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IMPACT OF FDI RESTRICTIONS ON INWARD FDI IN OECD COUNTRIES

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Industry Canada

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Abstract

Attracting foreign direct investment (FDI) has become an integral part of the national development strategies in many economies, as it is generally believed that the benefits from foreign direct investment (FDI) outweigh its drawbacks. The United Nations Conference on Trade and Development (UNCTAD) in its World Investment Report (2006) highlights that there were 205 FDI related policy changes across the world in 2005, and most of these changes made conditions more favourable for foreign companies to enter and operate. However, FDI is still far less liberalized than international goods. Recent studies undertaken at the Organisation for Economic Co-operation and Development (OECD) show that although FDI barriers declined significantly since 1980s, barriers to inward FDI are still widespread in OECD countries. Canada is one of the OECD countries with the highest restrictions on inward FDI.

This paper explores the impact of FDI restrictions on inward FDI stocks using panel time series (1981-2004) data for 23 OECD countries. Our empirical results show that FDI restrictions do have significant impact on inward FDI stocks. The estimated short-run elasticity of inward FDI stocks with respect to FDI restrictions is in the range between –0.06 to –0.14, and the corresponding long-run elasticity is in the range between –0.64 to –1.49. This implies that by reducing barriers to FDI, countries such as Canada can significantly increase their level of inward FDI stocks.

Key words: foreign direct investment, foreign direct investment restrictions

Résumé

Il est généralement admis que les bienfaits de l'investissement direct étranger (IDE) surpassent ses inconvénients. C'est pourquoi attirer l'IDE est devenu essentiel dans la stratégie de développement national de plusieurs économies. La Conférence des Nations Unies sur le commerce et le développement (CNUCED) souligne dans son World Investment Report (2006) qu'il y a eu changements des politiques relatives à l'IDE dans le monde en 2005, et que la plupart de ces changements facilitaient l'entrée et les activités d'entreprises étrangères. Cependant, l'IDE demeure nettement moins libéralisé que le commerce international des marchandises. De récentes études entreprises par l'Organisation de coopération et de développement économiques (OCDE) montrent que malgré le déclin considérable des obstacles à l'IDE depuis 1980, les obstacles à l'IDE entrant sont encore répandus dans les pays de l'OCDE. Le Canada fait partie des pays imposant le plus d'obstacles à l'IDE entrant.

L'étude examine les effets des obstacles à l'IDE sur les stocks d'IDE entrant en utilisant des données de panel chronologiques (de 1981 à 2004) de 23 pays de l'OCDE. Les résultats de nos expériences montrent que les obstacles à l'IDE ont bel et bien une incidence importante sur les stocks d'IDE entrant. L'élasticité approximative à court terme des stocks d'IDE relativement aux

obstacles à l’IDE se situe entre -0,06 et -0,14 et l’élasticité à long terme, de -0,64 à -1,49. Ceci signifie qu’en réduisant les obstacles à l’IDE, les pays comme le Canada peuvent sensiblement augmenter leurs stocks d’IDE entrant.

Mots clés : investissement direct étranger, obstacles à l’investissement direct étranger

1. Introduction

International capital flow, especially foreign direct investment (henceforth, FDI) is far less liberalized than international goods due to concerns about loss of national sovereignty and other possible adverse consequences on national industries. There have been intense discussions on the benefits of FDI liberalization versus economic protectionism in the literature. However, attitudes towards FDI have been changing since the last decade or more. It is now generally viewed that the benefits from FDI outweigh its drawbacks. Thus, attracting FDI has become an integral part of the national development strategies in many economies. The UNCTAD in its World Investment Report (2006) highlights that there were 205 FDI related policy changes across the world in 2005, and most of these changes made conditions more favourable for foreign companies to enter and operate. Canada too joined this process.

Yet, barriers to inward FDI are still widespread, even in OECD countries that are generally open to FDI. Table 1 presents FDI restriction scores (1=closed and 0=open) for selected OECD countries[1]. It shows that the FDI restriction index in OECD countries has fallen dramatically from a level of .38 in 1980 to 0.30 in 1990 and further to 0.15 in 2000, although the indices are not strictly comparable due to some methodological issues. The average score (0.15) for the OECD countries in Table 1 was lower than the average of 13 non-OECD countries (0.19)[2].

Canada is still a country with high FDI restrictions. Canada ranks fourth in 2000 among the OECD countries in Table 1 in terms of FDI restrictions. Iceland, Australia and Austria are the top three highly restrictive countries. The FDI restriction index for Canada was 0.228 in 2000, while the average score for the OECD countries 0.145. Between 1980 and 2000 although the restriction index for Canada fell significantly, its relative rank increased from 6th in 1980 to 5th in 1990 to 4th in 2000, implying larger reductions to barriers in FDI undertaken by others compared to Canada. The OECD report entitled "Economic Policy Reforms: Going for Growth 2007" highlights that restrictions on foreign direct investment in Canada remain higher than in the majority of OECD countries, particularly in telecommunications, broadcasting and air transport. These, it suggests, "hamper investment and slow the diffusion of new technology and management practices". The OECD report recommended Canada to further reduce the barriers by eliminating ownership restrictions in telecommunications and transport and by allowing a majority of board members to be non-residents in sectors where this is currently not allowed.

The Canadian government in recent years have undertaken significant steps aiming at reducing the barriers to FDI inflow in Canada. It established the Investment Partnerships Canada (IPC) in 1996, replacing the Foreign Investment Review Agency (FIRA) to attract FDI to Canada[3]. Another set of important initiatives towards reducing barriers to FDI by Canada were taken in 2006. The Telecommunications Policy Review Panel recommended a phased liberalization of foreign ownership restrictions in that sector. The government also made a commitment to

[1] See Golub (2003) for the detailed discussion of the measurement for FDI restrictions. The scores in Table 1 cover mainly statutory barriers.

[2] See Koyama and Golub (2006). The 13 non-OECD countries are: Argentina, Brazil, Chile, Israel, Estonia, Latvia, Lithuania, Romania, Slovenia, China, India, Russia and South Africa.

