A Note on Australia's Inward and Outward Direct Foreign Investment

by

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Abstract

This paper investigates the determinants of Australia's inward and outward Direct Foreign Investment using annual and quarterly data. It is found from pooled annual data for Australia and seven developed countries that DFI has been influenced by labor disputes, current account balances, Australia's real GDP and real exchange rates. The application of an econometric model using quarterly data shows that the elasticities of DFI with respect to real exchange rates and labor disputes are significant for selected cases.

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1. Introduction

The growth of direct foreign investment (DFI) after the Second World War has generated a large volume of literature. Agarwal (1980) even asserted that the growth of DFI had been exceeded by the growth of publications dealing with this topic. While most studies of the determinants of DFI have concentrated on the impact of economic variables (such as profits, GDP and/or GNP, current account balance, wage level and productivity, and exchange rates), some researchers have considered other variables such as political instability (e.g., Bennett and Green, 1972) and terrorism (e.g., Enders and Sandler, 1996). The possibility that investors regard a stable industrial relations climate as an important factor has also been pointed out by some researchers. Bennett and Green (1972), Schneider and Frey (1985), Lucas (1993), Tcha (1997a,b) are some of a few who have constructed theoretical models or empirically tested the relationship between labor disputes and DFI.

In this paper, various kinds of data are used to analyze Australia's inward and outward DFI. The impact of labor disputes, among other variables, on Australia's DFI is investigated using econometric models. It is a general consensus that unions are influential economic agents in the Australian economy. However, Miller and Mulvey (1993) pointed out that there has been very little quantitative analysis of the economic impact of their activities, suggesting that the research in this paper has the potential to make a substantial contribution to the understanding of the way labor markets function in Australia. In addition to labor disputes, the role of exchange rates in determining DFI is also investigated. The impact of exchange rates on DFI has been controversial, though some studies with US data such as Caves (1989), Froot and Stein (1991) and

Dewenter (1995) report that a depreciation of dollar is associated with higher flows of DFI into the nation.

2. Methodology, Data and Estimation

Two econometric methods are used due to the lack of data: a data-pooling analysis using annual data for 1980-1993 and a long-run elasticity analysis using quarterly data for 1985-1995. The definition of DFI employed by the Australian Bureau of Statistics changed in 1985, which made it difficult to construct a consistent data base that included observations prior to 1985. The new definition was taken into account and, according to the new definition, annual DFI data were reconstructed by the ABS only for 1980-1984. As only 14 observations (1980-1993) are available for Australia's DFI with each country, it is necessary to pool data for DFI flows between Australia and some countries. This study uses Australia's annual DFI figures transacted with six major developed countries which account for the largest shares of Australia's DFI: the US, Japan, the UK, New Zealand, Canada and Germany. This analysis will show which variables are important in determining Australia's inward and outward DFI.

Quarterly DFI data provide more observations, however, the quarterly data prior to 1985 were not reconstructed using the new definition of DFI. Therefore 42 observations (1985-1995) were available for the analysis. Using the quarterly data, this paper focuses on the impact of two selected variables - labor disputes and exchange rates - by investigating the long-run elasticities of DFI with respect to the two variables. For labor disputes, two measures were used: the number of strikes

(TNS) and total number of working days lost (WDL), which represent the frequency and duration of labor disputes respectively.

2.1 Data-Pooling Analysis

Australia's inward and outward DFI with the six developed countries for 1980-1993 are pooled together. For Australia's investment abroad, the DFI function to be estimated is:

$$\begin{aligned}
 (1) \quad RAIA = & a_0 + a_1 RER + a_2 ERSD + a_3 ARCA + a_4 XRGP + a_5 XRWG \\
 & + a_6 XLD + a_7 RGDP + a_8 DMNZ + a_9 DMCN + a_{10} DMUK \\
 & + a_{11} DMJP + a_{12} DMGM
 \end{aligned}$$

where RAIA is Australia's investment abroad, a_0 is a constant, a_j is a coefficient for the j th independent variable, RER is the real exchange rate between Australia and a relevant country considering different purchasing powers, ERSD is the volatility of exchange rates measured by the standard deviation, ARCA is Australia's current account balance, and XRGP, XRWG and XLD are respectively the ratio of real GDP per capita, the ratio of real wages and the ratio of labor disputes between Australia and a relevant country. RGDP is real GDP for each destination country. Dummy variables are used for New Zealand (DMNZ), Canada (DMCN), the UK (DMUK), Japan (DMJP) and Germany (DMGM)¹.

