteria such as AIC and SBC serve more to indicate the 'neighborhood' in which the optimal lag length lies rather than to specify the optimal lag length. In determining the VAR order Pesaran and Pesaran (1997) suggest that one must check the residuals of the individual equations in the VAR for possible serial correlation. To determine the order of the VAR, we begin with an arbitrary lag length of 10 in the unrestricted VAR. The AIC and SBC suggest lag orders 6 and 4 respectively. The six order VAR is adopted, as its residuals are free of serial correlation.

Plots of all the variables used in the analysis as well as the results of unit root testing are reported in the Appendix A. The tests reveal that the variables are non-stationary in their levels but stationary in the first differences.

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[5] 1973Q2 is the first quarter for which data on CAP is available.

5.1 Cointegration Test

We use the procedure developed by Johansen (1988; 1991) and extended by Johansen and Juselius (1990) to test for cointegration in the system of five variables (FDI, FPI, TWI, GDP and CAP). The results, presented in Tables I and II, indicate the presence of two cointegrating vectors.

Table I: λ_{max} Test for Cointegration (Order of VAR: 6)

Null	Alternative	Statistic	95% critical value	90% critical value
$r = 0$	$r = 1$	53.77	33.64	31.02
$r \leq 1$	$r = 2$	41.18	27.42	24.99
$r \leq 2$	$r = 3$	20.02	21.12	19.02
$r \leq 3$	$r = 4$	3.45	14.88	12.98
$r \leq 4$	$r = 5$	.88	8.07	6.50

Table II: λ_{trace} Test for Cointegration (Order of VAR: 6)

Null	Alternative	Statistic	95% critical value	90% critical value
$r = 0$	$r \geq 1$	119.29	70.49	66.23
$r \leq 1$	$r \geq 2$	65.52	48.88	45.70
$r \leq 2$	$r \geq 3$	24.34	31.54	28.78
$r \leq 3$	$r \geq 4$	4.33	17.86	15.75
$r \leq 4$	$r = 5$	.88	8.07	6.50

If a set of variables is cointegrated, the JJ procedure can identify the long run relationships between them in terms of cointegrating vectors. To identify the vectors, it needs to impose certain restrictions, such as normalization and zero parameter values. Since the JJ procedure treats all the variables as endongenous, normalizing on any of the variables produces identical cointegrating vectors. Given the fact that our primary interest lies in FDI and FPI, the two cointegrating vectors are normalized on FDI and FPI respectively.

For each vector a zero restriction is tested on the coefficient of TWI. This is in line with the findings of Dewenter (1995) and Yang et al. (2000) in that the relationship between foreign investment and real exchange rates seem to be neither consistent nor significant. Ernst & Young (2000) also indicate they have seen little evidence of foreign companies seeking out opportunistic investments in Australia because of its weak currency.

The large-scale financial deregulation in the 1980's is a plausible explanation of this result. The low levels of foreign investment during the period preceding the large-scale financial deregulation of 1980's must have led to pent up demand for capital in the economy. This pent up demand and the upsurge of foreign investment after deregulation is likely to swamped out the effects of exchange rates.

When TWI is restricted in the vector normalized on FDI, the coefficient on FPI becomes insignificant. Therefore, we restrict the coefficient on FPI to zero to obtain the over-identified vector (see equation (1) below). The practice of imposing restrictions based on the significance of t-statistic is common in empirical work, albeit it is deemed rather atheoretic. The LR test does not reject the null hypothesis that the restriction holds. Along similar lines, we restrict the coefficient on the TWI variable in the second vector. The coefficient on the FDI variable comes across as insignificant. The LR test for the joint restriction of FDI and TWI being not in the vector is not rejected (see equation (2)).

$$\begin{array}{l} ec1t = FDI - \underset{(0.34)}{0.78}\,GDP - \underset{(0.09)}{0.30}\,CAP \end{array} \tag{1}$$

$$\begin{array}{l} ec2t = FPI - \underset{(0.75)}{1.62}\,GDP - \underset{(0.19)}{0.41}\,CAP \end{array} \tag{2}$$

In conclusion, the over-identified vectors indicate that FDI and FPI are not related in the long run. Therefore, the results support the *no direct relationship hypothesis* discussed previously and, hence, the common practice of treating FDI and FPI separately in the literature.

