Welfare Aspects of FDI to Source Country: An Example of Increasing FDI in China

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Abstract

This paper takes FDI in China as an example to evaluate the impacts of FDI on source countries. The simulation results show that if capital rewards repatriated mechanism is not implemented, although FDI could benefit the social welfare of some source countries by term of trade effect, the loss of capital still dominate the total welfare effect. Source countries such as Taiwan, Hong Kong, Korea and Singapore may not suffer loss if capital rewards repatriated mechanism is implemented. Therefore, it should be considered to source countries to implement a capital rewards repatriated mechanism for reducing the loss of social welfare by capital drain.

Key words: foreign direct investment in China, welfare decomposition, capital rewards repatriated mechanism, computable general equilibrium model

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1. Introduction

Along with rising international trade, foreign direct investment (FDI) is also becoming an important economic activity worldwide. Many host countries are vying for investment from multinational enterprises. Source countries, however, are conservative.

For the host country, FDI is not only a form of capital inflow but can also be considered as a form of technology transfer. Therefore, many countries have been implementing favorable investment policies to attract foreign investment. For the source country, FDI may mean some advantages for its labor force (Skaksen and Sorensen, 2001) and can also boost the country's R&D intensity (Liu, Lee and Weng, 2000). Nevertheless, whether the firms in a source country directly invest abroad or they first plan to invest in their country and then transfer to host countries, for the source country, this is a form of capital drain or industry erosion. This phenomenon may result in deindustrialization.[1]

On the other hand, if consideration is given to the countries' bilateral trade, FDI may be seen as benefiting the source country. The reason for this is while the host country's income increases due to FDI, it will also stimulate the host country's purchasing power for intermediate and final goods from the source country. In addition, source country government may ask outward FDI firms to remit income from the host country back to the source country—a capital rewards repatriated mechanism. The source country's income thus grows and welfare increases. Therefore, it is debatable whether or not FDI causes a negative impact on the source country. The question probably can only be answered empirically. This paper is aimed at exploring this issue.

Mainland China adopted an open door policy in 1979. From that time, it started an FDI boom domestically which was ranked second in the world since 1993. By the end of 1999, around 307.6 billion U.S. dollars flowed to China through FDI. Given the significant FDI activity, we will take China as an example to evaluate the

[1] By using U.S. industrial data, Staudohor and Holly (1987) conclude that capital outflow may result in deindustrialization.

impacts of FDI on the source countries.

The literature on FDI's impact on the source country is few. But if FDI is seen as a form of international capital mobility, the literature abounds. For example, Ruffin (1984) and Miyagiwa (1990) employed theoretical models to explore capital mobility's effects on welfare of both host and source countries. They have shown that capital mobility benefits both.

This paper follows Miyagiwa (1990) by using a dual approach as a theoretical basis. Through this method, we can decompose the effects of FDI on welfare for both host and source countries. We then apply computable general equilibrium model to simulate the effects that are decomposed.

The rest of this paper is organized as follows. Section 2 modifies the general equilibrium model of Miyagiwa (1990). Section 3 discusses database and empirical model settings. This is followed by section 4 that uses time series data from 1979 to 1998 to calculate simulation shocks. Section 5 analyzes the results while section 6 concludes the paper.

2. Welfare decomposition

We extend the model of Miyagiwa (1990) to embody Armington's (1969) assumption that goods are differentiated on the basis of country of origin. In addition, we utilize a welfare decomposition method to evaluate the effects of an increase in FDI. Since capital outflow decreases domestic investment in the short run, and hence employment, source countries may impose some criteria to control capital flow. In the following, we will discuss two cases whether or not the so-called "capital rewards repatriated mechanism" is implemented.

2.1 Capital rewards repatriated mechanism is not implemented

Consider a simple general-equilibrium model where capital moves between countries without restrictions. In equilibrium, a country's consumption expenditure should be the value of production. Thus,

$$e^i\left(p^i, p_m^{ji}, u^i\right) = R^i\left(p^i, p_x^{ij}, \overline{L^i}, K^i\right), \tag{1}$$

where $e^i\left(p^i, p_m^{ji}, u^i\right)$ is the minimum expenditure necessary for the representative country i to achieve utility level u^i when the vectors of domestic prices p^i, and prices of imports from exporting country j (p_m^{ji}, $j \neq i$) are obtained.[2] The scalar $R^i\left(p^i, p_x^{ij}, \overline{L^i}, K^i\right)$ is the maximum attainable revenue for country i at the same domestic prices p^i, and the prices of exports to the other countries j (p_x^{ij}, $j \neq i$), given the country's immobile labor supply $\overline{L^i}$ and mobile capital supply K^i.