¹ Therefore, any significant coefficient suggests that Australia's DFI to the country be different from that to the US. The same argument applies to foreign DFI into Australia.

For the six countries' DFI into Australia (RFIA), the DFI function to be estimated is:

$$\begin{aligned}
 (2) \quad RFIA = & b_0 + b_1 RER + b_2 ERSD + b_3 RCAB + b_4 XRGP + b_5 XRWG \\
 & + b_6 XLD + b_7 AGDP + b_8 DMNZ + b_9 DMCN + b_{10} DMUK \\
 & + b_{11} DMJP + b_{12} DMGM
 \end{aligned}$$

where b_0 is a constant, b_j is a coefficient for the j th independent variable, RCAB and is a foreign country's current account balance and AGDP is Australia's real GDP. All variables in (1) and (2) are converted into real terms using 1990 as a base year. The DFI, figures are in million dollars, while ARCA, RCAB and GDP figures are in billion dollars.

Tables 1 and 2 summarize the results of the data-pooling analysis using the OLS method. Table 1 shows that the variables RER and ARCA appear to be significant in determining Australia's DFI when used with either labor dispute measure. The coefficient for real exchange rates suggests that when the Australian currency is appreciated by one unit, its DFI increases by 5.6 to 5.7 million dollars. The current account balance in Australia has a significant and negative relationship with DFI. A million dollar increase in Australia's current account deficit is associated with 73-75 thousand dollar increase in its DFI to foreign countries. Real GDP of Australia is marginally significant (at the 10% level) in the estimating equation with the ratio of the number of strikes. The ratio of working days lost between Australia and destinations is not significant while the ratio of the number of strikes appears to be significant. An increase in GDP in destination countries encourages Australia's DFI into the country.

A relative increase of strikes in Australia compared to destination countries is found to contribute to increase Australia's outward DFI. All the coefficients for dummy variables are insignificant, implying that the determination of Australia's outward DFI does not significantly vary across different countries.

Foreign countries' DFI into Australia has been affected by only two variables: real exchange rates and foreign countries' current account balances, as shown in Table 2. The coefficients for real exchange rates range from -5.4 to -5.7, explaining that a unit appreciation of the Australian currency against the foreign currencies induces a decrease in inward DFI by about 5.4 to 5.7 million dollars. It is noteworthy that the increase of Australia's DFI by the appreciation of the Australia's currency and the decrease of inward DFI by the appreciation of the Australia's currency are considerably similar. The foreign country's current account balance has a negative relationship with DFI. It is found that the marginal increase in foreign countries' DFI into Australia by the increase in their current account deficit is remarkably small compared to the increase in Australia's outward DFI responding to the increase in its current account deficit. Neither of the labor dispute variables significantly explains DFI into Australia. While several other countries have DFI patterns similar to that with the US, dummy variables for Canada and Japan indicate that these two countries' DFI into Australia is significantly different from that of the US.² The results indicate that *ceteris paribus* Canada's DFI and Japan's DFI into Australia are respectively lower and higher than the US and other three countries'.

² For RFIA, regression considering random effects may be more appropriate as some countries appeared to be different from others. Thus, the model was re-estimated under the assumption of random effects in disturbance terms. It was found that a random effects model reduces the fit of the model to the extent that no variables are significant. The results are available on request from the author.