The cointegration between FDI, GDP and CAP can be interpreted as a long run relationship. Since all variables are in logarithms, the results suggest that a one-percent increase in GDP is associated with a 0.78 percent increase in FDI in the long run, whereas a one-percent increase in CAP is associated with a 0.30 percent increase in FDI. Such a steady state relationship can be motivated as follows. A larger market size for the host economy attracts more FDI, especially the market seeking ones; and greater depth in capital markets also attracts more FDI, particularly the resource seeking ones. On the other hand, by contributing to capital formation and associated externalities, FDI will raise the level of CAP and GDP in the host country. The finding of a positive and significant relationship between GDP and FDI is in well line with many other studies in the literature (e.g. see, Tsai 1994; Billington 1999; Chakrabarty 2001).

The results from the second vector imply that one-percent increases in GDP and CAP are associated with 1.62 percent and 0.41 percent increases in FPI, respectively. Again, there already exists substantial empirical evidence suggesting that GDP is an important determinant of FPI and vice versa. It is also well known that flows of FPI are closely linked to stock market size in recipient countries. The implications of the second vector are, therefore, in conformity with apriori expectations and past studies. The long run relationship between FPI, GDP and CAP can be motivated along the same line as that between FDI and the latter two variables.

If we normalize both the vectors on GDP, the coefficients on FDI and FPI will be 1.28 and 0.62 respectively. The result shows support to the theoretical argument that FDI has greater growth impacts relative to FPI because of spillover effects. It is also in line with the conclusion reached by McLean and Shrestha (2002) mentioned in section 3.

It may be recalled that the reported results have been arrived at under the assumption that all variables included in the VAR, namely, FDI, FPI, GDP, TWI and CAP are endogenous. While this assumption can be justified on theoretical grounds, it is yet to be empirically validated. A significant coefficient of the error correction term indicates that the concerned variable adjusts to deviations from the long run equilibria and is, therefore, not weakly exogenous. Equivalently, a low p-value serves to reject the null hypothesis of exogeneity. Based on the reported p-values in Appendix B, the classification of FDI, FPI, GDP, TWI and CAP as endogenous seems appropriate.

5.2 Granger Non-Causality Test and Innovation Accounting

While the presence of cointegrating relationship(s) implies causality, it does not reveal information on the direction or strength of causality. The direction of causality may be identified using the Granger non-causality tests and the strength using innovation accounting methods.

The procedure developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) are adopted to test for Granger non-causality. This procedure utilizes a modified Wald (MWALD) test for restrictions on the parameters of a VAR(*k*), where *k* is the lag length in the system. This test has an asymptotic Chi-Squared distribution when a VAR(*k* + *dmax*) is estimated, where *dmax* is the maximal order of integration suspected to occur in the system. This procedure is preferred to other alternative procedures when the main purpose is to test for Granger non-causality because it avoids pre-testing for cointegration, and has a high power of the test in moderate to large samples (Zapata and Rambaldi 1997; Yamada and Toda 1998). The results of the Granger non-causality test are shown in Table III:

Table III: p-values associated with the Wald χ^2 statistic for the Null Hypothesis of Granger Non-Causality

Variable ←	FDI	FPI	GDP	TWI	CAP
FDI	----	0.00000	0.00170	0.03698	0.02743
FPI	0.00000	----	0.03836	0.00452	0.00000
GDP	0.19007	0.41697	----	0.00502	0.00004
TWI	0.28579	0.08676	0.60608	----	0.15927
CAP	0.00147	0.01880	0.17214	0.00048	----

Legend: ← denotes the direction of causality.

The results reveal bi-directional causality between FDI and FPI. This indicates that FDI and FPI contain information on the future movements of each other. It is clear from the previously identified cointegrating vectors that FDI and FPI are not causally related in the long run. This “seeming” contradiction between the short run and long run results is discussed later.

The motivation for the steady state relationship between FDI/FPI and GDP revolved around a bi-directional causal relationship between the variables. Empirical evidence from the Granger non-causality tests, however, indicates the presence of uni-directional causality running from GDP to FDI/FPI. This simply implies that GDP contains information on the future movements of FDI/FPI in the short run but not the other way round. Notwithstanding, this cannot be construed to mean that FDI and FPI are not important as determinants of growth. It is common in the literature to assume a one-way causality running from FDI to GDP.[6] The “reverse result” obtained in this paper underlines the importance of accounting for endogeneity in such research. In comparison, Yang et al. (2000) find GDP to be insignificant in their study on the determinants of FDI in Australia. This is clearly in contrast with both the long run and short run empirics observed in this paper.