We assume that capital is perfectly mobile internationally. In equilibrium, the rate of return on capital $R_{K^i}^i$ for country i will be equal to that in the world, r^*. That is

$$R_{K^i}^i = r^*, \tag{2}$$

where $R_{K^i}^i = \partial R^i / \partial K^i$. Taking the total differential of equation (1) and using equation (2), the welfare changes ($e_u^i du^i$) from capital movement through FDI can be derived as:[3]

$$e_u^i du^i = x^{ij} dp_x^{ij} - m^{ji} dp_m^{ji} + r^* dK^i, \tag{3}$$

where m^{ji} and x^{ij} are country $i's$ import and export quantities from and to country j. Under Armington's (1969) assumption, m^{ji} is not equal to x^{ij}.

[2] Throughout this paper, the first and second notations in superscript represent the exporting and the importing country, respectively.

[3] We impose market equilibrium conditions that the export equals the import ($x^{ij} = m^{ij}$, $i \neq j$) for each commodity and the domestic demand ($e_{p^i}^i = \partial e^i / \partial p^i$) equals the domestic supply ($R_{p^i}^i = \partial R^i / \partial p^i$).

Hence, the impacts of FDI on welfare, as shown in equation (3), can be decomposed into three effects. The first and second are the export-price effect (EPE) and the import-price effect (IPE), respectively. The sum of the two effects is referred to as the terms-of-trade effect (TOTE). An increase in the export prices or a decrease in the import prices improves the terms of trade, and is beneficial to country i. The third effect is the capital-mobility-effect (CME), which is welfare improving for country i if capital moves in. On the contrary, country $i's$ welfare will decrease if capital moves out. The total effect (TE) for country i from capital movement through FDI is the sum of the three effects discussed above.

Although CME has negative effects on the source country $i's$ welfare, from equation (3), welfare can be improved from outward FDI if TOTE is positive and is greater than CME. The same reasoning can be applied to the fact that FDI is not always beneficial to the host country. If TOTE is negative and dominates CME, the host country's welfare will decrease.

2.2 Capital rewards repatriated mechanism is implemented

If we assume that the source country eventually will repatriate the capital rewards, equation (1) can be modified as:

$$e^a\left(p^a, p_m^{ba}, u^a\right) = R^a\left(p^a, p_x^{ab}, \overline{L^a}, \overline{K}^a + K^f\right) - r^* K^f, \tag{4}$$

$$e^b\left(p^b, p_m^{ab}, u^b\right) = R^b\left(p^b, p_x^{ba}, \overline{L^b}, \overline{K}^b - K^f\right) + r^* K^f, \tag{5}$$

where country a and b represent the host and the source country, respectively. The p^i, p_m^{ji} and p_x^{ij} ($i, j = \text{a, b, and } i \neq j$) are the vectors of domestic prices, the import and export prices, respectively. The $\overline{L^i}$ and $\overline{K^i}$ are country $i's$ labor and capital endowment, respectively. The K^f is the volume of capital that moves to the host country a through FDI from the source country b. The $r^*(=R^i_{Kf})$ represents the rate of return in the world when the capital market is in equilibrium.

Taking total differential of equations (4) and (5), the welfare changes from capital movement through FDI on the host and source countries can be derived as:

$$e_u^a du^a = x^{ab} dp_x^{ab} - m^{ba} dp_m^{ba} - K^f dr,^* \quad (6)$$

$$e_u^b du^b = x^{ba} dp_x^{ba} - m^{ab} dp_m^{ab} + K^f dr^*. \quad (7)$$

Both equations (6) and (7) show that the welfare impacts of FDI can also be decomposed into three effects. The first and second effects are the export-price effect (EPE) and the import-price effect (IPE) which are discussed in the previous case that repatriation mechanism is not implemented. The sum of both effects is the terms-of-trade effect (TOTE). The third effect that is different from the previous case is the capital-rewards-effect (CRE). When capital market is perfectly competitive, the rate of return of FDI will be equal to the world interest rate (r^*). Compared to the case of capital rewards that are not repatriated and shown in equation (3), the capital movement affects welfare indirectly ($K^f dr^*$) instead of directly ($r^* dK^i$). The total effect (TE) for the host and source countries from FDI is the sum of the three effects discussed above and documented in equations (6) and (7), respectively.

