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Modeling FDI Flows from the USA to Canada: Two Main International Financial Variables Affect the Long-Run Economic Growth

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Abstract

This paper develops a model to predict for the spillover effects of the foreign capital inflows on the long run growth under conditions of international economic exposure to foreign exchange rate fluctuations. The paper utilizes a simple open economy version of the Solow growth model with the main features of real business cycle models. In addition, the paper uses a time series model with substitution techniques to test the impact of the spillover effect of foreign capital inflows from the USA on long run growth in Canada, while controlling for exposure to foreign exchange rate fluctuations, as well as for both external and internal balances. The results support the existence of positive spillover effects from foreign direct investment on the economy. The results also show that foreign exchange rate fluctuations have weaken the impact of underlying changes in productivity on the attractiveness of the economy to overseas investors and hence moderate the overall impact of the technology spillover effect of Foreign Direct Investment (FDI) on long-run growth.[1]

Keywords: Foreign Direct Investment, Exchange Rates, The Spillover Effect, International Exposure to Risk, Risk Analysis, Economic Growth, Time Series Analysis, Time Series Substitution Techniques, International Financial Management

JEL: B26, C , C32, C51, C54, C58, E, E32, E44, E60, F21, F3, F4.

1. Introduction

The efficient allocation of resources through the international movement of capital and the global application of technological experience are both key factors in world economic development. Foreign Direct Investment (FDI) is a key driver for both these factors.

Technology spillover effects can occur through a number of different mechanisms. Technological know-how can be learnt by employees through their work for a foreign-invested firm, with the benefits of technology-driven productivity being shared between labour and capital. Technology can also be passed on through the demonstration effect, whereby local labour becomes aware of new technologies and applies them in domestically owned businesses.

Exchange rate fluctuations are also a key factor in the efficient global allocation of resources, as they help to adjust the cost of investment in an economy to reflect productivity and also facilitate the competitive pricing of outputs from different countries.

It may be predicted that the overall benefits of the dissemination of technology will be global, as the ability to combine technologies from different parts of the world can be expected to raise global productivity. Moreover, the efficient allocation of tasks to labour forces in different parts of the world can also be expected to bring global productivity

[1] The first draft of this paper has been discussed at ECO-ENA, Inc. First Annual Conference of Economic Forum of Entrepreneurship & International Business in 2011: ISBN: 978-0-9810451-7-7: Library & Archive Canada. The title of the first draft of the paper was The spillover effect, international exposure to risk, and sustaining growth: Canada – USA

gains.

The immediate effects of exchange rate fluctuations, on the other hand, may be expected to be local and particular. Currency appreciations occur where the relative growth in the value of the outputs of individuals and corporations in one currency area compared with another exceeds the relative growth of the money supply. Gains from currency appreciations will accrue to individuals and corporations the relative growth of whose outputs exceeds the relative growth of the money supply. Those individuals and corporations whose outputs do not keep pace with the average for the currency area become less competitive and suffer a loss of income through wage reductions, job losses and falling returns on investment. However, their losses are normally outweighed by the gains accruing to growth industries, as these industries must be predominant within the currency area in order to cause a currency appreciation.

Where gains and losses from currency fluctuations are absorbed by capital rather than labour, a part of the gains and losses is attributable to foreign capital. This is true for all industries. Foreign investors in industries which are gaining in competitiveness in a currency area with an appreciating currency receive higher returns through currency appreciation and through rising returns on investment, while those with investments in industries with declining competitiveness receive lower returns, partially offset by currency appreciation to the extent to which the decline in competitiveness occurred relative to other industries in the same currency area rather than relative to global industry. Foreign investors in declining industries in currency areas with declining currencies will likewise receive returns which are lower as a result of falling returns and currency movements. Those with investments in industries whose productivity is not declining relative to global industry will be see their losses through currency fluctuations offset by rising prices in the invested industries' home currency, assuming that the supply and demand curves for their services and products are unaffected by the productivity changes underlying the currency movements.