Exchange rate is highly responsive to any “news”; consequently, one would expect TWI to contain information on the movements of other macro-economic variables. The results obtained are in accordance with such expectations –in that TWI Granger causes FDI, FPI, GDP and CAP. However, none of those variables contains significant information on the future movements of TWI. The result is consistent with the efficient market hypothesis.

Consistent with the long run relationship, CAP has a bi-directional causal relationship with FPI and FDI. This indicates that the depth of the capital market contains information about the future movements of FDI and FPI, and both types of foreign investments serve to predict CAP.

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[6] This has been noted and criticised in more recent studies (Shan, 2002).

Dynamic analysis of VAR models can be conducted using innovation accounting methods such as forecast error variance decomposition (FEVD) and impulse response functions (IRF). For instance, we can use the FEVD method to break down the variance of the forecast error for FDI growth into components that can be attributed to each of the endogenous variables, FPI, GDP, TWI and CAP. If, say, FPI explains more of the variance of the forecast error for FDI, then one can establish the hypothesis that FPI causes FDI growth. Similarly, the varying impacts of FDI and FPI on GDP can be evaluated by comparing their contributions to the variance in the forecast error of GDP.

Appendix C tabulates and plots the results of the FEVD analysis. The results from FEVD analysis are expectedly similar to the findings of the Granger non-causality tests. Bi-directional causality between FDI and FPI in Australia is reaffirmed. The roles of FDI and FPI in explaining inward FPI and FDI changes respectively is surpassed in importance only by "own" and CAP shocks. However, it is important to note that the strength of causality running from FDI to FPI is different from that running in the opposite direction. While FDI explains nearly 25%-30% of the FEVD of FPI, FPI explains only about 7.5% of the FEVD of FDI. It is also noteworthy that FDI and FPI explain the majority of their past values (in terms of forecast error variances). This means that both FDI and FPI exhibit a strong lag effect.

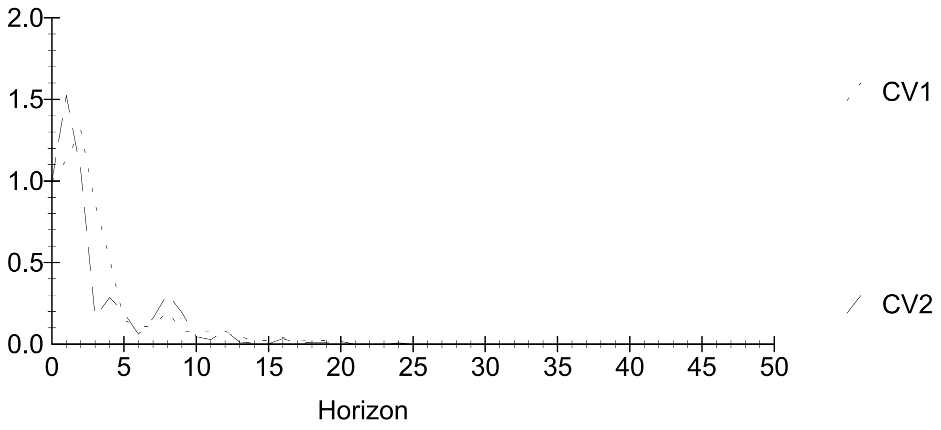
Consistent with the Granger non-causality tests, GDP shocks explain 30%-33% and 8%-10% of the FEVD of FDI and FPI respectively. However, this indicates that while GDP may be used in forecasting FDI, one may be better off using FDI rather than GDP to predict FPI. The causality running from FDI to GDP is weak with FDI shocks explaining merely 3% of the FEVD of GDP. The causality from FPI to GDP is marginally stronger with shocks to FPI explaining about 6% of the FEVD of GDP.

