

Capital Flight and Foreign Direct Investment

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Abstract

To systematically study the relationship between foreign direct investment inflow (FDI inflow) and capital flight, this chapter uses yearly-data in 1984-2012 in China, sets up two propositions and applies our model to explore the micro-relation and macro-relation between FDI inflow and capital flight.

At proposition (4-1), we can find that the estimated values of long-term foreign direct investment inflow (FDI inflow) and long-term capital flight are significant correlation. Then, under Augmented Dickey-Fuller test (ADF test) or Philips-Perron test (PP test), the residuals reject the null hypothesis with statistical significant at 5% level, which implies that the result is stable. Causal test also shows that the relation between FDI inflow and capital flight is Granger causal. Besides, results of error correction model (ECM) show that FDI inflow and capital flight, they are not only have the long-term positive relation, but also have short-term dynamic relationship. So we can find the proposition (4-1) is true.

At proposition (4-2), at first, we can find that the estimated values of long-term FDI inflow and long-term export are obviously correlated with statistical significant at 1% level, the R square value reaches highly level at 0.9, and they imply the model is good to fit. Next, results of error correction model show that FDI inflow and export, they are not only have the long-term positive relation, but also have short-term dynamic relationship. So we can find the first part of proposition (4-2) is true, which means that if FDI inflow increases, export will grows, too.

Finally, for the remainder of proposition (4-2), at first, we can find that the estimated values of long-term capital flight and long-term export are obviously correlated. Then, under ADF test or PP test, we can find the remainder of proposition (4-2) is true, which means that if export grows up, capital flight will increase, too. In short, FDI inflow increase, export will grows apparently, capital flight will increase obviously which will attract more FDI inflow.

Keywords: FDI inflow, capital flight, export

1. Introduction

To systematically study the relationship between foreign direct investment inflow (FDI inflow) and capital flight, this chapter sets up the theoretical model and econometric model to explore the micro-relation and macro-relation between FDI inflow and capital flight. This chapter tries to depict the behavior of foreign related enterprises and capital supervision sectors under the conditions of capital control and internal and foreign capital preference. Through long-term equilibrium of the solution model to understand the motivation and possibility of the enterprises to participate in capital flight through FDI and export, and the connection among FDI inflow, export, and capital flight. Following, in order to extract the macro-evidences of the connection between FDI inflow and capital flight, on basis of the past empirical studies, we adopts co-integration analysis and error correction model (ECM) to construct single equation model, and uses the macro annual data as the parameter of estimation model, to find the long-term static relationship and the middle-term dynamic relationship among FDI inflow, export, and capital flight.

In the previous chapter, we have evidenced the influence and impact of FDI inflow on the host country's export and economic growth. FDI inflow has significantly brought positive effects on macro variables of the host country. However, it may also bring negative effect on the host country.

According to empirical research, we could found that in developing countries FDI inflow has strong relationship with capital flight (ex:Kant, 1996), which seems could have negative effects. Generally, the damage caused by capital flight includes corruption in the supervision system, social inequality, tax and investment decrease, economic downturn, debt crisis, and uncertainty of decision making of national financial policies. This chapter tries to

re-comprehend the micro-motivation and macro-behavior between FDI inflow and capital flight, and use micro-theoretical framework to depict the microcosmic relationship between FDI inflow and capital flight, and a well empirical mode to analyze the significance of the relationship between FDI inflow and capital flight.

Consequently, we try to depict the relationship between FDI inflow and capital flight, which includes:

- (1) Is there any significant relationship between FDI inflow and capital flight?
- (2) If such relationship is significant, why the relationship between FDI inflow and capital flight happened?
- (3) What is the causal relationship between FDI inflow and capital flight?

To make the research more complete, the paper is organized as follows. Section 2 is to review the past literature, and section 3 constructs the analysis framework, and depicts the behaviors of multi-national enterprises. Then, it explores the long-term equilibrium of the model to understand the motivation and possibility of capital flight of business through trade and foreign direct investment. In section 4 involves empirical result, we describe co-integration and error correction (ECM) method to construct single equation model, and uses the macro annual data as the parameter of estimation model, to find the long-term static relationship and the middle-term dynamic relationship among FDI inflow, export, and capital flight. Finally, section 5 is the conclusion.

2. Literature Review

Regarding capital flight's influence on macro-economy, Mankiw (2006) points out that price variation caused by capital flight affects certain macro-economic variables. Currency depreciation makes export price cheaper and import price more expensive, leading to surplus of trade balance. At the same time, raising of interest rate reduces domestic investment, which also slows down capital accumulation and economic growth.

To find the relationship between foreign direct investment inflow (FDI inflow) and capital flight, Kant (1996) says that FDI inflow has strong relationship with capital flight in developing countries and seems could have negative effects. Generally, the damages caused by capital flight include the following aspects, such as corruption, social inequality, tax and investment decrease, economic decay, debt crisis, and uncertainty of national financial policies.

Some traditional theories hold that while bringing in FDI, the host country may be able to avoid occurrence of capital flight. According to the classical model in international economy "Mundell-Flemming" model, Krugman's "Impossible Trinity" theory (Krugman, 2000) has pointed out the macro financial policy in a country; namely, the fixed exchange rate, free capital flow, and independent currency policy, which are incompatible with one another. Each country can only put into practice two of the three goals at best. For example, since 1980's, the difference between plentiful Latin American countries or Southeast Asian countries, China is nearly loose the control of capital flow while attracting FDI inflow and enlarging foreign trade. This macro financial system is regarded as why China could to successfully pass the Financial Crisis in Southeast Asia from 1997 to 1998 (Ariyoshi etc., 2001).