[3] FIRA was formed in 1973 by the Parliament of Canada to screen inward FDI as a result of concerns about foreign presence in the Canadian economy. FIRA began screening foreign acquisitions of Canadian businesses in April 1974 and the establishment of new foreign businesses in October 1975.

review its foreign investment policy framework, including the screening mechanism under the Investment Canada Act. It also up-dated and expanded the 2005 "open-skies" agreement with the US.

FDI restrictions are considered to be important determinants of FDI locations (see Markusen and Maskus (2001)). A multinational firm chooses production location based on costs and benefits of alternative locations. FDI restrictions raise production cost and hence discourage inward FDI. Given the fact that FDI restrictions in Canada is high relative to other OECD countries, researchers and policy makers in Canada may want to know how these affect FDI inflows in Canada. What would be the impact of reducing the FDI restrictions on the stock of inward FDI in Canada? This paper addresses these issues by estimating econometric models using data from 23 OECD countries.

Quantifying FDI restrictions is difficult and we do not attempt to do that here, rather we use the estimates from Golub et al (2003) and Komaya and Golub (2006). Estimates of FDI restrictions are available only at country level for 4 points of time - 1981, 1986, 1990 and 2000. There are some break ups at a very aggregated sector level and but not enough to undertake an econometric study at a single country level. As a result, for our econometric analysis we rely on data obtained from 23 OCED countries and then investigate how good the results fit for Canada. Finally we draw on the implications of reducing the barriers to inward FDI in Canada.

Our panel data set consists of 23 OECD countries for the period of 1981 to 2004. An autoregressive distributed lag model, $ADL(1,1)$, is used for estimation, and 11 possible determinants of inward FDI including FDI restrictions are included as independent variables. The estimation results are generally consistent to findings in the literature. The influence of FDI restrictions on inward FDI is found to be negative and statistically significant. The estimated short-run elasticity and the long-run elasticity of inward FDI stocks with respect to FDI restrictions are in the ranges of [–0.06, -0.14] and [–0.64, -1.49], respectively.

The rest of the paper is organized as follows. We review the literature regarding the determinants of FDI in section 2. We elaborate on the OECD studies on FDI restrictions in section 3. In section 4 we specify the regression models, discuss the estimation methods, and present the econometric results. Section 5 concludes the paper.

2. The determinants of inward FDI: literature review

Lipsey (2002) discusses two concepts of FDI. First, it is the capital flow across international boundaries and the second is that FDI is nothing but a set of economic activities or operations carried out in a host country by multinational enterprises (MNEs). The first concept is related to balance payment accounts, while the second one is activity-based and the activity may take place not in the same industry or in the same host country or not from the same home country. For a proper economic analysis of FDI behaviour, the activity-based concept should be used.

The neoclassical trade theory and the Heckscher-Ohlin model predict that FDI flows from capital rich countries to capital poor countries to seek higher profit. This macro-level theory cannot

explain two-way FDI between countries in reality. Also, the variability of the level of outward FDI implies that availability of capital is not the only driver of outward FDI.

Due to the flaws of the neoclassical theory, economists developed firm-specific theory[4] to explain the determinants of FDI. Strong ownership advantages can sufficiently offset the costs of being foreign and hence drive firms to become MNEs. The theory is consistent to the observation that MNEs can move capital in both directions across international boundaries.

International capital movement is caused by multinational production; hence both forms' ownership advantages and country characteristics jointly determine the location of multinational production. This suggests that the two theories mentioned above should be combined to explain multinational production activities, as quoted by Heledd Straker[5] from Dunning (1993).

There are mainly three types of models to explain what determines FDI and the location of MNEs in the literature. The first one is the vertical FDI model. Vertical FDI occurs when a firm locates vertically integrated production stages in different countries due to differences of relative factor proportions across countries (Helpman (1984). For example, a firm can locate its labour-intensive activities in a country with relatively abundant labour supply and its capital-intensive activities in a country with relatively abundant capital supply. The vertical model of FDI requires moderate to low trade costs and significant differences in relative factor endowments such that the saving from lower cost of production net of extra trade cost is substantial.

The second one is a horizontal FDI model, which is based on proximity-concentration hypothesis (see Krugman (1983) and Markusen (1984)). When the benefits of proximity to markets are significant, a firm will split up its production into small units across countries to serve local markets and hence becomes a horizontal multinational firm. The horizontal FDI model assumes large local markets, high trade costs, similar ratio of factor endowments across countries, low set-up cost and plant-level economies of scale such that trade cost savings are significant[6].

The third model is called a knowledge-capital model, developed by Carr, Markusen and Maskus (2001). This model attempts to combine vertical and horizontal FDI in the same general equilibrium framework. The basic idea behind the model is that knowledge-generating activity and production are substantially different and can be separated geographically from each other. Knowledge-generating activity is highly skill-biased and hence located generally in countries with abundant skills. Knowledge generated can be supplied to production at low cost. Production can be located in one country or multiple countries, depending on the relative benefits of proximity and concentration. Generally speaking, any MNE could involve vertical and horizontal FDI simultaneously. There are some attempts in the literature trying to empirically distinguish these three types of models[7].

[4] See Hymer (1960), Dunning (1977) and Dunning and Rugman (1985).
[5] http://hel.org.uk/business/essay.doc.
[6] See Brainard (1993), Horstmann and Markusen (1992) for detailed discussion on the emergence of horizontal MNEs.
[7] For example, see Markusen and Maskus (2002) using the U.S. data and Gao (2003) using the OECD data.

Empirically literature uses a long list of variables as determinants of FDI. Blonigen (2005) provides a good review of the empirical literature. As discussed earlier, at the micro-level, a theory of FDI predicts that ownership advantages such as technologies and managerial skills motivate a firm to become multinational due to incomplete markets for these intangible firm-specific assets. R&D intensity and advertising intensity are often used as proxies for ownership advantages in the firm-level empirical studies and are found to be important, for example, see Saunders (1982). Besides ownership advantages, country characteristics or location advantages, such as market size (GDP), trade costs (transportation costs, tariffs and trade policies), factor endowments and costs, skills supply, set-up and operating costs, market risks, tax policies and FDI restrictions, have been shown to be important determinants of FDI. Note that it is easier for firms in a country with more supply of skills to develop firm-specific advantages, which may motivate inward FDI[8].