The FEVD of the sequences due to own shocks of all variables, excepting TWI, are found to be decaying through time. The proportions of movements due to own shocks are found to be higher at shorter horizons (almost hundred percent) and lower at longer horizons. But in case of TWI, the proportions of movements due to own shocks are persistently high at about 80% level. This is consistent with several other studies in this area (e.g. see, Kamin and Rogers 2000). FEVD analysis also suggests that TWI explains a reasonable proportion of the FEVD of FDI (25%) and CAP (22%). This is in conformity with the evidence from the Granger non-causality test. However, TWI shocks do not seem to explain the FEVD in FPI and GDP, which contrasts with the results from the Granger non-causality tests. Also in contrast with the Granger non-causality tests is the modest strength in the causality running from FDI, FPI and CAP to TWI.

Impulse response function is an efficient tool to determining the stability of traditional VAR models by illustrating how fast the effect of a shock dies out. However, in a cointegrating VAR model the impulse response coefficients for individual variables do not converge to zero. Lee and Pesaran (1993) suggest an alternative approach that considers the variable-specific shocks on the cointegrating relations rather than on individual variables. Pesaran and Shin (1996), on the other hand, consider the effect of system-wide shocks or the persistence profiles for the cointegrating relations. The validity of a cointegrating vector is measured by the speed in which the profile converges to zero.

Figure 2 plots the persistence profile of the effect of a system-wide shock. The effects of disappear over time in both the cointegrating relations. This confirms the validity of the cointegrating relations and, hence, the stability of the long run relationships between the variables. The estimates arrived at indicate that it takes about 10 quarters for 95% of the adjustments to be completed. The conclusion holds equally for both of the estimated cointegrating relations.

Figure 2



Legend: CV - Cointegrating Vector

5.3 Reconciling The Long Run and Short Run Results

Empirical results obtained herein clearly indicate that the relationship between FDI and FPI changes across the time horizon. While the two types of investments are not related in the long run, they Granger cause each other in the short run. Furthermore, the strength of such detected causality is stronger when running from FDI to FPI than in the opposite direction. These apparently disjointed findings in fact can be explained in a coherent framework.

Both FDI and FPI, though to varying extents, convey information on the economic conditions of the host country, such as investment opportunities and business environment. By acting as information channels, they contribute to the reduction of information-related transaction costs. Notwithstanding, to the extent that GDP is sluggish in adjusting to the changes in the economic environment, there exists possibility for other variables, including FDI and FPI to convey the new economic information. CAP, on the other hand, is expected to respond much more swiftly.

However, while CAP Granger causes FPI, it does not cause FDI. This may be because CAP denotes only the size of the stock market and while FPI is typically routed through stock market transactions, FDI is not. In conclusion, the bi-directional causality between FDI and FPI in the short run is merely a reflection of their responses to some common shocks. In the long run, broader macroeconomic indicators can more fully reflect such information and, thus, the predictive power of FDI and FPI with respect to each other diminishes significantly.

Secondly, in the FEVD analysis it was observed that the causality running from FDI to FPI is stronger than that running from the opposite direction. This can also be explained within the information channel framework. A key difference between FDI and FPI is that, for the same investment target, the former incurs higher transaction costs and lower asset liquidity than the latter. This means that direct investors need to be relatively more active in acquiring information than their counterparts. So, FDI flow will be more informative about the economic condition of a host economy than FPI one. Nonetheless, to the extent that direct investors do not privatize their acquisition targets, e.g., for risk diversification reasons, it opens up the possibility for portfolio investors to free ride on their endeavor. Consequently, the causality running from FDI to FPI will be stronger than that running in the opposite direction.

A drawback of the above explanation is that if FDI and FPI can convey economic information when GDP and CAP yet fully adjust, one would expect them to Granger cause both GDP and CAP. However, while FDI and FPI Granger cause CAP, they do not Granger cause GDP. We suspect that in the short run GDP is influenced by many other factors not included in the model, which dwarf the impacts of FDI and FPI.

6. Concluding Remarks

The objective of this study was to evaluate the nature of the relationship between inward FDI and FPI in Australia. The Australian economy has been relying on foreign capital to finance domestic investment. While it is known that both federal and state governments have used incentives to attract foreign investors to various extents, the policies are far from transparent. Understanding the linkages (or lack of it) between FDI and FPI will instrumental to the development of economically justifiable incentive schemes in relation to foreign investments.

We have constructed a quarterly data set covering the period of 1973Q2 to 2000Q4, which is more extended than those used in previous studies. Cointegration tests, Granger non-causality tests and innovation accounting have been deployed to identify the relationships between FDI, FPI and three other macroeconomic variables: GDP, CAP and TWI. Two cointegrating vectors have been identified – one normalized on FDI and the other on FPI. Two economically interpretable vectors were obtained after restricting certain coefficients to be zero. While the restrictions were justified by the LR tests, the validity of the cointegrating relationships was verified by means of persistence profiling.