Movements in foreign exchange rates do not affect the amount of foreign capital already employed in the country in domestic currency terms or as a proportion of total capital employed. They do, however, affect the benefits from foreign investment in two ways. Firstly, net new inward investment over a particular time period is affected by foreign currency exchange rates because the amount of domestic currency bought by each unit of foreign currency affects the amount of net new investment in domestic terms and the level of net additional assets which can be supported by that investment. To the extent that an appreciating currency in the recipient country reflects rising competitiveness relative to the investing country, foreign investors will suffer from a declining ability to compete for productive units of investment and foreign investment as a proportion of capital employed will fall unless foreign investors increase the proportion of their income which they invest in the country. The reverse applies where a declining currency in the recipient country reflects declining competitiveness, in which case foreign investment will rise as a proportion of capital.

Secondly, a national economy competing for investment must match the returns on investment available in the investor's home currency and therefore interest outflows measured in domestic currency increase when the domestic currency declines against the investor's currency, to the extent that the investor is able to vary the returns required (through dividends) or the returns are predetermined but denominated in the investor's currency.

As a consequence of the increasing share of foreign investment in total capital, a country with a declining currency may experience a disproportionate compensation for the declining competitiveness which caused its currency to depreciate in the form of greater FDI leading to greater productivity gains than those which would have been the result for greater domestic investment. This is the result of spillover effects. Although lower domestic productivity would results in lower incomes and lower investment, the reduction in investment is concentrated in the less productive investment of domestic capital and therefore the reduction in subsequent income is mitigated by higher capital productivity. By the same token, a reduction in the share of foreign investment in total capital acts as a drag on income growth in cases where rising productivity and competitiveness lead to a currency appreciation.

However, a further risk which arises in FDI is that of exchange rate volatility. The risk arises partly because exchange rates may be subject to noise trading or to delayed reactions to economic activities which result in exchange rates temporarily failing to reflect relative economic conditions. The result is that an investor may receive a lower return on foreign investments as a result of a temporary appreciation of the investor's currency or else the investee may have to pay a higher return in the investee's currency in order to maintain returns in the investor's currency. In addition, a temporary appreciation of the investee's currency may cause foreign investors to delay or abandon investment projects.

In this paper we focus on the effects of FDI on technology transfers via the technology spillover effect, whereby technological developments transferred under the influence of the foreign corporate investor become embedded in the host country's industry. Our aim is to develop and test a model for the spillover effect, taking account of exposures to foreign exchange rate risk arising from reliance on foreign capital. We first present a model to analyse the productivity gains from technology spillovers from FDI and then test the model in the context of US investment in Canada.

We contribute to the literature in two ways. Firstly, we contribute by demonstrating that the result of spillover effects is

that the economy benefits from the share of foreign investment in capital. The influx of new ideas means that foreign capital has a greater benefit on the economy that domestic capital, provided that foreign providers of capital are actively involved in developing industries, whether the new development takes the form of creating new production and service centres from scratch or modifying existing assets and working practices. Secondly, we contribute to the literature by providing a model for the effect of foreign exchange rate fluctuations on Foreign Direct Investment and consequently on economic benefits, thereby enabling us to answer the question of whether a depreciating currency brings overall benefits in terms of increased foreign investment leading to higher spillover effects. Our findings indicate that the ability of foreign investors to increase their stake in the economy mitigates but does not outweigh the weaknesses which underlie the currency depreciation and that these weaknesses still lead to reduced investment.

The paper is structured as follows: Section 2 reviews the salient literature on the spillover effect. Section 3 presents the theoretical framework and the optimal solution of the model. Section 4 presents the empirical analysis and the results of the paper and section 5 discusses these results. The conclusion follows section 5.

2. Literature Review

Arrow (1959) presents the basic reasoning behind the prediction of knowledge spillover effects by arguing that the benefits of knowledge cannot be fully appropriated by its creator, because it can neither be efficiently used while being kept private nor sold for its full value on an exclusive basis. He also discusses the role of knowledge in further knowledge creation, drawing attention to the fact that, in the same way that physical goods can be used as either instruments or raw materials for the further production of goods, knowledge can also be used in the production of further knowledge. Romer (1986), agreeing with Arrow that new knowledge cannot be entirely kept secret or appropriated by its discoverer, presents evidence that indicates that there are increasing returns on the contribution of new knowledge to the economy.