The gravity model has been used as an empirical specification to explain bilateral FDI flows between two countries. Indeed, the gravity model is quite successful in explaining bilateral trade flows between two trading partners, and its theoretical foundations have been re-established in Anderson and van Wincoop (2003). However, FDI behaviour is much more complicated than trade behaviour. So far in our knowledge, there is no theoretical foundation to support the use of gravity equations for FDI flows. In the gravity specifications, FDI flows between two countries only depend on the characteristics of these two countries. Actually, for allocating vertical FDI, firms pick the host with lowest cost so other hosts get zero. In addition, as sources of FDI are more firm-specific than country-specific, estimating bilateral FDI flows without using firm-specific variables may cause inconsistency.

3. Review of the OECD Studies on FDI restrictions

Given that the main objective of this study is to analyse how FDI restrictions affect FDI inflows, in this section we describe the FDI restrictions indices prepared by the OECD studies. It is quite complicated to measure FDI restrictions across countries because countries report FDI restrictions differently and restrictions are disparate by nature. Golub (2003) in a study for the OECD developed a comprehensive method to quantify FDI restrictions.

Golub first classifies and groups various FDI restrictions into three major types: foreign equity limits, screening and approval, and other restrictions including restrictions on board of directors, people movement and input and operations. He then assigns coefficients to each type of restrictions and constructs an aggregate index for a few key sectors. The sectoral indices are then aggregated into country-level indices. The scoring system is presented in Table 2. Note that a much higher coefficient is assigned to foreign ownership restrictions that are considered to be the most obvious barriers for MNEs to enter. Information on FDI restrictions is gathered from a variety of sources. These include the general agreement on trade in services' (GATS) commitments, OECD code of liberalization and related documents, data and documents obtained from the U.S., Japan, European Union and Price-Waterhouse-Coopers. The estimated results of the Country-level FDI restrictions are presented in Table 1. Note that the Golub's assessment

[8] See Kogut and Chang (1991) for the discussion of Japanese FDI in the U.S.

only covers formal FDI restrictions and mostly ignores informal restrictions. Even so, the Golub's methodology is relatively comprehensive and objective.

Golub and his associates from the OECD (Golub et al. (2003)) investigated the determinants of FDI using a panel data for 28 OECD countries. A gravity model is used for explaining the bilateral FDI stocks and a dynamic model is used for explaining the total inward FDI stocks. The authors estimated two equations for bilateral FDI stocks: one equation is called "country" equation in which bilateral FDI stocks and all explanatory variables are defined as deviations from their averages of *home* countries; and the other equation is called "partner" equation in which bilateral FDI stocks and all explanatory variables are defined as deviations from their averages of *partner* countries[9]. The explanatory variables used in both equations for bilateral FDI stocks are total GDP, size similarity, factor dissimilarity, human capital dissimilarity, transport costs, bilateral exchange rate, exchange rate variability, free trade area, bilateral tariff barriers, employment protection ratio, labour tax wedge ratio and regulation ratio. Besides, FDI restrictions and non-tariff barriers are included in the "partner" equation. In addition R&D intensity and infrastructure are also used.

The coefficient of FDI restrictions in the "partner" equation of bilateral FDI stocks is –0.019, and the estimated long-term coefficient in the equation of total inward FDI stocks is also –0.019 when employment protection ratio, labour tax wedge ratio and regulation ratio are not included[10]. The authors use this coefficient to estimate the increase in the inward FDI stocks when a country reduces its FDI restrictions to the U.K. level (U.K. being the least restrictive country, see Figure 24 in Golub et al. (2003), page 70 for the simulation results). For example, the simulation results show that Canada's inward FDI stock would be increased by about 70% if its score of FDI restrictions (35.2) were reduced to the U.K. level (6.4)[11].

We have a couple of concerns about the models used in Golub et al. (2003) for FDI. First, the dependent variable in a gravity model should be a flow, rather than a stock variable. The authors claim that they focus on FDI stocks instead of flows because "the decision of firms concerns the level of local production, which is a function of the desired level of the local stock of FDI" (Footnote 47, page 50, Golub et al. (2003)). We think that in this case a proper approach would be to use lagged bilateral FDI stock as an explanatory variable for bilateral FDI flows. Second, the quality of data on FDI is not as good as on international trade. As mentioned earlier, there are two concepts of FDI. The FDI activities under the first concept can be measured using balance of payments accounts. However, as claimed in Lipsey (2002), FDI activities under the second concept are "frequently not in the same industry as the stock, or not in the same host country, or have not originated from the same home country", so the balance of payments measures have many defects for FDI stocks and flows. This implies that disaggregated FDI data

[9] The corresponding estimation approach is called "transformed least squares (TLS)". For details, see Erkel-Rousse and Mirza (2002).

[10] See Table 4a in Golub et al (2003), page 56. The long-term coefficient of FDI restrictions in the equation of total inward FDI stocks equals to –0.007/(1-0.626)=-0.0187. Also note that the coefficient of FDI restrictions in the equation of total inward FDI stocks becomes statistically insignificant when employment protection ratio, labour tax wedge ratio and regulation ratio are included, which might imply that FDI restrictions and those protection ratios are not exogenous to each other.

[11] The percentage increase in inward FDI stocks is estimated as $(e^{-0.019\times(6.4-35.2)} - 1)\times 100 = 72.8$.

by country sources, which is required for analyzing bilateral FDI behavior, may not be in good quality.

4. Empirical Analysis

This paper focuses on the impact of FDI restrictions on inward FDI stocks in the OECD countries. It can be done either by using a bilateral framework or by a multilateral framework, as done by Golub et al (2003). However, as noted earlier, it is better to use the activity-based concept of FDI for the purpose of economic behavioural analysis. FDI data disaggregated by country source are obtained from the balance of payment account and are not activity-based. Using such data in a bilateral framework may not be appropriate. For example, FDI from country A (in the balance of payment) may actually come from country B, therefore values of country B instead of country A should be used to explain the investment flow. To overcome such drawback of a bilateral framework, we choose to use a multilateral framework i.e., we use host countries' characteristics to explain total inward FDI stocks.