The two vectors indicate that there exist two long run relationships: one between FDI, GDP and CAP; the other between FPI, GDP and CAP. However, FDI and FPI are found to be unrelated in the long run. This validates the common practice in the literature of treating FDI and FPI independently. Furthermore, when the vectors are normalized on GDP, the coefficient of FDI is much larger than that of FPI, suggesting that FDI is associated with greater spillover effects than its FPI counterpart. The use of Granger non-causality tests and FEVD analysis yield a very different picture of the short run dynamics among the variables. Most importantly, FDI and FPI were found to Granger cause each other in the short run; but the strength of causality running from FDI to FPI is stronger than that running in the opposite direction. We believe that the short run Granger causality between the two capital flows is merely a manifestation of their common responses to some exogenous changes. In the long run, GDP and CAP can fully reflect those changes and, therefore, FDI and FPI cease to convey any additional information regarding each other’s movement.

From the policy perspective, the findings seem to suggest that incentive schemes to attract to FDI and FPI can be considered independently. Obviously, the economic merit of those schemes is another issue. Moreover, since this study focuses on Australia only, whether such a conclusion can be generalized to other countries is an open question. In this regard, a natural extension of this research is to examine whether similar relationships between FDI and FPI exist amongst other OECD countries. Secondly, the study looks at inward foreign investment only. Nonetheless, inward and outward foreign investments coexist not only at the aggregate economy level, but also at the industry level. Therefore, a more general paradigm for foreign investments should incorporate both inward and outward, as well as direct and portfolio investments.

Appendix A.

The Data and the Time Series Properties of the Data

Figure I

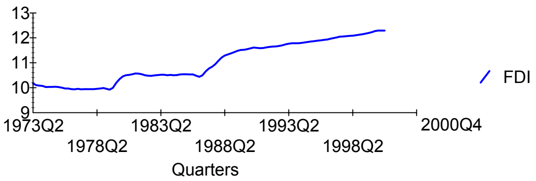


Figure II

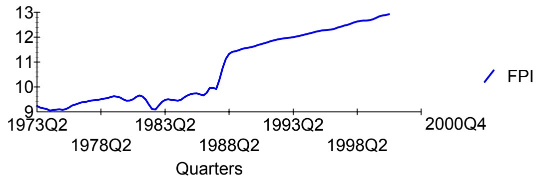


Figure III

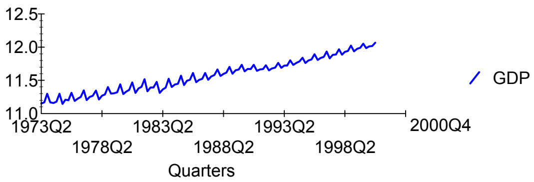


Figure IV

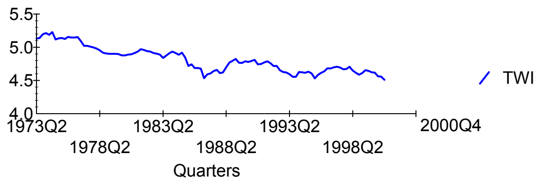
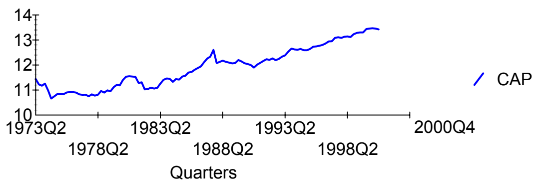


Figure V



Note: FDI, FPI, GDP and CAP are in Millions of Australian Dollars. For TWI (March 1995 = 100), an increase in the index indicates an appreciation of the Australian dollar.