3. Database and empirical model setting

The simulation model and database that we use in this paper are Global Trade Analysis Project (GTAP) which is constructed by the Center for Global Trade Analysis at Purdue University. Given the statistical data book published by the government in China in 1997, we select the top 15 source countries investing in China. We then aggregate the GTAP database's (Version 5) 66 regions into the 15 regional groups. They are Taiwan (TWN), China (CHN), Hong Kong (HKG), Australia (AUS), Japan (JPN), Korea (KOR), Canada (CAN), United States (US), Malaysia (MYS), Singapore (SGP), United Kingdom (UK), Germany (GER), France (FRA), Netherlands (NLD) and the rest of world (ROW). Furthermore, we aggregate GTAP's 57 detailed sectors into 3 sectoral groups. These are food, manufacture and service.

Since the base year of the GTAP database (Version 5) is 1997, the welfare impacts that we simulate will be the impacts from that year. However, we are more concerned with current impacts from the current year of 2002. Therefore, we first evaluate the effects of FDI increase on the world economy from 1997 to 2001. Given the results, we further simulate the effects of rising FDI in China in 2002 on the world economy, and examine the welfare impacts on the source countries.

In order to interpret why capital moves into China, we modify the model of Malcolm (1998). Malcolm introduces the concept of "country risk" into the GTAP model and explores how capital moves into South Africa due to country-risk reduction during the 1990s. In the model setting, Malcolm (1998) assumes that capital is perfectly mobile. In equilibrium, the expected rate of return under country risk consideration will be equal to the global net rate of return on capital stock. That is,

$$RORE(r) / RISK(r) = RORG, \tag{8}$$

where $RORE(r)$ is the expected rate of return without considering risk in country r, $RISK(r)$ is a risk coefficient in country r, and $RORG$ is the global net rate of return on capital stock. The value of $RISK(r)$ is greater than 1 if country r is riskier than the rest of the world. Otherwise, it is less than 1.

Following the model of Malcolm (1998), we introduce the concept of "investment attractiveness" to explore how capital moves into China due to an increase in its attractiveness. When a country is more attractive in terms of potential market size, labor productivity and so on, it will absorb more FDI. Therefore, equation (8) can be modified as follows:

$$RORE(r) \times INVATT(r) = RORG, \tag{9}$$

where $INVATT(r)$ is a coefficient of investment attractiveness in country r. If country r is more attractive than the rest of the world, the value of $INVATT(r)$ is

greater than 1. Otherwise, it is less than 1. Equation (9) demonstrates that, given $RORG(r)$, the more attractive the country is, the lower is the $RORE(r)$ required for firms to invest in the country.

We rewrite equation (9) as a percentage-change form

$$rore(r) = rorg - invatt(r), \tag{10}$$

where $rore(r)$, $invatt(r)$ and $rorg$ represent the percent changes of $RORE(r)$, $INVATT(r)$ and $RORG$, respectively. Equation (10) shows that in equilibrium the percent change of the expected rate of return without considering investment attractiveness in country r is equal to the percent change of the global net rate of return on capital stock subtracting the percent change of the investment attractiveness in country r.

4. Calculation of simulation shock

In this section, we will estimate the level of $INVATT(r)$ and its percentage change as the simulation shock. We then implement the shock to simulate welfare impacts on the source and host countries. Since investment attractiveness cannot be quantified, we assume that foreign investors evaluate the level of attractiveness of a certain country according to the determinants of FDI in that country. In the following analysis, we first identify the determinants of FDI by using econometric estimation and then calculate the elasticities and percentage changes of the determinants. We can therefore estimate the percentage change of investment attractiveness.