4.1. Econometric specification

The regression model we use in the paper is as follows:

(1) $$y_{it} = \alpha + \beta y_{it-1} + \gamma_0 x_{it} + \gamma_1 x_{it-1} + \zeta_i + \xi_t + u_{it}$$

Where the subscript i represents country and subscript t represents time. Equation (1) is a special case of autoregressive distributed lag (ADL) model, or $ADL(1,1)$. This model can tell us the long-run equilibrium relationship between independent variables and the dependent variable. Without error terms, all variables will converge to the steady-state, i.e.,

(2) $$y_i^* = \frac{\alpha + \zeta_i + \xi_t}{1-\beta} + \frac{\gamma_0 + \gamma_1}{1-\beta} x_i^* \equiv \frac{\alpha + \zeta_i + \xi_t}{1-\beta} + \lambda x_i^*$$

The long-run impact of x on y is $\lambda \equiv (\gamma_0 + \gamma_1)/(1-\beta)$. Actually equation (1) can be rewritten as its error-correction form,

(3) $$\Delta y_{it} = \alpha - (1-\beta)(y_{it-1} - \lambda x_{it-1}) + \gamma_0 \Delta x_{it} + \zeta_i + \xi_t + u_{it}$$

Equation (3) can be estimated using the Engle-Granger two-step procedure or directly by non-linear least squares (NLS), the latter is equivalent to estimating equation (1) by OLS. Note that some variables in equation (3) may not be stationary so the inference on the parameter estimates may not be valid. However, if x and y are co-integrated, standard asymptotic distribution theory would apply to all coefficients in the equation[12].

We choose to estimate equation (1) because it is simpler to proceed. Panel least squares (PLS) is used in the paper. We did cointegration tests and the results show that inward FDI stocks (in logarithm) and all explanatory variables used are cointegrated. The actual regression model we estimate is as the follow:

[12] See Davidson and MacKinnon (1993, page 724-725).

$$
\begin{aligned}
\ln(FDI_{it}) = {} & \alpha + \beta \ln(FDI_{it-1}) + \gamma_1^0 \ln(GDP_{it}) + \gamma_1^1 \ln(GDP_{it-1}) \\
& + \gamma_2^0 \ln(RE_{it}) + \gamma_2^1 \ln(RE_{it-1}) + \gamma_3^0 RD_{it} + \gamma_3^1 RD_{it-1} \\
& + \gamma_4^0 \ln(TEL_{it}) + \gamma_4^1 \ln(TEL_{it-1}) + \gamma_5^0 UEM_{it} + \gamma_5^1 UEM_{it-1} \\
& + \gamma_6^0 \ln(EDU_{it}) + \gamma_6^1 \ln(EDU_{it-1}) + \gamma_7^0 \ln(Wage_{it}) + \gamma_7^1 \ln(Wage_{it-1}) \\
& + \gamma_8^0 Open_{it} + \gamma_8^1 Open_{it-1} + \gamma_9^0 REX_{it} + \gamma_9^1 REX_{it-1} + \gamma_{10}^0 RIN_{it} + \gamma_{10}^1 RIN_{it-1} \\
& + \gamma_{11}^0 Tax_{it} + \gamma_{11}^1 Tax_{it-1} + \zeta_i + \xi_t + u_{it}
\end{aligned}
\qquad \textbf{(4)}
$$

4.2. Explanatory variables

This section briefly presents all explanatory variables that are used in the econometric analysis and discusses their expected signs based on theories and empirical studies in the literature.

GDP (*GDP*) is usually used in the literature as the indicator of market size of host countries. In the horizontal FDI model host countries' GDP is expected to have a positive impact on inward FDI because horizontal FDI serves a market directly and would be more profitable than exports when the market size is bigger. However, vertical FDI is motivated by relative factor cost, so market size should not be an important determinant.

FDI restrictions (*RE*) measure barriers to inward FDI and hence are expected to have a negative effect on inward FDI. Golub et al (2003) estimated the impact of FDI restrictions on inward FDI using data of OECD countries and the impact is found to be negative and significant.

R&D intensity (*RD*) is often used as a proxy for the presence of intangible assets. R&D expenditures create knowledge involving new products and processes and hence help firms to develop their ownership advantages. So firms spending more on R&D are more likely to become MNEs. Higher R&D intensity in host countries may also attract more FDI due to agglomeration economics and availability of firm-specific assets. Kogut and Chang (1991) and Blonigen (1997) show that FDI by Japanese firms in the U.S. was to access firm-specific assets, not necessarily to internalize their own firm-specific assets. Golub et al (2003) also show that host countries' R&D intensity had a positive impact on inward FDI.

Infrastructure (*TEL*) is closely related to firms' set-up and operating costs and hence expected to have a positive effect on FDI. In this paper we use public telecommunication investment per capita as a proxy for infrastructure.

Unemployment rate (*UEM*) is used to indicate labour supply condition. In a vertical FDI model, firms are motivated to locate their labour intensive activities in a country with relatively abundant labour supply; therefore unemployment rate should have positive impact on vertical FDI. In contrast, labour supply condition is not an important determinant of horizontal FDI.

Educational attainment (*EDU*) is used as a proxy for skills level of labour force. In a knowledge-capital model of FDI, firms locate their knowledge-generating activity in countries with abundant skills. So a country with a higher level of skills is expected to receive more FDI.

Real wage rate (*Wage*) is also used to indicate skills level; hence higher real wage rate will encourage inward FDI. Yang et al (2000) find a positive impact of real wage rate on Australia's inward FDI. However, it could be argued that real wage rate represents labour cost. So higher real wage rate will discourage vertical FDI. Faeth (2005) obtained negative sign of real wage rate on Australia's inward FDI.