Table I: The ADF Test for Unit Roots in the Levels of Variables

Series	t statistic	Comment
FDI	-2.7448 (3)	Not I (0)
FPI	-1.7078 (4)	Not I (0)
GDP	-2.7822 (4)	Not I (0)
TWI	-2.6933 (1)	Not I (0)
CAP	-3.3745 (1)	Not I (0)

Table II: The ADF Test for Unit Roots in the First-Differences of Variables

Series	t statistic	Comment
DFDI	-3.6028 (2)	I (0)
DFPI	-4.5844 (3)	I (0)
DGDP	-4.8440 (3)	I (0)
DTWI	-7.3351 (1)	I (0)
DCAP	-7.7728 (1)	I (0)

Notes:

- Numbers in parentheses corresponding to ADF t statistics are the optimal lags as specified by Schwarz's Bayesian criterion (SBC).
- Critical values for t-statistics with constant and trend at 5% and 10% significance levels are -3.45 and -3.15 respectively.

Table III: The KPSS Test for Unit Roots in the Levels of Variables

Series	KPSS statistic	Comment
FDI	0.1232 (8)	Not I (0)
FPI	0.1686 (9)	Not I (0)
GDP	0.1501 (10)	Not I (0)
TWI	0.1627 (8)	Not I (0)
CAP	0.1360 (8)	Not I (0)

Table IV: The KPSS Test for Unit Roots in the First-Differences of Variables

Series	KPSS statistic	Comment
DFDI	0.1043 (6)	I (0)
DFPI	0.1185 (4)	I (0)
DGDP	0.0610 (13)	I (0)
DTWI	0.0414 (6)	I (0)
DCAP	0.0779 (2)	I (0)

Notes:

- The numbers in parentheses corresponding to KPSS statistics are the Newey-West bandwidths arrived at using Bartlett kernel.

- Appropriate critical values at 5 and 10% are 0.146 and 0.119 respectively.

It must be noted that unit root tests are biased towards the non-rejection on unit root in the presence of structural breaks in the data generating process. We have used the Zivot and Andrews (1992) (ZA) test to account for the possible bias in unit root tests as a consequence of a structural break. The results of the ZA tests were not able to reject the unit root hypothesis for any of the variables.

Appendix B

Estimated matrix of adjustment coefficients (p-values in parentheses)

Equation	Error-correction term	
	$ecm1_{t-1}$	$ecm2_{t-1}$
DFDI	-3.8574 [0.000]	0.4118 [0.682]
DFPI	-1.3956 [0.167]	-3.4099 [0.001]
DGDP	2.9532 [0.004]	-2.2678 [0.026]
DTWI	1.2109 [0.230]	-1.9581 [0.054]
DCAP	0.3060 [0.760]	1.9940 [0.050]

Appendix C. Forecast Error Variance Decomposition (%)

Table 1. Variance decomposition percentage of one-year error variance (%)

Typical Shock in	Percentage of FEV in				
	FDI	FPI	GDP	TWI	CAP
FDI	74	4	1	12	21
FPI	12	77	0	2	24
GDP	26	3	67	2	22
TWI	23	0	1	83	14
CAP	10	15	2	4	80

Table 2. Variance decomposition percentage of two-year error variance (%)

Typical Shock in	Percentage of FEV in				
	FDI	FPI	GDP	TWI	CAP
FDI	60	10	3	13	26
FPI	10	56	1	7	25
GDP	32	6	58	2	32
TWI	27	0	0	80	16
CAP	11	18	1	8	56

Table 3. Variance decomposition percentage of five-year error variance (%)

Typical Shock in	Percentage of FEV in				
	FDI	FPI	GDP	TWI	CAP
FDI	30	24	3	11	37
FPI	7	47	5	8	37
GDP	31	9	56	1	37
TWI	26	1	0	80	21
CAP	6	24	1	11	46