However, Krugman (2000) did not consider to the motivation of capital flight, and the cross-border financial behavior under the capital control, some researchers (Depler, Williamson, 1987; Dooley, 1996; Kuczynski, 1987; Varman, 1991) proposed that, although capital control could effectively prevent capital flight in the short term, it could not stop it so effectively in the long term. On the premise that certain doubt exists in the effect of capital control, the subsequent empirical studies found that there is significant relationship between FDI inflow and capital flight, for example: China.

Generally, there are three reasons which will lead to capital flight: (1) Deterioration of the country's economic environment, such as high tax level, high inflation, economy deterioration, unstable politics, and etc. Under these conditions, the characteristic of capital flight is demonstrated as the country's capital outflows one-sided; (2) Financial factors, such as capital control that causes different interest rates of financial asset inside and outside the country, over-estimation or under-estimation of local currency value, and etc. In such situation, for interest arbitrage, the enterprises may keep the capital abroad through foreign trade. (3) Differentiated treatment of domestic capital and foreign capital, which makes domestic capital try to "disguise" as foreign capital and then inflows the local country for profit. Such capital flight is characterized as local country's capital outflow and foreign capital inflow processing simultaneously.

Take China for example, since 1980's, economy has developed rapidly, and the politics too stable, so the first reason that seduces capital flight almost does not exist. From around 2000 to the present, as export flourishes, the aggregate economic volume continuously increases, and RMB appreciates as expected; therefore, the second reason that seduces capital flight exists. Finally, since 1980's, in order to attract more foreign direct investment, the long-term discrimination policy for domestic capital and foreign capital has become the third reason that causes capital flight.

In analyzing the factors of capital flight, Gunter (2002) adopts correlation analysis, factor analysis, and causal method to analyze the capital flight in foreign direct investment, and finds that there is significantly positive correlation relationship between capital flight and FDI inflow. Nevertheless, correlation analysis and causal analysis cannot sufficiently explain whether there is long-term and steady "regression" relationship between FDI inflow and capital flight. Besides, it will be meaningful when regression with co-integration exists. Tsao (2005) uses the following variables to find the relationship between FDI inflow and capital flight from 1985 to 2002 in China, and variables include FDI, domestic credit, improvement in technology, GDP growth, etc., to carry out quantitative inspection of the macro-data from 1985 to 2002.

Chen (2006) & Han (2006) apply co-integration method and error correction model to analyze, and find that there is long-term stable and positive correlation between FDI inflow and capital flight. Then, Hsieh (2007) also use the added variables like FDI and the domestic and foreign interest rate differentials, to find the obvious relationship between FDI inflow and capital flight from 1982 to 2004.

3. Methodology

3.1 Theoretical Framework

As far as the country is concerned, in regulating and practicing foreign capital and foreign trade policies, when it enhances FDI inflow and export increase, capital flight is also regarded as a profitable activity that provides a microcosmic motivation for the foreign trade enterprises to proceed capital flight. As a result, the enterprises' foreign business activities may link the three variables-- FDI inflow, export, and capital flight.

Thus, it can be seen that the relationship among FDI inflow, export, and capital flight plays a very important role. Consequently, the purpose of this paper is to set up a basic framework for analysis of the motivation and possibility of capital flight through attracting foreign investment activities and foreign trade.

(1) Deduction (4-1): Under rationality condition, the higher the cost of supervision, the more possible the enterprise will join in capital flight.

On a long-term basis, if company is rational, when the cost of supervision cost raises, it is more possible for the enterprise to take part in capital flight activities. The cost of supervision increases with the higher export. Therefore, the enterprise participates capital flight will ceaselessly increase by trying to disguise as foreign capital and then re-investing the local country for profit. The action results in more possibility for the enterprises to join in capital flight activities.

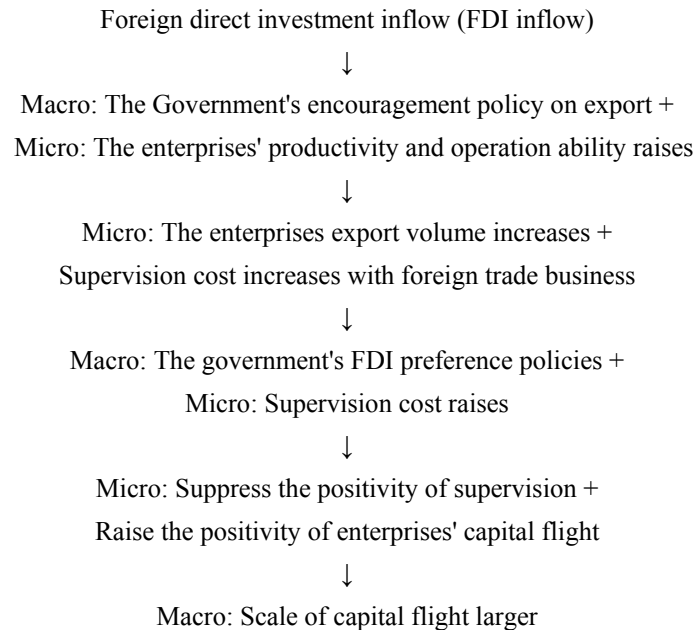
(2) Deduction (4-2): Under bounded rationality condition, the higher cost of supervision, and the punishing power for the enterprises that participate in capital flight remains the same, the more enterprises will join in capital flight activities.

For the long term, even under bounded rationality condition, when the cost of supervision raises, and the punishing power for the disobedient enterprises remains the same, then there will be even more enterprises that take part in capital flight activities. At the same time, the cost of supervision increases with the higher export. Therefore, the enterprise participates capital flight will ceaselessly increase by trying to disguise as foreign capital and then re-investing the local country for profit. The action results in more possibility for the enterprises to join in capital flight activities.