Previous literature dealing with determinants of FDI in China includes Liu et al. (1997), Dees (1998) and Wang and Swain (1997). Using 22 countries and 12 years of panel data, Liu et al. (1997) shows that the import and export values, the relative values of GDP, wage, exchange rates and cultural differences play important roles. Dees (1998) employs 11 countries and 12 years of panel data to identify the determinants of FDI in China. The results demonstrate that the market size in China, cost advantages of production, and openness to the rest of the world seem to be

relevant.

Compared to Liu et al. (1997) and Dees (1998) using panel data, Wang and Swain (1997) studies this issue by using time series data. They argue that when the market size in China measured by real GDP (GDP) increases, FDI in China increases too. Both variables are positively related. Tariffs are one of trade barriers. Higher tariff rates discourage exports and encourage FDI. Hence, both tariff levels (TARIF) and FDI in China are positively related. Wage rate is one of the production costs. If wage rate in the host country increases compared with the source country, firms will have more incentive to penetrate overseas markets through export rather than FDI. Both relative wage rate (WAGE) and FDI in China are negatively related.

Long-term bond rates in the U.S. (BOND) and China's central bank discount rates (DISCOUNT) represent the investor's opportunity costs of capital. As these two rates increase, FDI are discouraged. In addition, from the theoretical point of view, a devaluation of the host country's currency (EXRT) makes the investors pay less to purchase land or equipment in the host country, resulting in an increase in FDI. The relationship between imports (IMP) and FDI is indeterminate. If both are mutually substitutable, it then exhibits a negative correlation. If, however, both are complementary, then the relationship is positive. China's labor productivity (PRDTVY) is also another factor that attracts foreign investment. High labor productivity attracts more FDI and thus the relationship is positive.

In addition, Wang and Swain (1997) choose the growth rate of OECD as one of the determinants. They argue that higher growth rate of OECD (GROECD) shows that investors from the member countries have more potential to invest in China—a positive relation. Nevertheless, an increase in OECD average growth rate will also mean a higher domestic demand and higher local investment, eating up on possible investment to China. Given this possibility, the relationship is indeterminate. Finally, dummy variable (D) is used to represent the political situation in China. The value of D is 1 in the years of 1986, 1987 and 1989. Otherwise, D is set to 0.

In the following, we accept Wang and Swain's (1997) arguments, expand the time series data to include 1977 to 1998, and re-estimate the determinants of FDI in China.

A detailed description of the data and the sources are provided in the appendix. In addition, the relationship between dependent and independent variables is assumed to follow a Cobb-Douglas functional form for simplification. To avoid the problem of spurious regression, we first proceed a unit root test on each of the variables. Table 1 shows the results of the unit root test on the ten variables. It can be seen that each variable is stationary after the first differential is taken.

Table1: The results of unit root test

	Lag		ADF TEST	Order of integration
ln(FDI)	1	-4.10**	with drift and trend	I(1)
ln(GDP)	0	-3.83 **	with drift and trend	I(1)
ln(TARIF)	1	-3.95**	with drift and trend	I(1)
ln(DISCOUNT)	8	7.828***	with drift and trend	I(1)
ln(BOND)	8	-4.71**	with drift and trend	I(1)
ln(WAGE)	8	-9.31***	with drift and trend	I(1)
ln(EXRT)	3	-4.10***	with drift and trend	I(1)
ln(IMP)	8	-7.49***	with drift and trend	I(1)
ln(GROECD)	9	-9.23 ***	without drift and trend	I(1)
ln(PRDTVY)	1	-4.48**	with drift and trend	I(1)

Note: The method of unit root tests is based on Doldado, Jenkinson and Sosvilla-Rivero (1990). The "***" and "**" represent 1 and 5 percent significant in a two-tailed test, respectively. Each variable's drift and trend are determined through 5 percent significant in a two-tailed test. Lag is based on AIC's smallest value.