2.2 Long-Run Elasticities Analysis

The previous analysis using pooled annual data shows that real exchange rates, the real current account balance, Australia's real GDP and labor disputes affect Australia's inward and outward DFI. This section analyzes the long-run effects of two selected variables: real exchange rates and labor disputes³. This study applies the model previously used in Sjaastad (1997) and Sjaastad and Tcha (1997), because of its simplicity, convenience and rigor, especially when long-run elasticities are sought for. This model is described as follows:

$$\begin{aligned}\Delta \ln DFI_t = & C - \sum_{j=1}^n a_j \Delta \ln DFI_{t-j} + a_{n+1} \ln DFI_{t-n-1} \\ & + \sum_{j=0}^n b_j \Delta \ln RER_{t-j} - b_{n+1} \ln RER_{t-n-1} + \sum_{j=0}^n d_j \Delta \ln LD_{t-j} - d_{n+1} \ln LD_{t-n-1}\end{aligned}$$

where DFI is direct foreign investment, C is a constant and α , β and δ are parameters to be estimated. The prefix $\ln$ denotes that variables are in natural logarithms and a Δ denotes the first difference. Being similar to an error correction model, the above equation has the merit that long-run elasticities of DFI with respect to exchange rates (η_E) and labor disputes (η_L) are directly obtained from the estimation as

³ The author accepts the possibility that this model, based only on two variables, may not be free from problems arising from misspecification. Considering the results from the previous analysis using annual data, it would improve the reliability of the model if the current account balance and real GDP could be included. However, at the risk of getting biased estimators, only the first two variables are included as (i) the number of observations (42) used in this study limits the number of variables to be included for reliable results, and (ii) it is difficult to obtain quarterly data for various countries' current account balances consistently throughout the period. This problem will be resolved once more observations are accumulated on a consistent basis.

$$\eta_E = \beta_{n+1}/\alpha_{n+1} \quad \text{and} \quad \eta_L = \delta_{n+1}/\alpha_{n+1}^4.$$

To apply the model, a modification is necessary because, even in gross terms, occasionally Australia recorded negative DFI. A positive constant κ which makes $(DFI+\kappa)$ always positive is added onto DFI to generate sensible logarithmic values $\ln(DFI+\kappa)$. In this case, the elasticity η_E (or η_L) is not directly derived from the ratio of coefficients β_{n+1}/α_{n+1} (or $\delta_{n+1}/\alpha_{n+1}$) because the ratio β_{n+1}/α_{n+1} (or $\delta_{n+1}/\alpha_{n+1}$) measures the sensitivity of $(DFI + \kappa)$ rather than that of DFI.

The relationship between the coefficient ratio β_{n+1}/α_{n+1} and the elasticity is

$$\beta_{n+1}/\alpha_{n+1} = d\ln(DFI+\kappa)/d\ln(RER) = [(DFI)/(DFI+\kappa)] \eta_E.$$

Therefore the elasticity of DFI into (or out of) Australia with respect to the exchange rate is

$$\eta_E = [\beta_{n+1}/\alpha_{n+1}] [(DFI+\kappa)/(DFI)],$$

and the elasticity of DFI into (or out of) Australia with respect to labor disputes is

$$\eta_D = [\delta_{n+1}/\alpha_{n+1}] [(DFI+\kappa)/(DFI)].$$

⁴ Sjaastad (1997) proved that the coefficients for RER_{t-n-1} and LD_{t-n-1} can be decomposed into the elasticity and α_{n+1} .

In the empirical analysis, quarterly data from 1985 (Q3) to 1995 (Q4) were used⁵. DFI into Australia was categorized by selected origin countries (or groups) and industries as well as the total amount, while for Australia's outward DFI, only the total amount was used due to limits on the data. Exchange rates used are between the Australian currency and three major currencies - the US dollar, Japanese yen and the UK pound⁶ - to find which currency is influential on Australia's inward and outward DFI. All exchange rates were converted into real terms considering different purchasing powers between countries, using 1990 (Q2) as a base period. When investigating inward DFI by industry, economy-wide total number of working days lost (WDL2) is used as well as the number of working days lost in each industry (WDL1) and the economy-wide number of strikes (TNS), because the DFI decision for a certain industry in Australia can be affected by the country's overall reputation.