Knowledge or technology spillovers occur where knowledge and ideas are acquired free of charge or at less than their maximum economic value by one firm from another, whether in the same industry or a different industry (Griliches 1992, Kaiser 2002). While spillover effects occur within the domestic economy independently of any foreign investment, the possibility of spillovers can be increased by the introduction of ideas from a more alien environment through the involvement of foreign firms (Blomstrom *et al.* 1994).

Spillover effects do not appear to be inevitable, with Khawar (2003) finding an absence of spillovers from FDI in Mexico and Hadad and Harrison (1993) likewise finding no evidence of technology spillovers or overall productivity improvements in Morocco. Aitken and Harrison (1999), Khawar (2003) and Elmawazini *et al.* (2005) all found that overall the effect of FDI was to lower productivity in domestically owned firms, because of competition for skilled labour and the effects of loss of market share on overhead recovery. Liu (2008) finds that spillover effects from FDI exist both within and between industries but are more powerful in the long term, with early losses in productivity offset by longer term technology transfers. The extent of spillover effects is partly dependent on the ability of domestic labour to absorb technological lessons from outside (Borensztein *et al.* 1998, Qi and Li 2008).

A further issue with FDI is the effect of foreign currency exchange rates. Movements in foreign exchange rates do not affect the amount of foreign capital already employed in the country but they affect the benefits from foreign investment in two ways. Firstly, net new inward investment over a particular time period is affected by foreign currency exchange rates because the amount of domestic currency bought by each unit of foreign currency affects the amount of net new investment in domestic terms and the level of net additional assets which can be supported by that investment. Secondly, a national economy competing for investment must match the returns on investment available in the investor's home currency and therefore interest outflows measured in domestic currency increase when the domestic currency declines against the investor's currency.

Froot and Stein (1991) demonstrated that foreign investors increased their investments in US assets when the US Dollar depreciated against the investor's currency, which is consistent with the view that the foreign borrowing in capital increases for countries with declining currencies. Baek and Okawa (2001) found that foreign direct investment by Japanese investors increased when the Japanese Yen appreciated against the currencies of investees. This was confirmed by Tagaki and Shi (2011), who also found that currency volatility was associated with higher FDI, as the uncertainty led corporations to seek to reduce reliance on imports and exports of goods and services. These findings are consistent with Cushman (1986), who also found that US foreign direct investment was reduced for countries with appreciating currencies and that currency volatility led US firms to refocus efforts from exports to FDI. In contrast, Kyereboah-Coleman and Agyire-Tettey (2008) found that exchange rate volatility reduced FDI, while Abbott and De Vita (2011) found that membership of a currency union, which eliminates exchange rate volatility led to an increase in FDI both from within the currency union and from outside, although they found no strong relationship between FDI and currency pegs and suggested that the increase in FDI was the result of the creation of a large open economy rather than the result of a currency union *per se.* There is therefore some evidence that foreign currency exchange rate volatility

affects FDI. The extent to which it may reduce FDI depends on whether the risk created by volatility overall outweighs the tendency to use substitute FDI for exporting activity.

3. Theoretical Model

3.1 Model Framework

(1) Assuming that firms produce a single commodity generating income Y_t by means of domestic capital K_{Dt}, Labor L_t, and effective foreign capital as a percentage of the domestic capital δ_t, and $\delta_t = A_t K_{Ft}/K_{Dt}$, where A_t is a factor of productivity and K_{Ft} is the foreign capital stock.

(2) Assuming that the technology is Cobb-Douglas with constant return to scale:

$$Y_t = K_{Dt}^{\alpha} \delta_t^{\beta} L_t^{\theta}, \quad (\alpha+\beta+\theta) = 1, \alpha > \beta \tag{1}$$

(3) Assuming that labor equals the size of the population and it is normalized to 1 for simplicity.

(4) Assuming that the savings rate s representing the fraction of their income saved by domestic residents is constant:

$$S_t = s(Y_t - r_w K_{Ft}). \tag{2}$$

where S_t is savings for the period, $(Y_t - r_w K_{Ft})$ is the national income, and r_w is the interest rate paid on foreign capital. r_w is exogenous because of the smallness assumption.