We use trade openness (*Open*) to test the relationship between FDI and trade. The vertical FDI model predicts that inward FDI and trade should be complements due to a difference in relative factor ratio between home and host countries, while the horizontal FDI model suggests that inward FDI and trade are substitutes for similar countries[13]. Faeth (2005) provided evidence that trade openness had a positive effect on Australia's inward FDI in the long run, though the contemporaneous effect was insignificant. In contrast, the impact of trade openness on Australia's inward FDI was found to be negative in Yang et al (2000).

Real exchange rate (*REX*) is used to test the link between currency movements and inward FDI. There are basically two channels through which real exchange rate may affect FDI. First, as emphasized in Froot and Stein (1991), capital market imperfections lead firms to invest more abroad when their home currency appreciates because their relative wealth increases and the internal cost of capital is lower than borrowing; and second, currency movements will affect relative labour costs across countries. Both channels imply that a real depreciation encourages inward FDI. Froot and Stein (1991) and Klein and Rosengren (1994) found that US dollar depreciation increases US inward FDI. The same conclusion is obtained in Golub et al (2003) for OECD countries. Kogut and Chang (1991) examined the mutual investment serving as platforms between US and Japan and claimed that movements of real exchange rates trigger the timing of entry. The volatility of real exchange rate is considered to be a kind of market risk and hence discourages FDI. The hypothesis is confirmed in Amuedo-Dorantes and Pozo (2001) for US inward FDI and in Kiyota and Urata (2004) for Japanese inward FDI. Note that real exchange rate and real wage rate may correlate to each other as real exchange rate may have an effect on relative labour cost.

Real interest rate (*RIN*) is assumed to have a positive effect on inward FDI in Heckscher-Ohlin model because higher interest rate implies higher return to capital. In contrast, in ownership location internalization (OLI) framework of FDI, interest rate is considered to be a kind of market risk because risk-free rate should be the same across countries. So higher real interest rate will discourage FDI.

Higher corporate tax rates (*Tax*) in host countries reduce returns to capital and hence discourage FDI. It is an empirical question how big the impact is.

4.3. Definition of variables and data sources

We create a panel data set for 23 OECD countries from 1981 to 2004. The first column in Table 1 presents the list of all countries. The dependent variable in equation (4) is inward FDI stock (in logarithm) in millions of US dollars in 2000 price. The nominal inward FDI stocks in US

[13] Markusen and Maskus (2001) provide detailed discusses on trade and affiliate production.

dollar are obtained from the United Nations Conference on Trade and Development (UNCTAD) and are deflated using GDP deflators. GDP in current and 2000 prices (in US dollar) are obtained from the World Bank. The FDI restrictions for the years of 1981, 1986 and 1991 are from Professor Golub directly, and the FDI restrictions for the year of 2000 are obtained from Komaya and Golub (2006). Data for all other years are interpolated using average annual growth rates.

R&D intensity is defined as gross domestic expenditure on R&D (GERD) to GDP ratio. GERD in US dollar in 2000 prices comes from the OECD MSTI database. Missing values are interpolated using growth rates. Public telecommunication investment per capita in nominal US dollar comes from the table 4.20 in OECD Communication Outlook 2005. The table only has data for the period from 1988 to 2003. We interpolate data for all other years using average annual growth rates. The nominal values are converted into constant values in 2000 prices using GDP deflators.

Unemployment rate data are obtained from the OECD main economic indicators (MEI) dataset. Educational attainment is measured using the average years of schooling of the total population aged 25 and over, and the data are obtained from Appendix Table A1 in Barro and Lee (2000) for the years of 1980, 1985, 1990, 1995 and 2000. Data for all other years are interpolated using average annual growth rates. The real wage rate is defined as total labour compensation per employment. Total nominal labour compensation data in national currency are obtained from OECD national accounts; total employment and nominal exchange rates are from the OECD Economic Outlook. Nominal labour compensation is converted into nominal US dollar using nominal exchange rates and then into constant US dollar using GDP deflators.

Trade openness is defined as the sum of exports and imports to GDP ratio (nominal). Nominal exports and imports are obtained from the World Bank. The nominal exchange rates (US dollar per local currency) are converted into real exchange rates using relative prices that are indicated using the ratios of CPI indexes. CPI indexes equal to 100 for the year of 2000 and are obtained from the World Bank. The real short-term interest rates are measured as the differences between nominal short-term interest rates and inflation rates. The nominal rates are obtained from the OECD economic outlook, supplemented with data from national statistics agencies for missing values. Inflation rates are calculated using CPI indexes. The combined corporate income tax rates[14] are used in this paper and the data for the period from 2000 to 2004 are from the OECD taxation database. The averages of this period are used for all other years. As a result, this variable is almost unchanged over time.

4.4. Estimation results

Panel estimations of equation (4) are presented in Table 3. There are eight sets of estimation results in the table, in which columns (1) to (4) are OLS estimations with or without fixed effects and columns (5) to (8) are feasible GLS estimations with or without fixed effects. Note that in equation (4) each independent variable has temporal and one-year lagged effects. When the two

[14] OECD defines this as the basic combined central and sub-central (statutory) corporate income tax rate given by the adjusted central government rate plus the sub-central rate.

effects of an independent variable are similar, the temporal effect is excluded from the equation to minimize possible endogeneity problem.

Now we briefly summarize the estimation results. Basically the results are consistent to theoretical predictions and empirical findings in the literature. As shown in Table 3, the value of β is about 0.9, meaning that the inward FDI stocks are highly persistent. The result is intuitive by the nature of stock variables. The coefficient of GDP is positive in all estimations but statistically significant only in models (2), (3), (5) and (6). The impact of FDI restrictions is shown to be negative and statistically significant with only one exception in model (8). The coefficients of R&D intensity and telecommunication investment per capita are positive and statistically significant only except that the coefficient of telecommunication investment per capita is not statistically significant in models (2) and (4). The short-run impact of unemployment rate is negative in all models but its long-run impact is numerically quite small, negative in model (6) and positive in all other models. This implies that labour supply conditions have very small impact on inward FDI in OECD countries[15]. The coefficient of education is numerically small, positive in some models and negative in other models. A possible reason is that education is correlated with some other variables. To check whether it is the case, we exclude GDP and the real wage rate from the equation, re-estimate it and found that the impact of education becomes positive and statistically significant while the impact of all other variables remain the same in terms of signs and significances. The impact of the real wage rate is also not significant, though negative in all models. Again, we found that its impact becomes positive and significant when excluding GDP and education variables from the equation. The coefficient of trade openness is positive but not statistically significant in models (1), (3), (5), (7) and (8), while it is negative in the other three models and statistically significant in models (2) and (6), weakly suggesting that inward FDI and trade are substitutes and hence implying that the horizontal FDI model prevails in OECD countries[16]. The short-run impact of real exchange rates is negative and statistically significant in all models, and its long-run impact is negative and numerically significant in models (2), (4) and (6). The short-run impact of real interest rate is positive and statistically significant in most models, but its long-run impact is numerically small. Corporate tax rate has no impact on inward FDI probably because we do not have a good time series for the variable.