On the other hand, owing that the cost of supervision increases with the enterprises' export business volume, as the enterprises' export business volume keeps on enlarging, the cost of supervision will further raises. Therefore, the return obtained by the enterprises after participating capital flight will ceaselessly increase, which results in more possibility for the enterprises to join in capital flight activities.

In short, deduction (4-1) and (4-2) indicate that, as long as proceeding capital flight is profitable (preference policies for foreign capital), the possibility of a single enterprise to participate in capital flight activities will increase with ceaseless enlargement of the enterprise's export; for all enterprises, the proportion of amount of participation in capital flight activities will increase.

To sum up, because the government gives preference policies to the foreign capital, capital flight and re-inflow activities become profitable for the enterprises. The Government's encouragement policies on export allows the enterprises to enlarge their foreign trade, which signifies that under the condition that capital supervision requires cost, the cost of supervision increases doubly. Consequently, on one hand, the positivity of supervision sector's inspection is suppressed; on the other hand, the possibility of the enterprises to take part in capital flight activities through export increases. So far, the conclusion in this section can be expressed by the following work flow:



Theoretically, if the enterprise's foreign business enlarges, the cost of supervision will rise. Then, if the supervision authority's punishing power towards the disobedient enterprise is limited, there will be increasingly more and more enterprises joining in capital flight. In other words, from theoretical, as long as the external conditions satisfy, capital flight can be conducted through export and foreign direct investment inflow (FDI inflow).

Logically, if capital flight is caused by the first reason which the deterioration of the local country's investment environment, when the environment is improved, and the FDI inflow increases, local country's capital flight will decrease. Therefore, there is negatively correlation relationship between capital flight and FDI inflow.

Then, if capital flight is caused by the second reason; that is the financial factors, it will be profitable for the enterprise to conduct capital flight through export. As a result, such capital flight has positively correlation relationship with export.

If capital flight is caused by the second reason--the differentiated preference treatment to the domestic capital and foreign capital, capital flight will be the source of FDI inflow. Thus, there is positively correlation relationship between such capital flight and FDI inflow.

3.2 Variables and Propositions

In the previous empirical literature, there are primarily two kinds of ways for variable selection. The first method focuses on the impact of multivariables, merely considering FDI inflow as one of the factors that influences capital flight, and placing it at the left side for equation. In analyzing the factors of capital flight, Tsao (2005) uses the following variables to find the relationship between FDI inflow and capital flight from 1985 to 2002 in China, and variables include FDI, domestic credit, improvement in technology, GDP growth, etc., to carry out quantitative inspection of the macro-data from 1985 to 2002. Also, Hsieh (2007) also use the added variables like FDI and the domestic and foreign interest rate differentials, to find the obvious relationship between FDI inflow and capital flight from 1982 to 2004.

The second method takes FDI inflow as the main influential variable of capital flight. That is, there is only a variable FDI inflow at the right side of the equation, and other influential factors are included in the residual errors of the regression model. Gunter (2002) adopts correlation analysis, factor analysis, and causal method to analyze the capital flight in foreign direct investment, and finds that there is significantly positive correlation relationship between capital flight and FDI inflow. Nevertheless, correlation analysis and causal analysis cannot sufficiently explain whether there is long-term and steady regression relationship between FDI inflow and capital flight. Besides, it will be meaningful when regression with co-integration exists. Then, Chen (2006) uses co-integration method and error correction model to analyze, and find that there is long-term stable and positive correlation between FDI inflow and capital flight. It seems that co-integration analysis and error correction model are powerful tools for analysis of FDI inflow and capital flight.

In the light of the previous research's shortage, this section has to conduct a new empirical inspection on the

relationship between FDI inflow and capital flight, and focus on the following two propositions through empirical analysis.

Proposition (4-1): There is significantly positive correlation between FDI inflow and capital flight.

Proposition (4-2): the relation of FDI inflow, export, and capital flight is $FDI \uparrow \rightarrow \text{Export} \uparrow \rightarrow \text{Capital flight} \uparrow \rightarrow FDI \uparrow$.

3.3 Relationship between FDI and Capital Flight

Considering the long-term relationship between capital flight (**Capital Flight**) and foreign direct investment (**FDI**), and to avoid multicollinearity, we set up the following single factor regression model:

$$\text{Capital Flight } t = \beta_0 + \beta_1 FDI_t + u_t \quad (4-1)$$

where β_1 is parameter that is determined empirically; FDI_t is foreign direct investment in t year; u_t is error term.

To find the dynamic relationship between capital flight (Capital Flight) and foreign direct investment (FDI), we set up the error correction model (ECM):

$$\Delta \text{Capital Flight } t = \beta'_0 + \beta'_1 \Delta FDI_t + \alpha_1 [\text{Capital Flight } t-1 - \beta_1 FDI_{t-1}] + \varepsilon_t \quad (4-2)$$

where Δ is the difference; β_1 is parameter that is determined empirically; FDI_t is foreign direct investment in t year; ε_t is residual term.

Assume that

$$ecm_{t-1} = \text{Capital Flight } t-1 - \beta_1 FDI_{t-1}$$

ECM(4.2) can simplify as

$$\Delta \text{Capital Flight } t = \beta'_0 + \beta'_1 \Delta FDI_t + \alpha_1 ecm_{t-1} + \varepsilon_t \quad (4-3)$$

where Δ is the difference; β_1 is parameter that is determined empirically; FDI_t is foreign direct investment in t year; ε_t is residual term.