(5) Y_t is devoted to private consumption C_t, including $r_w K_{Ft}$, private domestic investment I_t and net exports NX_t:

$$Y_t = C_t + I_t + NX_t \tag{3}$$

(6) Assuming perfect capital mobility and $r = r_w$, where r is the domestic interest rate.

(7) Imposing the external balance condition; the current account deficit $(-NX_t + r_w K_{Ft})$ equals the foreign capital inflows F_{ft}:

$$F_{ft} = -NX_t + r_w K_{ft} = -NX_t + rK_{ft} \tag{4}$$

(8) Investment adds to the stock of the domestic capital:

$$\dot{K}_{Dt} = I_t \tag{5}$$

The dot above the variable means the change of the variable over time.

(9) Foreign capital inflows add to the stock of foreign capital:

$$\dot{K}_{Ft} = F_{ft} \tag{6}$$

(10) This open economy is vulnerable to two opposite changes: (i) The change of the effective foreign capital as a percentage in the domestic capital δ_t over time because of its imported technology, and (ii) the vulnerability of the inflows of foreign capital to foreign exchange rate fluctuations. The first change captures the spillover effect of the effective foreign capital in the economy over time while the second change captures the international exposure to risk.

The following two equations explain those two changes:

(i) $\delta_t = A_t \lambda_t$,

where $(\lambda_t = K_{Ft}/K_{Dt})$ and

$$\delta_t = \delta_0 + gt + e_t \tag{7}$$

where, δ_0 and g are positive constants, t refers to time, and e_t is the random disturbance,

$$e_t = p\, e_{t-1} + \varepsilon_t, \quad 1 > P \geq 0 \tag{8}$$

$$\varepsilon_t \sim N(0, \sigma^2_{\varepsilon}).$$

If $P = 0$, then, $e_t = \varepsilon_t$, and the foreign technology shock is a white noise, assuming here that the shock comes from the imported technology of the foreign capital.

(ii) F_{ft} is exposed to the movement of the foreign exchange rate as follows (Madura and Fox 2007):

$$F_{ft} = a + b\, \dot{R}_t + \mu_t \tag{9}$$

Where R is the foreign exchange rate, defined as the number of domestic currency units bought by one foreign currency unit, a and b are constants, and μ_t is a white noise term,

$$E(\mu_t) = 0, \qquad Cov(\mu_t, \mu_s) = 0 \text{ for any } t \neq s$$

3.2 Optimal Solution

Equations 4, 6, 7 and 8 give the following equation:

$$\dot{\delta}_t = g\,\lambda_{t-1} + A_t(F_{ft}/K_{Dt}) - \delta_t\,(I_t/K_{Dt-1}) + \lambda_t\dot{\varepsilon}_t. \tag{10}$$

where g is the growth rate of the foreign technology augmenting the foreign capital and g is assumed to be constant for simplicity.

According to equation (10), the change in effective foreign capital as a percentage of the domestic capital that captures the change in the spillover effect of the foreign technology into the economy is positively correlated both with the proportion of foreign capital to domestic capital and with effective capital flows as a percentage of domestic capital and is negatively correlated with the ration of investment to domestic capital. In addition, it is correlated with the movement of the foreign exchange rate: this effect can be captured by substituting equation (9) into equation (10).

On the other hand, equations (1), (3), and (4) lead to equation (11):

$$\dot{Y}_t/Y_t = \alpha(I_t/K_{Dt}) + \beta(\dot{\delta}_t/\delta_t). \tag{11}$$

According to equation (11), the growth rate of the output depends positively on both the growth rate of the domestic capital stock and on the growth rate of the effective foreign capital to the domestic capital stock.

With assumptions of perfect competition, α is the domestic capital share in the output and β is the effective foreign capital share in output. With the inspiration of the Solow residual, we can establish the value of the growth rate of δ.[2]

Equation (10), together with equation (11), indicates that the growth rate of the output is also affected by the determinants of the growth of δ. Thus, the business cycle can be caused by changes in the spillover of the imported foreign technology in addition to fluctuations in the foreign exchange rate. Thus, domestic business cycles are influenced by external fluctuations in an open world both positively and negatively. We assume, however, that the spillover effect of the effective foreign capital may counteract the effect of the exposure to international risk.