The purpose of this paper is to examine how big the impact of FDI restrictions is on inward FDI, so we are not going to further discuss the impact of all other variables. The long-run impact of FDI restrictions on inward FDI relies on two numbers: the short-run impact of FDI restrictions and the persistency of inward FDI stocks. Obtaining accuracy estimations of the two numbers matters for our purpose. Residuals are needed to be normally distributed for least squares estimators to be efficient. We did a normality test for all eight models in Table 3 using Jarque-Bera statistics that is distributed as χ^2 with two degrees of freedom under the null hypothesis of a normal distribution. The testing results suggest that only models (5) and (6) have normally distributed residuals[17] (see Table 3). Note that the two models are only models having cross-

[15] It is consistent with the findings in Gao (2003) that the vertical FDI model does not prevail in OECD countries.
[16] Later in the paper we conclude after a discussion that model (6) should be the one used for.
[17] A model is claimed to pass the normality test when the p-value of the Jarque-Bera statistics for its residuals is greater than 0.1, which means that the null hypothesis of a normal distribution cannot be rejected at 10% level of significance.

country weights, which suggests that a correction for cross-country heterogeneity in equation (4) is necessary to have an efficient or accurate estimation. Therefore, we will continue our discussions based on the estimations of the models (5) and (6).

The difference between (5) and (6) is that model (5) does not have cross-country fixed effect while model (6) does. The two models give similar estimations of the short-run impact of FDI restrictions but different estimations of the coefficient of the lagged dependent variable (β). One may argue that model (6) is superior to model (5) due to the inclusion of cross-country fixed effect. However, in finite sample, the fixed effect may correlate with the lagged dependent variable and may lead to biased estimations. For dynamic panel data models, as claimed in Kiviet (1995), there is "no technique that has shown uniform superiority in finite samples over a wide range of relevant situations as far as the true parameter values and the further properties of the data generating mechanism are concerned". To access which estimation of β in (5) and (6) is more close to the true value of β , a simple calibration based on the law of motion of capital stocks has been done in Appendix 1. The calibration implies that $\beta \leq 0.92$, which supports the estimation of β in (6). As a result, the estimation of β in (6) is used for calculation of the long-run elasticity of the inward FDI stocks with respect to the FDI restrictions.

Now we turn to look at the short-run elasticity of the inward FDI stocks with respect to the FDI restrictions. Both (5) and (6) give similar estimations of the short-run elasticity. A potential problem is that these estimations might be biased due to possible multi-collinearity between FDI restrictions and all other independent variables. To investigate the possible multi-collinearity problem, we follow the suggestion in Davidson & MacKinnon (1993, page 184-185) and calculate the ratio of the sum of squared residuals from the regression of FDI restrictions on all other independent variables to the sum of squared deviations of FDI restrictions from its mean. The ratio gives the share of FDI restrictions that cannot be explained by all other independent variables. The smaller the ratio is, the more serious the collinearity problem could be. The ratio is about 0.2, which suggests that the collinearity between FDI restrictions and all other independent variables may well be a problem[18]. As a result, the estimations of the short-run elasticity of the inward FDI stocks with respect to the FDI restrictions in Table 3 is much lower that the "true" value of the short-run elasticity as a significant part of the impact of FDI restrictions is captured by other variables. However, we can claim that Table 3 gives the lower bound of the impact of FDI restrictions. Choosing (6) as our benchmark model, the lower bound of the short-run elasticity is –0.06 and correspondingly, the lower bound of the long-run elasticity is –0.64.

To obtain the upper bound of the estimations, we can assume that the impact of the common area between FDI restrictions and all other variables is fully caused by FDI restrictions. More specifically, we regress each of all other independent variables on FDI restrictions and use the residuals obtained to replace all those variables in equation (4). Therefore, FDI restrictions and all other "newly valued" independent variables are orthogonal to each other. Re-estimation of equation (4) gives a new set of estimations. Frisch-Waugh-Lovell (FWL) theorem predicts that all new coefficients but the one for FDI restrictions are the exactly the same as those before. The new value of the coefficient of FDI restrictions can be claimed as the upper bound of the short-

[18] We conjecture that the problem may arise from the interpolation of FDI restrictions data.

run elasticity of the inward FDI stocks with respect to the FDI restrictions. It equals –0.14 based on model (6). The corresponding long-run elasticity equals -1.49. Generally speaking, our estimations imply that the short-run elasticity of the inward FDI stocks with respect to the FDI restrictions should be in the range between –0.06 and –0.14, and the corresponding long-run elasticity should be in the range between –0.64 and –1.49.

To know how good are our estimations for Canada, we present in Figure 1 the actual values, the fitted values and the residuals of the dependent variable for Canada based on model (6) in Table 3. It shows that the model fits very well for Canada.

5. Concluding Remarks

This paper investigates the impact of the FDI restrictions on inward FDI stocks using a panel data set for 23 OECD countries over the period of 1981 to 2004. We do find that the coefficient of FDI restrictions is negative and statistically significant. However, due to the serious multi-collinearity problem, we cannot obtain an exact estimation of the impact of FDI restrictions except its lower bound and upper bound. The short-run elasticity of inward FDI stocks with respect to the FDI restrictions is estimated in the range between –0.06 and –0.14, and the long-run elasticity is estimated in the range between –0.64 and –1.49.