Figure I: Generalized Forecast Error Variance Decomposition for Variable FDI

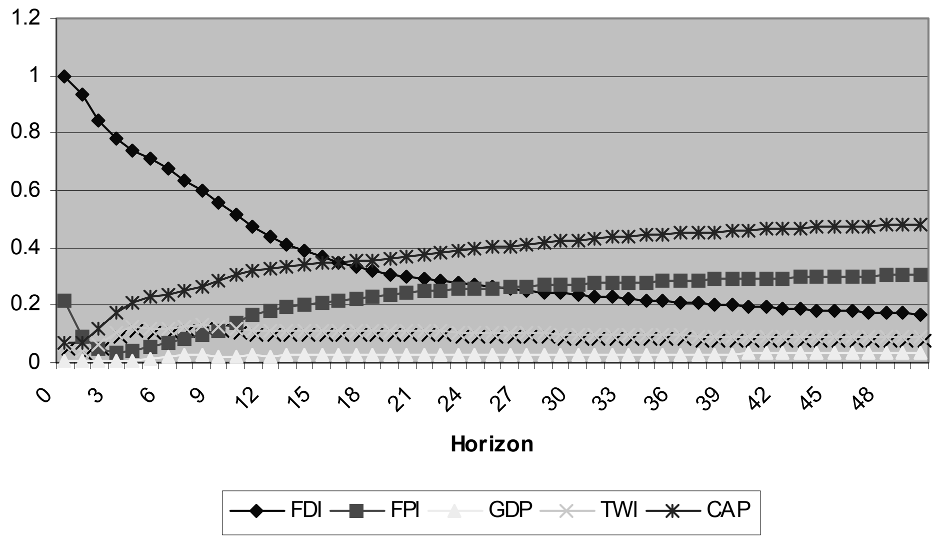


Figure II: Generalized Forecast Error Variance Decomposition for Variable FPI

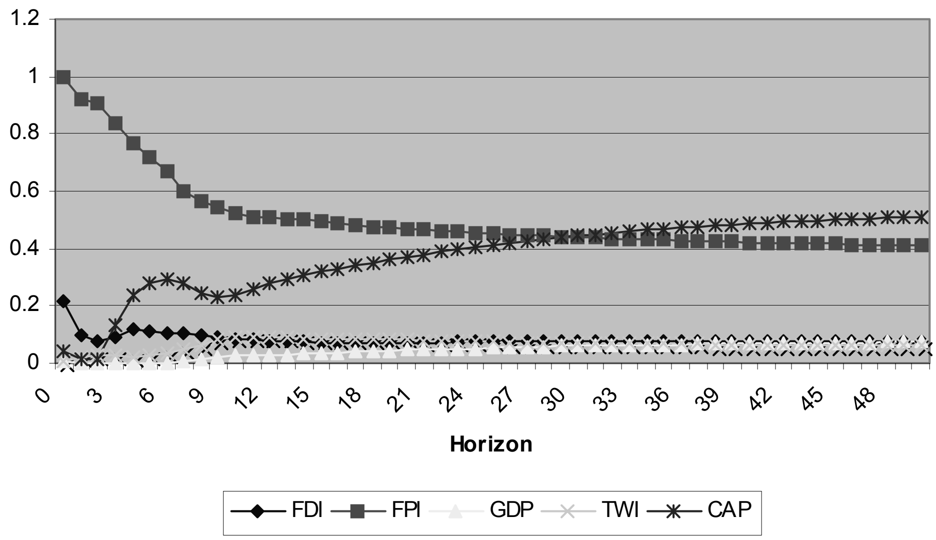


Figure III: Generalized Forecast Error Variance Decomposition for Variable GDP

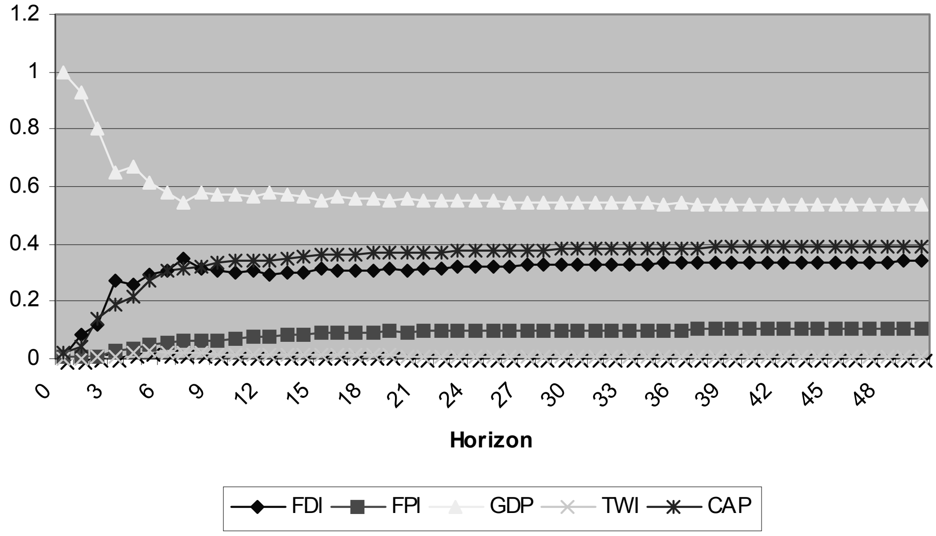