Four lags were chosen ($n=4$) as they provided the best fit and eliminated serial correlation. Also, one year is considered to be long enough for shocks to influence the DFI decision.

Tables 3 to 5 show the results of estimation. Only elasticities are listed as all other coefficients are economically meaningless⁷. Table 3 shows the elasticity of Australia's total outward DFI with respect to each exchange rate and labor disputes. The elasticities with respect to WDL appear to be significant for all exchange rates,

⁵ It is controversial whether we have to examine the stationarity of variables when the number of observations is relatively small (for example, Enders(1995) pointed out the potential problem that arises from the small number of observation when adopting the (Augmented) Dickey-Fuller test). In this study the number of observations is 42, which may not be large enough considering that the Dickey-Fuller test is based on an asymptotic property. However, the model adopted in this study anyway deals with I(1) variables by using the first difference.

⁶ The German mark may be regarded as a major currency. In this study, as the data for DFI between Germany and Australia were not continuously collected, the German mark was not included in analysis.

⁷ More detailed estimation results are available from the author on request.

ranging from 0.90 to 0.97, while the elasticity with respect to TNS was significant only when the exchange rate between the Japanese yen and the Australian dollar (yen/\$A) was included in the estimating equation. A 1% increase in Australia's WDL causes 0.90 - 0.97% increases in the nation's outward DFI. The elasticity with respect to TNS appears to be greater than that with WDL, however, the former is significant in one case only.

Exchange rates in general appeared to be insignificant, except the yen/\$A when the estimation equation included TNS as a labor disputes measure. The result implies that a 1% appreciation of the Australian currency (in terms of Japanese yen) results in a 0.75% increase in Australia's outward DFI ($\eta_E = 0.75$).

Table 4 summarizes the elasticities of DFI into Australia by selected countries or regions. The variable WDL, when associated with \$A/\$US and \$A/yen, is a significant determinant of DFI from the OECD. That variable also has a significantly negative effect on DFI from Japan. The total number of strikes (TNS) significantly decreases total investment, but only when it is used with \$A/\$US and \$A/yen. It also appears to decrease DFI from the OECD when used with \$A/yen for estimation. The elasticities with respect to exchange rates are also significant for some cases, particularly when \$A/yen is used. All significant elasticities range from 2.6 to 5 and their signs are positive as expected. These elasticities imply that a 1% depreciation of the Australian currency encourages a 2.6-5% increase of DFI from overseas.

The elasticities of DFI with respect to the three selected industries - mining, manufacturing and transport - are summarized in Table 5. It is notable that in general the elasticities with respect to the economy-wide total number of working days lost (WDL2) are more significant than those with respect to the number of working days

lost in each industry (WDL1). While the elasticities of DFI in mining are significant with respect to WDL2 only, those in manufacturing are significant with respect to both WDL1 and WDL2, except when WDL2 is used with \$A/pound. The total number of strikes appears to be significant for manufacturing and in some cases for the mining and transport sectors. The exchange rate between Australian dollar and Japanese yen (\$A/yen) provides significant elasticities. Inward DFI in the mining sector increases by 2% when the Australian currency is depreciated by 1%. A 1% depreciation of Australian currency against the yen induces a 0.9-1.2% increase of DFI in the manufacturing sector and a 2.6-2.9% increase of DFI in the transport sector. For the manufacturing sector, the elasticity with respect to the exchange rate \$A/\$US falls in a higher range (1.5-1.8) than that with respect to \$A/yen (0.9-1.2), implying that DFI in the manufacturing sector from the US is more sensitive to the changes in exchange rates.

3. Conclusion

Using the two econometric methods - a data-pooling and a long-run elasticity approaches - , this study examines the determinants of various types of DFI into or out of Australia. For the two variables whose effects on DFI has been controversial, the real exchange rates and labor disputes, this paper suggests that their importance should not be ignored, at least in understanding DFI between Australia and selected countries, although the significance of these variables is sometimes limited to some cases.