The concept of "long-run" may be vague for general public. "Long-run" refers to a steady state in economic theory, but empirically, the number of years for an economy to converge to a steady state is different. For example, in this paper, the coefficient of the lagged dependent variable is about 0.91, which implies that about 70 years would be needed for the inward FDI stocks to converge if any deviation today. In Golub et al (2003) the coefficient of the lagged dependent variable is about 0.63, implying that the impact of a deviation today will last for 12 years. The results suggest that the dynamics of the inward FDI stocks in this paper and in Golub et al (2003) are quite different. Based on the calibration exercise in Appendix 1, for the coefficient of the lagged dependent variable (β) is as low as 0.63, the annual net growth rate of the inward FDI stocks should be as high as 58%.

The country note for Canada in the OECD report entitled "Economic Policy Reforms: Going for Growth 2007" recommends Canada to further reduce FDI restrictions. To understand the impact of reducing FDI restrictions on inward FDI in Canada, we do a simple simulation using the estimates in this paper for Canada. In order to compare with the results in Golub et al (2003), we also examine the impact of reducing Canada's FDI restrictions to the U.K. level. The simulation results are shown in Table 4[19]. As shown in the table, the bilateral model in Golub et al (2003) predicts that Canada's inward FDI stocks would increase by 72.8% and there is no dynamics in the model. The multilateral model in Golub et al (2003) predicts that Canada's inward FDI stocks would increase by 22.3% in the short-run, 70.6% in 10 years and 71.4% in the log-run. Our estimates imply that the increase would be 4.3% to 10.1% in the short-run, 28.8% to 67.0% in 10 years and 45.6% to 106.2% in the long run. Note that the long-run impact in Golub et al

[19] The FDI restrictions for the year of 2000 used in Golub et al (2003) are different from what have been used in this paper. As a result, we evaluate their model implications using actual data they used for their estimations and our model implications using actual data we use for our estimations.

(2003) is quite close to the medium value of the long-run impact in our model. But the short-run and the medium-run (10 years) impacts are much smaller in our model.

A drawback of our estimations is that we only have FDI restrictions data for four years and the data for all other years are interpolated. It is not clear how this will affect our estimation results; therefore the use of them should be with caution. One extension to our work is to add industry dimension in our model to examine in which industries inward FDI is more sensitive to barriers to FDI. Data availability is a major issue for studies in the area.

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Appendix 1

Equation (4) can be rewritten as:

(A1) $\ln(y_t) = \alpha + \beta \ln(y_{t-1}) + \gamma^0 X_t + \gamma^1 X_{t-1} + u_t$

So we have

(A2) $\beta = \frac{\partial \ln(y_t)}{\partial \ln(y_{t-1})} = \frac{\partial y_t / \partial y_{t-1}}{y_t / y_{t-1}}$

Which implies that

(A3) $\frac{\partial y_t}{\partial y_{t-1}} = \beta \frac{y_t}{y_{t-1}} = \beta(1+g)$

Where the parameter g is the net growth rate of inward FDI stocks (y). The law of motion of inward FDI stocks is

(A4) $y_t = (1-\delta) y_{t-1} + I_t$

Where the parameter δ denotes depreciation rate of inward FDI stocks, and the variable I denotes foreign direct investment. Assume that the investment can be decomposed into two parts: the first part only depends on the previous year's inward FDI stock while the second part only depends on all other variables, i.e.,

(A5) $I_t = \sigma y_{t-1} + f(X)$

Substituting (A5) into (A4) gives

(A6) $\frac{\partial y_t}{\partial y_{t-1}} = 1 - \delta + \sigma$

Combining (A3) and (A6) solves

(A7) $\beta = \frac{1-\delta+\sigma}{1+g}$

It is reasonable to assume that $\sigma \le \delta$. If it were not the case, inward FDI stocks would be growing forever without economic reasons. Under the assumption we have $\beta \le 1/(1+g)$. The average annual growth rate of total inward FDI stocks of the 23 OECD countries over the period of 1981 to 2004 was 8.55%, which implies that $\beta \le 0.92$.

Tables and Figures

Table 1: FDI Restriction Scores by Country (1 = closed, 0 = open), total economy

	1980	1990	2000
Australia	0.460	0.332	0.280
Austria	0.432	0.432	0.242
Belgium	0.291	0.291	0.052
Canada	0.484	0.379	0.228
Denmark	0.246	0.161	0.131
Finland	0.521	0.463	0.180
France	0.487	0.233	0.094
Germany	0.181	0.174	0.063
Greece	0.404	0.332	0.187
Iceland	0.600	0.481	0.309
Ireland	0.345	0.250	0.078
Italy	0.264	0.264	0.073
Japan	0.251	0.237	0.101
Netherlands	0.264	0.243	0.074
New Zealand	0.396	0.237	0.170
Norway	0.510	0.466	0.144
Portugal	0.569	0.233	0.120
Spain	0.336	0.230	0.140
Sweden	0.429	0.335	0.147
Switzerland	0.306	0.278	0.174
Turkey	0.507	0.391	0.173
U.K.	0.215	0.167	0.065
U.S.	0.171	0.170	0.119
Mean	0.377	0.295	0.145
Maximum	0.600 (Iceland)	0.481 (Iceland)	0.309 (Iceland)
Minimum	0.171 (U.S.)	0.161 (Denmark)	0.052 (Belgium)
Standard Deviation	0.128	0.100	0.071

Source: Golub (2003) and Komaya and Golub (2006).

Table 2: Coefficients on FDI Restrictions

Type of Restrictions	Scores
Foreign Equity Limits	
No foreign equity allowed	1.0
1-19% foreign equity allowed	0.6
20-34% foreign equity allowed	0.4
35-49% foreign equity allowed	0.3
50-74% foreign equity allowed	0.2
75-99% foreign equity allowed	0.1
No restriction but unbound	0.05
Screening and Approval	
Investor must show economic benefits	0.2
Approval unless contrary to national interest	0.1
Notification (pre or post)	0.05
Other Restrictions	
Board of directors/Managers	
Majority must be nationals or residents	0.1
At least 1 must be nationals or residents	0.05
Must be locally licensed	0.025
Movement of people	
No entry	0.1
Less than one year	0.075
One to two years	0.05
Three to four years	0.025
Input and operational restrictions	
Domestic content must more than 50%	0.1
Other	0.05
Total	[0, 1]

Source: Table 1 in Golub (2003).