We use the annual data from 1984 to 2012 in China as the sample. The time series samples of the two variables, foreign direct investment inflow [$FDI(F)$] and capital flight (*Capital Flight*), are organized as follows:

(1) Foreign direct investment inflow [$FDI(F)$]: data comes from Ministry of Commerce in China. To diminish the influence of heteroscedasticity, we take logarithm value for $FDI(F)$ [$fdi(f)$].

(2) Capital flight (*Capital Flight*): capital flight is a terminology that has several different definitions (Dooley, 1980, 1986 and 1988; WorldBank, 1985; Erbe, 1985; Morgan Guaranty Trust Company, 1986; Pastor, 1990; Claessens, 1997). Meanwhile, in order to easily discuss, we apply the four estimations by Gunter (2002) to estimate the scale of capital flight.

Considering the long-term relationship between capital flight (*Capital Flight*) and foreign direct investment (*FDI*), stationarity test is conducted for variable $fdi(f)$ and $capitalflight$ (Table 2). Under Augmented Dickey-Fuller test (ADF test) and Philips-Perron test (PP test), the level value of the two variables do not reject the null hypothesis. Then, difference of first order of the two variables rejects the null hypothesis with statistical significant at 10% level, and mostly with statistical significant at 1% level. Consequently, we can generalize that within sample period, $fdi(f)$ and $capitalflight$ are both time series with first order integration [$I(1)$].

The logarithm values of FDI's and capital flight's estimaties values are both $I(1)$ time series. Generally speaking, we can take the difference to make time series becomes $I(0)$ stationery time series, and the equation can be simulated. Nevertheless, time series that takes the difference cannot reflect the relationship among the variables' level values. In accordance with co-integration theory, if there exists co-integration relationship among $I(1)$'s variables, OLS estimation of parameter that exerts $I(1)$'s level value of the variable is still meaningful. Thus, we will use level value to conduct OLS estimation of the model's parameter.

3.4 The Relationship among FDI, Export, and Capital Flight

Since foreign direct investment belongs to capital inflow, and capital flight belongs to capital outflow, we need further to explain two questions: (1) How do FDI inflow and capital flight connect? (2) What is the relationship with FDI inflow, capital flight, and export?

In order to explore the delivery process of FDI inflow and capital flight, subsequently, we try to take export as a variable, and to find the evidences of correlation among FDI inflow, export, and capital flight.

Based on the previous studies, there is significantly regression relationship between FDI inflow and export, so we cannot directly put FDI and export as the explanation variables at the right side of the equation to find their relationship with capital flight. So the following we will set up two models:

Equation (4-4) presents the long-term relationship between FDI inflow and export as follow:

$$\begin{cases} EX_t = \beta_2 + \beta_3 FDI_t + u_t \\ u_t = \phi_2 u_{t-1} + \phi_3 u_{t-2} + \varepsilon_t \end{cases} \quad (4-4)$$

where β_i is parameter that is determined empirically; Ext is export in t year; $FDIt$ is foreign direct investment in t year; u_t is error term; ε_t is residual term.

And equation (4-5) presents the long-term relationship between export and capital flight as follow:

$$Capital\ Flight_t = \beta_4 + \beta_5 Ex_t + u_t \quad (4-5)$$

where β_i is parameter that is determined empirically; Ext is export in t year; $CapitalFlight_t$ is estimated value of capital flight in t year; u_t is error term.

To further investigate the short-term dynamical adjusting relationship among FDI inflow, export, and capital flight, it is necessary to set up and estimate the following two models.

Error correction model (ECM) that short-term export is impacted by short-term FDI inflow:

$$\Delta EX_t = \beta'_2 + \beta'_3 \Delta FDI_t + \alpha_2 (EX_{t-1} - \beta_3 FDI_{t-1}) + \varepsilon_t \quad (4-6)$$

where Δ is the difference; β_i is parameter that is determined empirically; $FDIt$ is foreign direct investment in t year; Ext is export in t year; ε_t is residual term.

Assume that

$$ecm_{t-1}^2 = EX_{t-1} - \beta_3 FDI_{t-1}$$

the ECM (4-6) can be simplify as:

$$\Delta EX_t = \beta'_2 + \beta'_3 \Delta FDI_t + \alpha_2 ecm_{t-1}^2 + \varepsilon_t \quad (4-7)$$

where Δ is the difference; β_i is parameter that is determined empirically; $FDIt$ is foreign direct investment in t year; ε_t is residual term.

And, ECM that short-term capital flight is impacted by export:

$$\Delta Capital\ Flight_t = \beta'_4 + \beta'_5 \Delta EX_t + \alpha_3 (Capital\ Flight_{t-1} - \beta_5 EX_{t-1}) + \varepsilon_t \quad (4-8)$$

where Δ is the difference; β_i is parameter that is determined empirically; Ext is export in t year; ε_t is residual term.

Assume that

$$ecm_{t-1}^3 = CapitalFlight_{t-1} - \beta_5 EX_{t-1},$$

the ECM (4-8) can be simplify as:

$$\Delta CapitalFlight_t = \beta'_4 + \beta'_5 \Delta EX_t + \alpha_3 ecm_{t-1}^3 + \varepsilon_t \quad (4-9)$$

where Δ is the difference; β_i is parameter that is determined empirically; ε_t is residual term.

Data source of FDI inflow (FDI) and capital flight ($CapitalFlight$) are the same as in the previous section. According to the previous content, the logarithm values (fdi) and ($capitalflight$) are also series with the first order of integration $[I(1)]$.