Therefore, taking the first differential of each variable results in the following:

$$\begin{aligned} d\ln(FDI) = {} & \alpha_0 + \beta_1 d\ln(GDP) + \beta_2 d\ln(TARIEF) + \beta_3 d\ln(WAGE) + \beta_4 d\ln(BOND) \\ & + \beta_5 d\ln(DISCOUNT) + \beta_6 d\ln(EXRT) + \beta_7 d\ln(IMP) + \beta_8 d\ln(GROECD) \\ & + \beta_9 d\ln(PRDTVY) + \beta_{10} D + \varepsilon_t \end{aligned} \quad (11)$$

After running regression for equation (11) by using step-wise regression method, we obtain the best combination of predictors that are IMP, GROECD and PRDTVY. Results are displayed in Table 2. [4]

Table 2 shows that IMP and PRDTVY are positively correlated while GROECD is negatively correlated with FDI in China. This means that there is a complementary relationship between China's imports and FDI. An increase in labor productivity in

[4] In this paper, we carry out the cointegration test by using Johansen method. A detail description of the testing process is provided in the appendix.

China helps in attracting FDI. Nevertheless, higher economic growth in OECD countries will make their firms to invest more in their own countries than in China. Furthermore, given the log-linear functional form taken in equation (11), the coefficient value for each variable in Table 2 represents the elasticity for the variable.

Table 2: Independent variable selection

	IMP	GROECD	PRDTVY
Coefficient	3.73	-0.14	9.94
Std. Error	(0.60)***	(0.08)*	(3.25)***
$\overline{R}$	0.674068		
D-W	1.977670		

Note: The "***" and "*" represent 1 and 10 percent significant in a two-tailed test, respectively.

Finally, the predicted changes of IMP, GROECD and PRDTVY can be derived. They are 15.25%, -19.38% and 1.14% from 1997 to 2001, respectively, and are 2.43%, -3.96% and 0.13% from 2002 to 2003, respectively. The contribution of each variable to FDI can be obtained through the product of the elasticity and the predicted percentage change. The sum of the contribution from each variable is the total contribution which is the predicted change in FDI. Therefore, as shown in Table 3, the predicted change of FDI (or investment attractiveness) is 70.97% from 1997 to 2001, and is 10.92% from 2002 to 2003.

Table 3: Predicted change in FDI in China Unit: %

	IMP	GROECD	PRDTVY	Total
Elasticity: (A)	3.73	-0.14	9.94	
predicted changes of the variables from 1997 to 2001: (B)	15.25	-19.38	1.14	
Contribution: (A) * (B)	56.83	2.77	11.34	70.97
percentage changes of the variables from 2002 to 2003: (C)	2.43	-3.96	0.13	
Contribution: (A) * (C)	9.06	5.68	1.29	10.92

In addition, from equation (10), the effect of an increase in $invatt(r)$ is equivalent to a decrease in $rore(r)$ if we follow Malcolm (1998) to assume that a change in $rore(r)$ has little impact on $rorg$. Therefore, the percentage shocks on

$rore(r)$ are -70.97% and -10.92% for the two periods of 1997 to 2001 and 2002 to 2003, respectively.

5. Simulation Results

Table 4 lists the simulation results. The results in column (6) show that China, the host country, is the only beneficiary if capital rewards repatriated mechanism is not implemented. All the source countries investing in China incur negative welfare impacts. In particular, those countries, such as the U.S., Japan and Germany, having higher FDI intensity in China receive larger reduction in welfare. As shown in column (4), welfare reduction mainly comes from the reduction in CME. Although some source countries, such as Taiwan, Hong Kong, Korea and Singapore, gain in TOTE as shown in column (3), the effects are too small to cover the loss in CME.

Table 4: Welfare changes under simulation Unit: million U.S. dollar, 1997

	EPE	IPE	TOTE	CME	CRE	Total Effect	
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)*=(3)+(4)	(7)**=(3)+(5)
TWN	-1290	-1694	404	-1790	28	-1386	432
CHN	2280	-5952	8232	181205	-387	189437	7845
HKG	-587	-1239	652	-2667	176	-2015	828
AUS	-994	-1004	10	-11473	3	-11463	13
JPN	-8291	-5326	-2964	-172102	37	-175066	-2927
KOR	-1861	-2302	441	-7011	18	-6569	460
CAN	-3640	-3343	-297	-18730	3	-19026	-294
USA	-14419	-13824	-594	-221758	28	-222352	-567
MYS	-1275	-1248	-27	-1699	3	-1726	-24
SGP	-1647	-1964	318	-898	22	-580	340
UK	-5247	-5177	-70	-45654	16	-45723	-54
GER	-9134	-7660	-1474	-110643	8	-112117	-1466
FRA	-5611	-4732	-879	-61868	4	-62748	-875
NLD	-3147	-2996	-151	-14483	4	-14633	-147

Note: "*" represents that capital rewards repatriated mechanism is not implemented.
"**" represents that capital rewards repatriated mechanism is implemented.