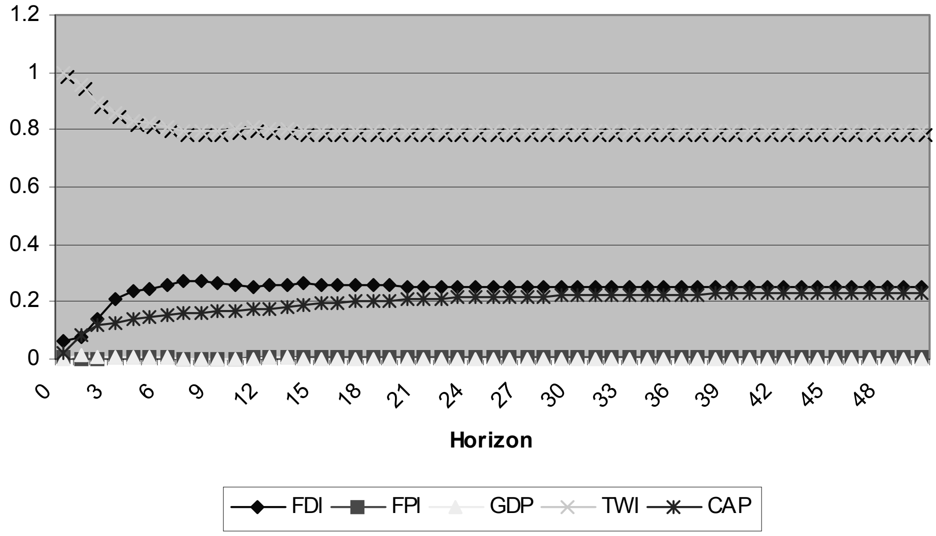


Figure IV: Generalized Forecast Error Variance Decomposition for Variable TWI



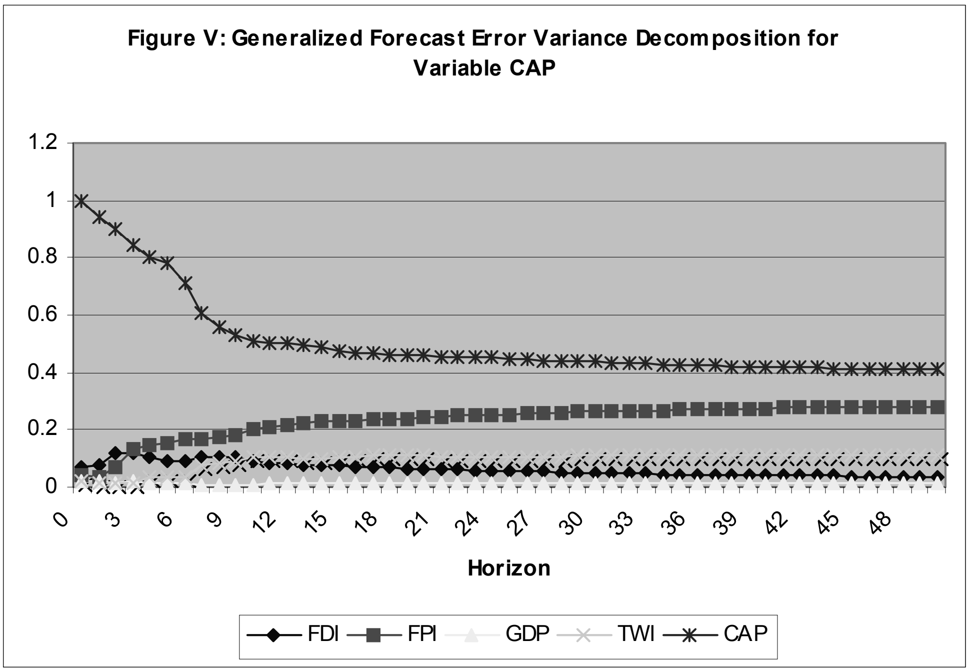


Figure V: Generalized Forecast Error Variance Decomposition for Variable CAP
1.2
1
0.8
0.6
0.4
0.2
0
0
3
6
9
12
15
18
21
24
27
30
33
36
39
42
45
48
Horizon
FDI
FPI
GDP
TWI
CAP

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