Data of export (EX) are from Ministry of Commerce in China, and we also take the logarithm value (ex). Stationarity test is conducted for at first. Under Augmented Dickey-Fuller test (ADF test) and Philips-Perron test (PP test), the level value of this variable rejects the null hypothesis with statistical significant at 10% level. Then, difference of first order of this variable rejects the null hypothesis with statistical significant at 10% level under Augmented Dickey-Fuller test (ADF test), and with statistical significant at 5% level under Philips-Perron test (PP test). Consequently, we can generalize that within sample period, ex is time series with first order integration $[I(1)]$

Table 1. Stationary test

Variable	ADF Unit Root Test	Philips–Perron Unit Root Test	Variable	ADF Unit Root Test	Philips–Perron Unit Root Test
fdi(f)	1.3312	2.6405	Δ fdi(f)	-2.6653*	-2.6450*
Capitalflight (higher estimated value)	3.1337	-0.5441	Δ capitalflight (higher estimated value)	-2.4827	-5.2718***
Capitalflight (lower estimated value)	1.5811	0.5657	Δ capitalflight (lower estimated value)	-4.2185***	-4.7091 ***
Capitalflight (average estimated value)	2.7734	2.5052	Δ capitalflight (average estimated value)	-2.9826**	-3.7874 ***
Capitalflight (indirect estimated value)	1.6087	0.8270	Δ capitalflight (indirect estimated value)	-3.9074***	-4.7443 ***
ex	1.1534	1.6250	Δ ex	-1.6326*	-1.6264**

Notes: Δ is the first order difference; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

4. Empirical Result

4.1 Relationship between FDI and Capital Flight

Table 2 shows estimation results of Model (4-1). First, we investigate the results of cointegration test. Under Augmented Dickey-Fuller test (ADF test) and Philips-Perron Test test (PP test), the residual reject the null hypothesis with statistical significant at 1% level, so it sufficiently explains that the residual series is stationery, which means that foreign direct investment inflow (FDI inflow) and capital flight has long-term and stable cointegration relationship, and estimation of OLS model's parameter are meaningful. At the same time, under goodness-of-fit measure, the value of R Square or Adjusted R Square is higher, which implies that FDI inflow can significantly explain estimated value of capital flight.

One of the most important tests for time series model is autocorrelation test. The value of Durbin–Watson statistic ranges from 2.4~2.9. Besides, two of Lagrange Multiplier Test (LM Test) statistics are not significant, which sufficiently demonstrates that Model (4-1) does not have serious autocorrelation problem.

Then, White test of Model (4-1) shows, expect capitalflight (higher estimated value) as explanation variable has has significantly heteroscedasticity. The other three capital flight's estimated values do not have significant heteroscedasticity, which denotes that the heteroscedasticity of the model is not significant.

Table 2. OLS estimation results of Model (4-1)

	Capitalflight (average estimated value)	Capitalflight (higher estimated value)	Capitalflight (lower estimated value)	Capitalflight (indirect estimated value)
fdi(f)	1.6733*** (6.3611)	1.4325*** (4.5078)	1.9809*** (10.3034)	2.0169*** (9.9780)
constant	3.0027*** (5.2536)	3.8460*** (5.5724)	0	0
Sample size (2012-1984)	29	29	29	29
R2 or adj.R2	0.9333	0.7893	0.8246	0.7987
Durbin–Watson statistic	2.3367	2.4755	2.9120	2.8482
ADF test of residual	-3.5094***	-3.1962***	-3.5866***	-3.5749***
Phillips-Perron test of residual	-3.2428***	-4.4721***	-4.5497***	-4.2057***
LM test F-statistic	2.3186	0.2757	2.0833	1.0315
White test F-statistic	1.5531	7.0146	2.7350	2.7423

Note: () is the t-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

Table 2 results show that there is long-term and stable relationship between FDI inflow and capital flight. The regression relationship among the four kinds of estimation values of FDI inflow and capital flight are significant statistically. From the long-term view, ceteris paribus, when FDI inflow grows 1%, the growth rate of capital flight reaches from 1.4% to 2%. The estimation results strongly demonstrate that there is long-term positive correlation between FDI inflow and capital flight.

In order to further understand the short-term and dynamic adjustment between FDI inflow and capital flight, we try to estimate the ECM (4-3), and show the estimation results in Table 3. After the cointegration test, under Augmented Dickey-Fuller test (ADF test) and Philips-Perron test (PP test), the residual reject the null hypothesis with statistical significant at 5% level, which sufficiently explains that there is co-integration relationship among the error correction model variables, and the OLS estimation of the model's parameter is meaningful.

In autocorrelation test, the value of Durbin–Watson statistic ranges from 2.4 to 2.7, showing that the model's autocorrelation almost does not exist. For LM test's statistic, except capitalflight (higher estimated value) as explanation variable has statistical significance, other conditions do not have statistical significance. As a result, autocorrelation of ECM (4.3) is not severe.

In heteroscedasticity test, empirical results are similar to autocorrelation test, except capitalflight (higher estimated value) as explanation variable has statistical significance, other conditions do not have statistical significance. As a result, heteroscedasticity of ECM (4.3) is not severe, either.