It is noted that CME is the effect of net capital flow in equilibrium. Countries with higher initial FDI investing in China may not suffer higher loss in CME. For example, Hong Kong, the biggest investor in China, suffers less loss than the U.S., Japan and Germany. The reason is that improvement on terms of trade in the source country may attract capital to flow in. This will reduce the negative effect of CME

in Hong Kong.

However, source countries may not suffer loss if capital rewards repatriated mechanism is implemented. The results in column (7) show that there are still negative welfare impacts on the U.S., Japan and Germany. However, compared to the results in the case of not having capital rewards repatriated mechanism, the impacts are relatively small. Some source countries such as Taiwan, Hong Kong, Korea, and Singapore turn out to be the beneficiaries. The reason is that the TOTE plays a more important role than CRE on welfare changes.

6. Conclusion

In general, FDI is a form of capital drain or industry erosion for the source country. However, if bilateral trade between source and host countries is considered, FDI may be seen as benefiting the source countries. In addition, the government in source country may ask outward FDI firms to remit income from the host country back to the source country—a capital rewards repatriated mechanism. The source country's income thus grows and welfare increases. Therefore, it is debatable whether or not FDI causes a negative impact on the source country.

By taking FDI in China as an example, this paper follows Miyagiwa (1990) to decompose the effects of FDI on welfare for both host and source countries. We then apply computable general equilibrium model to simulate the effects that are decomposed.

The simulation results show that if capital rewards repatriated mechanism is not implemented, all the source countries investing in China experience negative welfare impacts. However, source countries such as Taiwan, Hong Kong, Korea and Singapore may not suffer loss if capital rewards repatriated mechanism is implemented.

7. Appendix

7.1 Data descriptions

Symbol	Mean (Std. Dev.)	Unit	Data source
FDI	312.31 (382.05)	USD 100 million	Statistical Yearbook of China
GDP	33.02 (16.92)	RMB million	International Financial Statistics (IFS) Yearbook
TARIF	9.02 (5.89)	%	Statistical Yearbook of China
WAGE	2.46 (0.61)	%	China Labour Statistical Yearbook & International Financial Statistics (IFS) Yearbook
BOND	8.74 (2.40)	%	International Financial Statistics (IFS) Yearbook
DISCOUNT	7.64 (2.31)	%	International Financial Statistics (IFS) Yearbook
EXRT	9.76 (3.23)	%	International Financial Statistics (IFS) Yearbook
IMP	9.71 (2.45)	USD 100 million	International Financial Statistics (IFS) Yearbook
GROECD	2.75 (1.19)	%	OECD Economic Outlook
PRDTVY	106 (3.29)	None	China Labour Statistical Yearbook; Index of Social Labour Productivity

7.2 Testing for Cointegration

The integration order of all the independent variables and dependent variable are 1. Therefore, cointegration can be used to verify whether there is a long-run equilibrium relationship between the variables. We first find a suitable lag length which makes residuals to be white noise. By Ljung-Box test, the results show that number of lags is 2 where χ^2 test is 85.204 and p-value of 0.04.

After determining the lag length, we need to choose a suitable cointegration model. Following Pantula's (1989) principle, the table below shows that the suitable model has no deterministic trends, cointegrating equations have intercepts, and cointegrating rank is 3. Therefore, there is a long-run equilibrium relationship between the variables.

Johansen's cointegration test

H_0	H_1	Trace	95% critical value	Eigenv.
$r \leq 0$	$r = 1$	77.68	53.42	0.8278
$r \leq 1$	$r = 2$	40.74	34.86	0.6382
$r \leq 2$	$r = 3$	19.39	19.99	0.4750
$r \leq 3$	$r = 4$	5.86	9.13	0.2434

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