From a pooled data constructed with the annual figures of Australia's DFI with the six developed countries, it is found that real exchange rates and current account

balance are significant determinants for both Australia's inward and outward DFI, while the destination country's real GDP and the ratio of labor disputes between Australia and foreign countries have a significant explanatory power in some cases.

Analyses conducted using the long-run elasticity approach for the significance of real exchange rates and labor disputes provide mixed results, showing that some elasticities are significant with expected signs while some are not significant. The significance of the elasticities of DFI with respect to real exchange rates and labor disputes varies across equations. When they are significant, the elasticities show that in the long run Australia's outward DFI is encouraged by labor disputes in Australia and the appreciation of the Australian currency. In contrast, foreign countries' DFI into Australia appears to be discouraged by Australia's labor disputes and the appreciation of the Australian currency. It is noteworthy that foreign countries' DFI into Australia in the manufacturing sector is significantly influenced by all kinds of labor dispute measures for Australia, while that in the mining sector is responsive to the whole industry's (including manufacturing and transport sectors') working days lost rather than mining sector's working days lost.

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Table 1. Australia's Investment Abroad
(pooled annual data for 1980-1993)

Variable	(1) with the Ratio of WDL	(2) with the Ratio of TNS
Constant	-2960.2885 (-1.1384)	-3688.5254 (-1.4538)
ERSD	33.9967 (0.5577)	37.4846 (0.6248)
RER	5.6253 (1.8305)*	5.6724 (1.9579)*
ARCA	-75.3270 (-2.1080)**	-73.1877 (-2.0815)**
XGDP	-514.5042 (-0.7200)	-381.0339 (-0.5620)
XRWG	706.3555 (0.2994)	207.7149 (0.0888)
XLD	6.0589 (0.7663)	30.4037 (1.7312)*
RGDP	0.6826 (1.5069)	0.7515 (1.6790)*
DMNZ	2467.0296 (1.18801)	3294.2538 (1.56639)
DMCN	1455.9167 (0.6964)	2487.3932 (1.1573)
DMUK	1847.2943 (1.0276)	2819.19289 (1.5096)
DMJP	-1228.6350 (-1.1655)	-341.5863 (-0.3072)
DMGM	1017.7327 (0.6003)	1842.7825 (1.0720)
Adj.R²	0.2803	0.3037
D-W	1.9450	1.9037
F(12,71)	3.6938***	4.0173***

NOTE: All the variables are in real terms (base year=1990). RAIA are in million Australian dollars, and ARCA and RGDP are in billion Australian dollars. Numbers in parentheses are t-statistics. Adj.R² is an adjusted R-squared. D-W is the Durbin-Watson statistic. ***,** and * denote that the coefficient is significant at the 1%, 5% and 10% levels respectively.

Table 2. Foreign Investment into Australia
(pooled annual data for 1980-1993)

Variable	(1) with the Ratio of WDL	(2) with the Ratio of TNS
Constant	-910.7053 (-0.4774)	-849.6222 (-0.4526)
ERSD	-49.6280 (-0.9918)	-50.5166 (-1.0098)
RER	-5.4124 (-1.9365)*	-5.6496 (-2.0956)**
RCAB	-6.3479 (-2.1206)**	-6.5902 (-2.1568)**
XRGP	-351.1452 (-0.7124)	-314.0713 (-0.6739)
XRWG	1655.3001 (0.9042)	1749.5060 (0.9560)
XLD	0.1640 (0.0237)	-5.6762 (-0.3499)
ARGD	1.5540 (0.4832)	1.3426 (0.4110)
DMNZ	-147.7230 (-0.3486)	-234.47363 (-0.4779)
DMCN	-778.3516 (-2.0128)**	-901.6960 (-1.7270)*
DMUK	572.5597 (1.4243)	441.9077 (0.8127)
DMJP	2280.5989 (2.5199)**	2226.1592 (2.4926)**
DMGM	-471.3549 (-0.9680)	-537.2536 (-1.0626)
Adj.R²	0.3270	0.3282
D-W	1.9428	1.9432
F(12,71)	4.3612***	4.3789***

NOTE: All the variables are in real terms (base year=1990). RFIA are in million Australian dollars, and RCAB and ARGD are in billion Australian dollars. Numbers in parentheses are t-statistics. Adj.R² is an adjusted R-squared. D-W is the Durbin-Watson statistic. ***,** and * denote that the coefficient is significant at the 1%, 5% and 10% levels respectively.