Table 3. OLS estimation results of Model (4-3)

	Δ capitalflight (average estimated value)	Δ capitalflight (higher estimated value)	Δ capitalflight (lower estimated value)	Δ capitalflight (indirect estimated value)	
Δ fdi(f)	1.3871 (2.3289)	1.3565 (2.3212)	2.3229** (3.3835)	2.3791** (3.0835)	
ecm	-1.5659* (-2.8390)	-2.0278*** (-4.5756)	-2.3384*** (-4.4466)	-2.2262*** (-4.0447)	
constant	0.4382 (1.2538)	-0.5865 (-1.6745)	0 0	0 0	
Sample size	28	28	28	28	
adj R2	0.3808	0.7987	0.8246	0.7273	
Durbin–Watson statistic	2.5495	2.4755	2.7232	2.6351	
ADF test of residual	-4.0768***	-3.0312**	-3.6965***	-3.6387***	
Phillips-Perron test of residual	-4.0591***	-3.0509**	-3.6862***	-3.6222***	
LM test	F-statistic	0.9654	9.9595*	0.1897	1.0119
White test	F-statistic	0.8270	3.5502*	3.6343	1.3342

Note: Δ is the difference; () is the t-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

In ECM (4-3), the difference item reflects the influence of short-term fluctuation. Capital flight's short-term variation can be categorized into two parts: one is the impact of short-term FDI inflow's fluctuation, and the other is the influence of deviation from the long-term equilibrium. The coefficient of the error modification item reflects the adjustment magnitude of deviation from long-term equilibrium. Finally, considering *ecm* coefficient, when the short-term fluctuation deviates from long-term equilibrium, the unstable state will be back to the equilibrium state with the adjusting power that ranges from -1.6 to -2.3.

Finally, FDI inflow is the vital economic cause of capital flight. In order to understand whether there is statistically causal relationship between FDI inflow and capital flight, Granger causal test is conducted for FDI inflow and capital

flight. (Table 4)

Empirical results show that, statistically, or at least in most conditions, FDI inflow is the Granger cause of capital flight's estimated value, and is significant statistically. In accordance with the theoretical model and the results of Granger causal test, it is learned that capital flight is one of the capital sources of FDI inflow.

Table 4. Granger causal test of FDI and capital flight

	Hypothesis	t-1	t-2	t-3	t-4
Capitalflight (average estimated value)	H1: fdi(f) does not Granger-cause capitalflight	2.1991	0.6812	1.4213	1.605
	H2: capitalflight does not Granger-cause fdi(f)	3.9038	3.6183*	1.873	1.1136
Capitalflight (higher estimated value)	H1: fdi(f) does not Granger-cause capitalflight	9.4183**	0.2	0.0894	0.5367
	H2: capitalflight does not Granger-cause fdi(f)	2.3503	3.7905*	2.1373	4.3405
Capitalflight (lower estimated value)	H1: fdi(f) does not Granger-cause capitalflight	7.2479**	4.5852**	2.1707	2.9967
	H2: capitalflight does not Granger-cause fdi(f)	1.3957	1.2231	0.5404	1.1764
Capitalflight (indirect estimated value)	H1: fdi(f) does not Granger-cause capitalflight	5.7418**	3.1591	2.0484	2.0435
	H2: capitalflight does not Granger-cause fdi(f)	2.9536	2.5542	1.1593	1.355

Note: () is the F-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

4.2 The Relationship among FDI, Export, and Capital Flight

In order to explore the delivery process of FDI inflow and capital flight, following we try to takes export as a variable, and to find the evidences of correlation among FDI inflow, export, and capital flight. Based on co-integration theory, OLS is applied to estimate the parameters of the models.

4.2.1 Results of Model (4-4)

Table 5 shows estimation results of Model (4-4). First, we investigate the results of cointegration test. Under Augmented Dickey-Fuller test (ADF test) and Philips-Perron test (PP test), the residual reject the null hypothesis with statistical significant at 1% level, so it sufficiently explains that the residual series is stationery., which means that FDI inflow and export has long-term and stable cointegration relationship, and estimated value of OLS model's parameter are meaningful. At the same time, under goodness-of-fit measure, the value of adj R Square exceeds 0.9, which implies that FDI inflow can significantly explain estimated value of export.

Table 5. OLS estimation results of Model (4-4)

	Parameter	(t-statistic)
fdi(f)	1.3266***	5.0188
AR (1)	1.8665***	3.5682
AR (2)	-1.2522	-2.3529
constant	4.3391***	7.1791
Sample size(2012-1984)	27	
adj R2	0.9731	
F-statistic	26.8145***	
Durbin-Watson statistic	2.7893	
ADF test of residual	-3.7624***	
Phillips-Perron test of residual	-3.7916***	
LM test F-statistic	0.7797	
White test F-statistic	2.6359	

Note: () is the t-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level; ADF test of residual and Phillips-Perron test of residual do not have constant

Source: the estimation in this paper

Autocorrelation test shows that both the Durbin–Watson statistic and Lagrange Multiplier Test (LM Test) statistic cannot demonstrate that Model (4-4) has the problem of autocorrelation. Besides, results of heteroscedasticity test also show that the problem of heteroscedasticity does not exist in Model (4-4). Then, due to FDI's coefficient is 1.3, which implies that for a long time, ceteris paribus, when FDI inflow increases 1%, the export will grow around 1.3% averagely.

4.2.2 Results of Model (4-5)

Table 6 shows estimation results of Model (4-5). First, we investigate the results of cointegration test. Under Augmented Dickey-Fuller test (ADF test) and Philips-Perron test (PP test), the residual reject the null hypothesis with statistical significant at 10% level, which means that capital flight and export has long-term and stable cointegration relationship, and estimated values of OLS model's parameter are meaningful. Second, Autocorrelation test shows that both the Durbin–Watson statistic and Lagrange Multiplier Test (LM Test) statistic cannot demonstrate that Model (4-12) has the problem of autocorrelation. Besides, results of heteroscedasticity test show that, only in capitalflight (higher estimated value) as explained variable, we can reject the null hypothesis, which means that the problem of heteroscedasticity does not exist in Model (4-5).