With targeting of the internal balance; the fluctuations of Y_t equal zero. Thus, equation (11) becomes:

$$\alpha(I_t/K_{Dt}) + \beta(\dot{\delta}_t/\delta_t) = 0 \tag{12}$$

Accordingly:

$$(\dot{K}_{Dt}/K_{Dt}) = -(\beta/\alpha)(\dot{\delta}_t/\delta_t) \tag{13}$$

Transposing (9) and (10) into (13), a change in the rate of accumulation of domestic capital stock is accompanied by an opposite change in the rate of accumulation of effective foreign capital. In other words, with targeting of an internal balance, the accumulation of foreign capital causes a decrease in the domestic investment and *vice versa*. Thus, to smooth the business cycle of this economy over time and according to the assumptions of the model, the internal balance condition in equation (13) must be maintained.

The remainder of this paper rather focuses on explaining specific concepts related to the interrelationships amongst the exposure to the fluctuations of the foreign exchange rate, the spillover effect of foreign capital inflows and the status of the business cycle translated into changes of the economic growth rates.

4. Empirical Modeling

4.1 Data

Quarterly data from 1971:Q3 to 2010:Q3 are obtained for the GDP, GDP deflator, foreign capital flows, exports, imports, the price index of exports, the price index of imports, the gross national income, the lending rate, the long term government bond rate, the fixed domestic capital, the net inventory, the foreign exchange rate per US dollar for Canada,

[2] $\dot{\delta}_t/\delta_t$ can be found as follows:

Since, $Y_t = K_{Dt}^{\alpha}\,\delta_t^{\beta}$, Thus,

$ln(Y_t) = \alpha ln(K_{Dt}) + \beta ln(\delta_t)$,

Thus, $\beta ln(\delta_t) = ln(Y_t) - \alpha ln(K_{Dt})$, thus,

$ln(\delta_t) = (1/\beta)\,ln(Y_t) - (\alpha/\beta)\,ln(K_{Dt})$.

And since all data of the right hand side of this equation are known, then, we can derive (by the inspiration of the Solow residual) the value of $ln(\delta_t)$.

And since, $\dot{\delta}_t/\delta_t = ln(\delta_t) - ln(\delta_{t-1})$ by logic, and by knowing data of $ln(\delta_t)$, the data of $ln(\delta_{t-1})$ can be derived easily and hence, the change rate of δ can be derived.

in addition to the same variables for the USA from the International Financial Statistics Yearbook (IMF, 2011). Raw data are used to derive the economic growth rate of Canada, the real domestic investment of Canada, the real domestic capital stock, the real investment/ real domestic capital stock ratio, the real foreign capital inflows of Canada, the real foreign trade of Canada, the relative real national income (Canada/USA), the relative inflation rate (Canada/USA), the relative lending rate (Canada/USA), the relative real foreign trade (Canada/ USA), and the economic growth rate of USA. Values of δ, α, β, and the foreign capital stock have been calculated as described in the footnotes i and iii consecutively.[3] Also, data for λ is derived by calculating the foreign capital stock. Derived data of USA is used to control for the determinants of the foreign exchange rate movement over time and to control for the business cycles of USA over time. Calculated data depended on strong assumptions of perfect capital mobility between Canada and USA and perfect competition conditions.

Intensive data checks for possible existence of unit root and heteroscedasticity were run for all data series by using Philips-Perron unit root test and Q-statistic test. No evidence was found for unit root in any of the data series. However, evidence of heteroscedasticity was found in all data series. Accordingly, the paper utilized the ARCH method in all regressions.

4.2 Empirical Models

Three models are used to establish empirically the impact of both the exposure to foreign exchange rate fluctuations and the spillover effect of the foreign capital inflows on Canada's economic growth rate. These three models depend on equations 9, 10, and 11 in the theoretical model of this paper and their determinants.