Table 3. Elasticities of Australia's Direct Investment Abroad
(quarterly data for 1985 - 1995)

<u>Labor Disputes</u>		<u>Exchange Rates</u>		
WDL	TNS	\$US/\$A	YEN/\$A	POUND/\$A
0.9611	-	insig.	-	-
-	insig.	insig.	-	-
0.9033	-	-	insig.	-
-	2.0163	-	0.7471	-
0.9675	-	-	-	insig.
-	insig.	-	-	insig.

NOTE: Insig. means that the elasticity is not significant at the 5% level.

Table 4. Elasticities of Foreign Direct Investment into Australia
- from the world, OECD and selected countries

(quarterly data for 1985-1995)

	<u>Labor Disputes</u>		<u>Exchange Rates</u>		
	WDL	TNS	\$A/\$US	\$A/YEN	\$A/POUND
<u>From the World</u>					
	insig.	-	insig.	-	-
	-	-0.6552	insig.	-	-
	insig.	-	-	insig.	-
	-	-2.0069	-	3.8234	-
	insig.	-	-	-	insig.
	-	insig.	-	-	insig.
<u>From the OECD</u>					
	-0.5413	-	insig.	-	-
	-	insig.	insig.	-	-
	-0.7908	-	-	insig.	-
	-	-1.5232	-	3.3100	-
	insig.	-	-	-	insig.
	-	insig.	-	-	insig.
<u>From Selected Countries</u>					
US	insig.	-	insig.	-	-
	-	insig.	insig.	-	-
Japan	-0.5757	-	-	2.6359	-
	-	insig.	-	insig.	-
UK	insig.	-	-	-	insig.
	-	insig.	-	-	4.9931

NOTE: Insig. means that the elasticity is not significant at the 5% level.

Table 5. Elasticities of Foreign Direct Investment into Australia
- for selected industries and exchange rates
(quarterly data for 1985-1995)

Labor Disputes			Exchange Rates		
WDL1	WDL2	TNS	\$A/\$US	\$A/YEN	\$A/POUND
<u>Mining</u>					
insig.	-	-	insig.	-	-
-	-0.2254	-	insig.	-	-
-	-	insig.	insig.	-	-
insig.	-	-	-	insig.	-
-	-0.2102	-	-	insig.	-
-	-	-0.4865	-	2.0564	-
insig.	-	-	-	-	insig.
-	-0.2654	-	-	-	insig.
-	-	insig.	-	-	insig.
<u>Manufacturing</u>					
-0.2785	-	-	insig.	-	-
-	-0.5021	-	1.7744	-	-
-	-	-0.4344	1.5104	-	-
-0.3343	-	-	-	1.2180	-
-	-0.4792	-	-	0.9012	-
-	-	-1.0215	-	insig.	-
-0.3063	-	-	-	-	insig.
-	insig.	-	-	-	insig.
-	-	-0.4215	-	-	insig.
<u>Transport</u>					
insig.	-	-	insig.	-	-
-	insig.	-	insig.	-	-
-	-	insig.	insig.	-	-
-0.2424	-	-	-	2.6424	-
-	-0.3658	-	-	2.8542	-
-	-	insig.	-	insig.	-
insig.	-	-	-	-	insig.
-	insig.	-	-	-	insig.
-	-	-0.9113	-	-	3.4266

NOTE: Insig. means that the elasticity is not significant at the 5% level. WDL1 and WDL2 stand for working days lost for each industry and the economy-wide working days lost.