Table 6. OLS estimation results of Model (4-5)

	Capitalflight (average estimated value)	capitalflight(higher estimated value)	Capitalflight (lower estimated value)	Capitalflight (indirect estimated value)	
ex	2.3605*** (3.8543)	1.9058*** (13.8943)	1.6613*** (9.1838)	1.6923*** (9.2122)	
constant	-3.9090*** (-4.7481)	0	0	0	
Sample size	29	29	29	29	
R2	0.9649	0.8155	0.7071	0.7113	
Durbin–Watson statistic	2.7893	2.3580	2.3100	2.3126	
ADF test of residual	-3.8601**	-2.6510*	-2.9237**	-3.0338**	
Phillips-Perron test of residual	-3.8440**	-4.3827***	-3.2125**	-3.2342**	
LM test	F-statistic	1.0159	0.1414	2.5822	2.5877
White test	F-statistic	1.3638	5.3748***	0.8367	1.1967

Note: () is the t-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

The regression results of export to capital flight are significant statistically, for the long time, the increase of export and increase of capital flight are stable. From the regression coefficient of export(ex), ceteris paribus, when the long-term export increases 1%, capital flight will averagely increase around 1.7% to 2.4%.

4.2.3 Results of Model (4-7) and (4-9)

In accordance with Model (4-4) and (4-5), there exists a long-term and steady positive regression relationship among FDI, export, and capital flight. To further investigate the dynamic adjusting relationship among the three variables, we estimate their error correction models respectively, and show the results at Tables 7 and 8.

From the emperical results, first, no matter in Augmented Dickey-Fuller test (ADF test) or Philips-Perron test (PP test), the model reject the null hypothesis with statistical significant at 5% level, which each error correction model is stable. Second, Autocorrelation test shows that both the Durbin–Watson statistic and Lagrange Multiplier Test (LM Test) statistic cannot demonstrate that Model (4-7) and (4-9) have the problem of autocorrelation. Besides, results of heteroscedasticity test show that we can reject the null hypothesis, which means that the problem of

heteroscedasticity does not seriously exist in Model (4-7) and (4-9).

Table 7. OLS estimation results of Model (4-7)

	Parameter	(t-statistic)
$\Delta fdi(f)$	0.3795	1.3755
ecm	-0.8050	-2.2900
constant	0.7043***	1.2538
Sample size	28	
adj R2	-0.8944	
Durbin-Watson statistic	2.8468	

Note: () is the t-statistic; *** statistical significant at 1% level

Source: the estimation in this paper

In ECM (4-7), the difference item reflects the influence of short-term fluctuation. Export's short-term variation can be categorized into two parts: one is the influence of short-term FDI inflow's fluctuation, and the other is the influence of deviation from the long-term equilibrium. The coefficient of the error modification item (*ecm*) represents the adjustment magnitude of deviation from long-term equilibrium. In the short time, FDI difference's coefficient and the error modification item's coefficient are not statistical significantly. However, according to the results of the long-term regression model, when the short-term fluctuation deviates from long-term equilibrium, the unbalanced state will be pulled back to the equilibrium state with the adjusting magnitude of economic power.

In ECM (4-9), the difference item also reflects the influence of short-term fluctuation. Capital flight can be categorized into two parts: one is the influence of short-term export's fluctuation, and the other is the influence of deviation from the long-term equilibrium. The coefficient size of the error modification item represents the adjustment magnitude of deviation from long-term equilibrium. In the short time, every error modification item of estimated value of capital flight is statistical significantly. Considering *ecm* coefficient, when the short-term fluctuation deviates from long-term equilibrium, the unbalanced state will be pulled back to the equilibrium state with the adjusting power that ranges from -1.6 to -2.2.

Table 8. OLS estimation results of Model (4-9)

	Δ capitalflight (average estimated value)	Δ capitalflight (higher estimated value)	Δ capitalflight (lower estimated value)	Δ capitalflight (indirect estimated value)
Δ EX	2.6321*	0.8075	1.5735	2.2307
	(2.5822)	(1.0789)	(1.2915)	(1.8055)
ecm	-2.1643***	-2.0239***	-1.6395**	-1.6211**
	(-3.7094)	(-4.8493)	(-3.1730)	(-3.1528)
constant	-0.4195	0	0	0
Sample size	28	28	28	28
adj R2	0.7308	0.8468	0.5422	0.5621
Durbin-Watson statistic	2.5776	1.2961	2.6420	2.6706
ADF test of residual	-3.7197**	-4.6321**	-4.1221**	-4.1342***
Phillips-Perron test of residual	-3.7159**	-4.3731**	-5.0561***	-4.1347***
LM test F-statistic	3.8812	0.5367	0.7348	1.0139
White test F-statistic	2.1317	3.6321*	1.4505	2.3392

Note: Δ is the difference; () is the t-statistic; *** statistical significant at 1% level; ** 5% level; * 10% level

Source: the estimation in this paper

4.2.4 Causal Test

To investigate whether there exists statistically causal relationship among FDI inflow, export, and capital flight, we conduct Granger causal test, and the results are shown in Table 9 and Table 10.