The first model captures the exposure to foreign exchange rate fluctuations as follows:

$$RFK_t = C_0 + A(L)\, RFK_{t-1} + C_1\, emovement_t + B(L)\varepsilon_t,$$

Subject to:

$$Instrument_t = [relativeincome_t, relativeinflation_t, relativeinterest_t, relativetrade_t, growth_t, USgrowth_t].$$

Where, *RFK* is the real foreign capital inflows, *emovement* is the percentage change in the foreign exchange rate over time, $A(L)$ $[1 + a1L + a2L2 + \ldots + aqLq]$ and $B(L)$ $[1 + b1L + b2L2 + \ldots + bqLq]$ are polynomials in lag operator L, ε is a white noise disturbance term, t refers to time. The instrument controls for the relative real national income (Canada/ USA), the relative inflation rate (Canada/ USA), the relative lending rate (Canada/ USA), the relative real foreign trade (Canada/ USA), the economic growth rate of Canada and the economic growth rate of USA) consecutively. The first four-variables included in the instrument are chosen to control for the main determinants of the fluctuations of the foreign exchange rate over time, the fifth variable included in the instrument included to control for the Canadian business cycles over time, and finally the sixth variable in the instrument is included to control for the US business cycles over time. *emovement* is calculated as $((erate_t - erate_{t-1})/erate_{t-1}) * 100$, where e is the value of the US Dollar expressed in Canadian Dollars. A positive value for *emovement* therefore indicates a decline in the relative value of the Canadian Dollar.

The second model captures the spillover effect as follows:

$$deltydotdelty_t = C_0 + A(L)\, deltyddotdelty_{t-1} + C_1\, lambda_t + C_2\, RFKR_t + C_3\, DIR_t + B(L)\varepsilon_t,$$

Where, *deltydotdelty* is the change rate of δ calculated from the theoretical model of this paper, lambda is the real foreign capital stock/ real domestic capital stock ratio, *RFKR* is the (real foreign capital inflows/ real domestic capital stock) ratio, and *DIR* is the (real domestic investment/ real domestic capital stock) ratio.

The third model explains the behavior of the economic growth rate of Canada as follows:

$$growth_t = C_0 + A(L)\, growth_{t-1} + C_1 Mdeltydotdelty_t + B(L)\varepsilon_t,$$

Subject to:

$$Instrument = [fiscalpolicyt, monetarypolicyt, DIR_t].$$

Where, $Mdeltydotdelty_t$ is the modified $deltydotdelty_t$ that depends on results of the first and the second models, $fiscalpolicy_t$ is the change rate of the real government spending of Canada over time as a proxy variable of a fiscal policy, $monetarypolicy_t$ is the change rate of the government of Canada long run bond rate as a proxy variable for a

[3] The foreign capital stock is calculated from foreign capital inflows in Canada by using the following equation: *The foreign capital stock* $= e^{-(the\ US\ lending\ rate).}$ *the foreign capital inflows*. The US lending rate is used as a proxy of the foreign interest rate for Canada as a discount rate.

α *= [(Canada lending rate). (real domestic capital)]/ (real GDP),*

β *= [(US lending rate).(real domestic capital/real foreign capital stock)]/(real GDP).*

monetary policy. The first and the second variables included in the instrument to control for the fiscal policy and the monetary policy consecutively. The *DIR* variable included to control for the real domestic investment ratio. The *DIR* variable is included in the instrument to avoid the multicollinearity between the *Mdeltydotdelty and the DIR.*

4.3 Empirical Analysis

The first model is regressed by using the ARCH method with an instrument. The second model is also regressed by using the ARCH method. Intensive specifications for best fit models have been run to ARMA (5,5). The forecast of the first best fit model captures the exposure to foreign exchange rate risk. The variable $MRFKR_t$ is the forecast of the best fit first model for the modified ratio of real foreign capital inflows to real domestic capital stock, adjusted to control for the risk of the foreign exchange rate movement. The forecast of the second best fit model captures the spillover effect of the foreign capital into the domestic capital. The variable $Mdeltydotdelty_t$ refers to the forecast of the best fit second model that refers to the *modified deltydotdelty* captures the spillover effect. The result of the best fit first model and the best fit second model are illustrated in Table 1, columns 2 & 3 consecutively. Column 4 of Table 1, however shows the result of the best fit second model by including the $MRFKR_t$ instead of $RFKR_t$ in the second model to control for exposure to foreign exchange rate fluctuations. The result of the best fit model in the forth column shows then the best fit $deltydotdelty_t$ with controlling for both the exposure to risk and the spillover effect. The forecast of this new model illustrated in column 4 is represented in the variable $MMdeltydotdelty_t$. Finally, columns 5 & 6 in the same table show the impact of the $Mdeltydotdelty_t$ and $MMdeltydotdelty_t$ respectively on the economic growth rate of Canada respectively after controlling for the fiscal policy, the monetary policy, and the *DIR* as explained in section 3a.