Table 3: Panel Estimations*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
α	0.1280 (0.3579)	-2.4362 (0.0297)	0.0932 (0.3939)	0.9643 (0.6629)	0.1434 (0.2431)	-1.5488 (0.0640)	0.2205 (0.0828)	0.1757 (0.1543)
β	0.9630 (0.0000)	0.8823 (0.0000)	0.9617 (0.0000)	0.8661 (0.0000)	0.9597 (0.0000)	0.9052 (0.0000)	0.9666 (0.0000)	0.9646 (0.0000)
$\ln(GDP(-1))$	0.0118 (0.3577)	0.3818 (0.0010)	0.0186 (0.0778)	0.1306 (0.4575)	0.0233 (0.0558)	0.2163 (0.0169)	0.0091 (0.4306)	0.0171 (0.1470)
$\ln(RE(-1))$	-0.0563 (0.0003)	-0.0732 (0.0206)	-0.0319 (0.0613)	-0.0584 (0.0769)	-0.0583 (0.0000)	-0.0605 (0.0225)	-0.0461 (0.0011)	-0.0107 (0.5509)
$RD(-1)$	0.0442 (0.0002)	0.1046 (0.0007)	0.406 (0.0002)	0.1123 (0.0002)	0.0353 (0.0028)	0.0714 (0.0046)	0.0417 (0.0001)	0.0356 (0.0004)
$\ln(TEL(-1))$	0.0571 (0.0002)	0.0285 (0.2113)	0.0606 (0.0006)	0.0229 (0.3318)	0.0585 (0.0000)	0.0410 (0.0171)	0.0464 (0.0013)	0.0442 (0.0047)
UEM	-0.0232 (0.0012)	-0.0214 (0.0043)	-0.0111 (0.1493)	-0.0106 (0.2099)	-0.0277 (0.0000)	-0.0297 (0.0000)	-0.0151 (0.0183)	-0.0113 (0.1098)
$UEM(-1)$	0.0304 (0.0000)	0.0294 (0.0001)	0.0193 (0.0103)	0.0155 (0.0749)	0.0320 (0.0000)	0.0287 (0.0000)	0.0214 (0.0007)	0.0180 (0.0102)
$\ln(EDU(-1))$	0.0014 (0.9717)	-0.1023 (0.5084)	-0.0040 (0.8992)	-0.1495 (0.3179)	0.0033 (0.9247)	0.0674 (0.6061)	0.0084 (0.8130)	-0.0140 (0.6783)
$\ln(Wage(-1))$	-0.0317 (0.1627)	-0.0825 (0.5545)	-0.0319 (0.1106)	-0.0540 (0.7078)	-0.0409 (0.0467)	-0.0434 (0.7144)	-0.0346 (0.0988)	-0.0262 (0.2109)
$Open(-1)$	0.0301 (0.3730)	-0.2705 (0.0229)	0.0464 (0.1038)	-0.1781 (0.1387)	0.0456 (0.1238)	-0.1786 (0.0582)	0.0170 (0.5806)	0.0298 (0.3334)
REX	-0.4916 (0.0000)	-0.5265 (0.0000)	-0.3566 (0.0013)	-0.3276 (0.0008)	-0.4041 (0.0000)	-0.4494 (0.0000)	-0.4218 (0.0000)	-0.2569 (0.0015)
$REX(-1)$	0.4920 (0.0000)	0.3591 (0.0000)	0.3555 (0.0012)	0.2459 (0.0173)	0.4044 (0.0000)	0.3069 (0.0000)	0.4188 (0.0000)	0.2623 (0.0013)
RIN	0.0039 (0.0463)	0.0044 (0.0617)	0.0040 (0.0177)	0.0038 (0.1297)	0.0020 (0.2699)	0.0033 (0.0875)	0.0040 (0.0265)	0.0049 (0.0046)
$RIN(-1)$	-0.0041 (0.0369)	-0.0046 (0.0520)	-0.0048 (0.0178)	-0.0056 (0.0243)	-0.0007 (0.6889)	-0.0004 (0.8375)	-0.0026 (0.1796)	-0.0031 (0.1046)
$Tax(-1)$	0.0001 (0.9318)	-0.0051 (0.6822)	-0.0002 (0.8479)	-0.0160 (0.2273)	-0.0006 (0.6707)	0.0007 (0.9301)	-0.0001 (0.9448)	-0.0003 (0.8034)
Long-run elasticity of FDI restrictions	-1.52	-0.62	-0.83	-0.44	-1.45	-0.64	-1.38	-0.30
Country fixed effect	No	Yes	No	Yes	No	Yes	No	No
Cross-country weights	No	No	No	No	Yes	Yes	No	No
Period fixed effect	No	No	Yes	Yes	No	No	No	Yes
Period weights	No	No	No	No	No	No	Yes	Yes
Normality test	Reject	Reject	Reject	Reject	Pass	Pass	Reject	Reject
Adjusted R^2	0.9932	0.9934	0.9939	0.9941	0.9950	0.9953	0.9944	0.9951
Sample size	506	506	506	506	506	506	506	506
D.W. Statistics	1.98	1.95	1.89	1.85	1.93	1.93	1.96	1.90

*: Numbers in brackets are probability values.

Table 4: The effect of reducing Canada's FDI restrictions to the U.K. level

	Short-run	Long-run	In 10 years
Bilateral model in Golub et al (2003)	72.8%		
Multilateral model in Golub et al (2003)	22.3%	71.4%	70.6%
This paper	4.3%-10.1%	45.6%-106.2%	28.8%-67.0%

Figure 1: Actual, fitted and residuals of inward FDI stocks, Canada
(based on the estimation in Column (6), Table 3)