Table 9. Granger causal test of FDI and export

Hypothesis	t-1	t-2	t-3	t-4
H1: fdi(f)does not Granger-cause ex	2.1707	1.7100	3.6006	1.4993
H2: ex does not Granger-cause fdi(f)	2.1071	4.4236**	2.1251	2.8851

Note: number is the F-statistic; ** statistical significant at 5% level

Source: the estimation in this paper

Table 10. Granger causal test of export and capital flight

Hypothesis		t-1	t-2	t-3	t-4
Capitalflight (average estimated value)	H1: ex does not Granger-cause capitalflight	4.9872**	2.1808	0.8124	1.8078
	H2: capitalflight does not Granger-cause ex	1.3535	2.2698	3.8926*	7.4675**
Capitalflight (higher estimated value)	H1: ex does not Granger-cause capitalflight	19.0536**	1.7216	0.9508	2.0582
	H2: capitalflight does not Granger-cause ex	2.4811	1.4993	3.3166	3.7041
Capitalflight (lower estimated value)	H1: ex does not Granger-cause capitalflight	7.2166**	3.5485*	2.1071	2.5511
	H2: capitalflight does not Granger-cause ex	0.3406	1.2313	1.8166	2.3799
Capitalflight (indirect estimated value)	H1: ex does not Granger-cause capitalflight	6.5897**	3.2619	2.6275	2.2280
	H2: capitalflight does not Granger-cause ex	0.6450	0.6512	1.3100	1.7504

Note: number is the F-statistic; **statistical significant at 5% level; * 10% level

Source: the estimation in this paper

To results of Granger test in Table 9 show that, the mutual causes between FDI inflow and export are almost not statistical significantly. Then, in Table 10, according to different lag time, the Granger causes between export and capital flight have different statistical significance.

5. Conclusions

To investigate that how is capital inflow and outflow through the two channels, foreign trade and foreign investment, this paper uses yearly-data in 1984-2012 in China, sets up two propositions and applies our model to conduct empirical tests.

At proposition (4-1), from the results of co-integration analysis, OLS model, and Granger causal test, we can find that the estimated values of long-term foreign direct investment inflow (FDI inflow) and long-term capital flight are significant correlation (under the four kinds estimated values of capital flight, the coefficients of FDI inflow are all with statistical significant at 1% level), which implies the model is good to fit, particularly when simulated with the average estimation value of capital flight, the R square value reaches highly level at 0.9.

Then, under Augmented Dickey-Fuller test (ADF test) or Philips-Perron test (PP test), the residuals reject the null hypothesis with statistical significant at 5% level, which implies that the result is stable. Causal test also shows that

the relation between FDI inflow and capital flight is Granger causal. Besides, results of error correction model (ECM) show that FDI inflow and capital flight, they are not only have the long-term positive relation, but also have short-term dynamic relationship. So we can find the proposition (4-1) is true.

At proposition (4-2), at first, we consider the relation between FDI inflow and export. from the results of co-integration analysis, OLS report, and Granger causal test, we can find that the estimated values of long-term FDI inflow and long-term export are obviously correlated with statistical significant at 1% level, the R square value reaches highly level at 0.9, and they imply the model is good to fit.

Next, under Augmented Dickey-Fuller test (ADF test) or Philips-Perron test (PP test), the residuals reject the null hypothesis with statistical significant at 10% level, which implies that the result is stable. Causal test also shows that the relation between FDI inflow and export is Granger causal. Besides, results of error correction model show that FDI inflow and export, they are not only have the long-term positive relation, but also have short-term dynamic relationship. So we can find the first part of proposition (4-2) is true, which means that if FDI inflow increases, export will grows, too.

Finally, for the remainder of proposition (4-2), at first, we consider the relation between export and capital flight, from the results of co-integration analysis, OLS report, and Granger causal test, we can find that the estimated values of long-term capital flight and long-term export are obviously correlated with statistical significant at 1% level, the R square value reaches highly level at 0.8, and they imply the model is good to fit.

Then, under Augmented Dickey-Fuller test (ADF test) or Philips-Perron test (PP test), the residuals reject the null hypothesis with statistical significant at 10% level, which implies that the result is stable. Causal test also shows that the relation between export and capital flight is Granger causal. So we can find the remainder of proposition (4-2) is true, which means that if export grows up, capital flight will increase, too.

With proposition (4-1) is established, there is strongly positive regression relationship between FDI inflow and capital flight, and explaining that part of the FDI inflow and capital flight are mutually source of financing. Then, With proposition (4-2) is established, we can find that FDI inflow and capital flight flow bi-dimensionally, and capital flight caused by FDI inflow is mostly through the indirect channel, export, to happened.

Foreign researchers have already found the obvious relationship between FDI that flows into developing country and capital flight in that country. Even there is external capital supervision system, if it is profitable to conduct capital flight, the foreign enterprises will try their best to take advantage of foreign trade and FDI to join in capital flight.

So, we try to find the causal relation between foreign direct investment inflow (FDI inflow), export, capital flight. Empirical results show that there is significantly positive regression relationship between FDI inflow and capital flight, and finds such a conclusion-- FDI can conduct cro-border flight through the indirect channel, export. Next, there is also significantly positive regression relationship between export and FDI inflow, which implies that if FDI inflow increase, export will grows apparently. And between capital flight and export, which implies that if export grows, capital flight will increase obviously. Consequently, by combined the previous research and our empirical result, a mechanism exists: FDI inflow grows, enterprises' production scale enlarges, the cost reduces, and then the enterprises' export raises, and finally, the enterprises use export to take part in capital flight activities. In short, FDI inflow increase, export will grows apparently, capital flight will increase obviously which will attract more FDI inflow.

However, the assumption of analysis in this chapter is: there are exist the second factor (differentiated treatment towards the domestic and foreign capital) and the third factor (financial factor). Under such assumption, the theoretical models and empirical analysis in this chapter have found that, there is indeed a close relationship between FDI inflow and capital flight. As a result, we hold that under certain conditions, FDI inflow will lead to occurrence of capital flight. Such conditions include: capital control measures taken by the government, the preference policies for the domestic and foreign capital announced by the government, the gradually increasing supervision cost for the cro-border capital flow and etc.. We suggest that the subsequent studies may consider to extend this topic based on our findings, and explore the gambling process of different types of enterprises and multiple supervision divisions. On the other hand, due to data limited, the subsequent research can try to utilize monthly or quarterly data to construct multi-factor regression model with dummy variables for verification.

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