Table 1.The results of the three empirical models under different possibilities Data: (1971:Q3 – 2010:Q3)

The model	**Model 1** RFK_t	**Model 2-1** $deltydotdelty_t$	**Model 2-2** $Mdeltydotdelty_t$	**Model 3-1** $growth_{t1}$	**Model 3-2** $growth_{t2}$
C	1.448806 (0.0673)*	-0.026722 (0.0000)***	-0.108703 (0.0000)***	0.831206 (0.0000)***	0.827500 (0.0000)***
$emovement_t$	0.012813 (0.0000)***				
RFK_{t-1}	0.979891 (0.0000)***				
$deltyddotdely_{t-1}$		0.527720 (0.0000)***			
$deltyddotdely_{t-3}$		0.167938 (0.0000)***			
$lambda_t$		-26852.04 (0.0000)***	-25275.93 (0.0000)***		
$RFKR_t$		1.448839 (0.0030)***			
DIR_t		0.023889 (0.0000)***	0.069874 (0.0051)***		
$MRFKR_t$			8.697182 (0.0190)**		
$growth_{t-1}$				0.433551 (0.0000)***	0.431194 (0.0000)***
$growth_{t-5}$				-0.104672 (0.1041)*	-0.105133 (0.1034)*
$Mdeltyddotdely_t$				0.176922 (0.0761)*	
$Mdeltyddotdely_{t-1}$			0.923782 (0.0000)***		
$MMdeltyddotdely_t$					0.170271 (0.0585)*
e_{t-1}	-0.471251 (0.0000)***	-0.213862 (0.0002)***	-0.750445 (0.0000)***		
e_{t-2}		-0.116681 (0.0020)***			

e_{t-5}		-0.107007 (0.0000)***	-0.210096 (0.0000)***		
Adj R^2	0.801112	0.109888	0.10815	0.180130	0.179490
D.W. Stat.	1.996762	2.186640	1.997027	2.022733	2.016285
AIC	0.290770	-0.017946	0.717027	2.001934	2.014505
SC	0.543835	0.215653	0.911692	2.196599	2.209170

- *** means significant at ρ-value ≤ 1%., ** means significant at 1% < ρ-value ≤ 5%, and * means significant at 5% < ρ-value ≤ 10%.
- Method used for regression is: ML:ARCH (Marquardt) – Normal distribution.
- Best fit models criteria depend on both the diagnostic checks and the lowest values of AIC & SC criteria.

5. Discussion and Analysis

The results for model 1 show that, as expected, FDI is positively correlated with an appreciation of the foreign investor's currency, as foreign investors take advantage of the weak domestic currency to increase their holdings of capital stock. There is also a positive correlation between FDI for the present and immediately preceding periods.

The results for model 2 show that the rate of increase in δ (the ratio of effective foreign capital to domestic capital) decreases as the existing ratio of effective foreign capital to domestic capital increases and increases as the level of foreign investment relative to existing domestic capital stock increases, both of which are to be expected. However, it the results also show that the increase in δ is positively correlated with domestic investment as a proportion of domestic capital (DIR). Hence at times of high domestic investment, domestic investment does not keep pace with increases in foreign capital. The accumulation of foreign capital appears to be more susceptible to underlying factors affecting capital accumulation than domestic capital. The correlations between δ and both foreign investment and domestic capital accumulation are considerably greater when foreign investment is adjusted to control for currency fluctuations. When the element of foreign capital inflows explained by the change in value of the Canadian dollar against the US dollar is excluded, the correlation between foreign capital inflows and the increase in δ becomes more strongly positive. In other words, the effect of foreign capital inflows on the share of foreign capital in total capital is not only not enhanced by a depreciation of the domestic currency but weakened by it. Nevertheless, it remains positive in Model 2-1, without modification for currency fluctuations, indicating that these fluctuations do not nullify them. Thus a weakening domestic currency has a negative impact on the share of foreign investment in total capital.

This illustrates that an increasingly competitive economy, characterized by an appreciating currency has a tendency to attract foreign investment to an extent which outweighs the increasing cost of the investment when calculated in foreign currency. A depreciating currency is therefore associated with lower, not higher, inward investment.

In both models 3-1 and 3-2, an increase in the share of foreign capital in total capital has a very similar and positive effect on economic growth, demonstrating that the spillover effect exists independently of currency fluctuations. Gains from the spillover effect itself are very slightly lower after controlling for domestic currency depreciation. So, in fact, domestic currency depreciation has a slight tendency to increase the spillover effect. This may be because a domestic currency depreciation reflects a decline in the relative productivity of existing productive capacity and the greater opportunity for productivity improvements from foreign technology. This partially offsets the lower level of growth in the share of foreign capital in the economy as a whole associated with a depreciating currency.

It is obvious from Table 1, columns 5 and 6 that after controlling for the exposure to foreign exchange rate fluctuations the impact of the spillover effect of the foreign capital inflows becomes more positively significant on the economic growth rate of Canada. However, it does not change the cyclical movement of the growth rate for both the first lag and the fifth lag of the economic growth rate of Canada. The plausible interpretation is that the cyclical movement in the Canadian economic growth rate could most likely have arisen because of the technological spillover effect of the foreign capital inflows rather than from its exposure to US dollar fluctuations over time.

6. Summary and Conclusion

This paper presented a theoretical model of an open economy version of the Solow growth model with features of real business cycle models under the assumption of perfect capital mobility. The theoretical results show that the economic growth rate of a small open economy can be affected by both the real domestic investment ratio and the real foreign capital inflows ratio, in addition to factors of technological spillover effect and exposure to fluctuations of the foreign exchange rate. An empirical time series analysis that depends on substitution techniques arise from utilizing three empirical models show that the impact of the technological spillover effect of the foreign capital inflows on the Canadian economy can have a better positive significant impact on the economic growth rate after controlling for exposure to foreign exchange rate risk. The control of the exposure to risk however does not affect the cyclical movement in the Canadian economic growth rate which can be interpreted as that the cyclical movement of the

economy can be related to factors of spillover effect of foreign capital inflows.

Our results show that economic growth is positively affected by changes in the effective share of foreign capital in the economy, adjusted for productivity resulting from technological capacity attaching to inward FDI.

Our results also show that the change in the effective ratio of foreign to domestic capital is influenced by exposure foreign currency fluctuations but that this does not outweigh other factors, including those factors underlying the accumulation of capital in general. Furthermore, our results show that a declining currency is associated with lower growth in the share of foreign capital in total capital employed. The cheapening of investment capital cannot offset the lack of attractiveness of this capital which is the cause of currency depreciation. In addition, the increase in spillover effects resulting from currency depreciation is a mitigating factor in poor productivity performance but does not cancel out the underlying factors causing poor productivity and a consequent currency depreciation.

Further research would be useful to establish the extent to which a similar spillover effect exists for immigrant labour. Immigrant labour, whether or not it accompanies capital inflows as part of an FDI-supported project, may also be expected to bring unfamiliar skills into an economy, especially if the immigrant labour involved consists of skilled craftspeople or professionals of a generic nature. Immigrant labour may therefore provide greater benefits to the economy than indigenous labour with the same remuneration rate. This is an area which would merit future research.

An earlier version of this paper (Mohamed and Handley-Schachler, 2011) was presented at the ECO-ENA First Annual Conference of Economic Forum of Entrepreneurship and International Business from April 14th to April 17th, 2011 in Cairo, Egypt, and we are grateful to conference participants for the comments made. The substantially revised paper presented here contains a theoretical introduction and a full discussion of the results which are both lacking in the earlier version. In particular, the discussion of the relationship between productivity, currency fluctuations and investment did not appear in the earlier version. We have also substantially extended the literature review in relation to the impact of currency fluctuations.

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