How FDI influence real exchange rate and economic growth

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Abstract—since the 1970's, Developing countries have begun to introduce structural economic liberalization and stable macroeconomic plan, but these attempts do not achieve the expected effects in the short term. While the external environment is becoming increasingly complex, fixed exchange rate system began to appear collapse and monetary crisis has appeared. Especially since the 1980's, the international financial crisis began frequently. As the traditional monetary crisis model has general lack of quantitative analysis to the monetary system .Thus, apply the VaR method to exchange rate risk assessment has stronger reality, it can make scientific quantitative analysis of the exchange rate risk, then make the central bank's supervision more effective.

Keywords- Open FDI Strategy; Dynamic model; Exchange rate; Stability of the economic growth

I. INTRODUCTION

Some developing countries take the practice of the opening capital account partly, they think in this way they can get the benefits of open capital account and avoid the negative consequences. FDI open and non-FDI still keep control state is one of the most common forms in the possible combinations of the opening Strategy of the capital account [1].

Developing countries usually have a good attitude to FDI; the reason is that they generally think that FDI will not appear sudden reversal. So it can't cause macroeconomic and financial system instability. However, open capital account is inherently unstable, though it may be possible to promote macroeconomic growth, but it can also lead to volatility of economic growth. Therefore, FDI can't play a "stabilizer" role to macro economic.

This paper extends and develops the dynamic open economic model based on the Aghlion (2001, 2004) [2] to analysis the macroeconomic and financial instability problems which the open capital accounts FDI brings. In this paper, we use the real exchange rate volatility to refer to the instability of financial markets; with the domestic economic growth fluctuation refers to the instability of macroeconomic.

In this paper, we construct a panel data model which including 30 countries for quantitative analysis, the model analysis the influence of macro economic and financial that open FDI caused. We also have estimate and test to explain the real contact between the FDI opening and economic instability.

II. MODEL

A. . The basic model and related parameter definitions

In dynamic and open model established by Agllion (2001, 2004) [2], the basic assumption is one country only one trade product, production factors are capital and a domestic specific endowment element. Definite P is the price of the specific element of the endowment; P is the relative price of non-trade product and trade product. Based on the macro economic theory, P is the real exchange rate. The largest supply constraints for domestic endowment elements is Z, one country savings is (1-a) of the final wealth, the total amount of economic individuals in different types is "1".

In Leontief economies [3], formula of GDP Y is:

$$y = Min(K/a, z) \qquad (1)$$

In this formula: $1 / a > r$, r is international interest rates, K is the current capital, z as domestic endowment elements.

Because there has credit constraints in developing countries, the country which initial wealth accumulation is W_B most can lending μW_B, credit multiplier $\mu > 0$. Define L as borrowing amount, so one country can invest for $I = W_B + L$. If there has credit constraints $I = (1+\mu)W_B$, $K = I - pz$, the maximization of Y demands $z = K/a$,we can get:

$$I - pz = az \qquad (2)$$

According to the different initial wealth level, there are three possible conditions:

1) W_B is small and $K/a < z$,credit constraints works, $L = \mu W_B, p = 0$, there exist excess supply to domestic endowment elements. GDP in t stage is:

$$y^t = K^t/a = I^t/a = (1+\mu)W_B^t$$

2) W_B is small but $K/a \geq z$,At this time, there exist excess demand to endowment elements, The balance value of the real exchange rate is:

$$P^t = \left[(1+\mu)W_B^t - aZ\right]/Z \qquad (3)$$

3) W_B is big enough, $L < \mu W_B, K/a \geq z$. Same to the formula (2), we can have $p > 0, y^t = z$. At this time, a country's lending will continue until $y - rL = rW_B$, the real exchange rate is: $P^t = 1/r - a$

The basic model definite W_B^{t+1} as nation's initial wealth in t + 1 stage, the dynamic equation for W_B is:

$$W_B^{t+1} = (1-a)(e + y^t - \gamma \mu W_B^t) \qquad (4)$$

e is refer to the unproductive income, If W_B big enough, investment can absorb all the domestic endowment elements，then $y^t = Z$, we have：

$$W_B^{t+1} = (1-a)\left(e + Z - \gamma \mu W_B^t\right) \qquad (5)$$

According to the steady-state theory of dynamic economic $dW_B^{t+1}/dW_B^t < -1$ is the necessary condition of long-term fluctuation. Based on formula (5), $-(1-a)\gamma\mu < -1$ is the necessary conditions of financial instability.

For CES economies, the production function is: $f(K,z) = A\left(K^\theta + \gamma z^\theta\right)^{1/\theta}$, $A > r$, $\gamma > 0$, θ means the elasticity of substitution between K and z ,Assume that $\theta < 1$, When $\theta = 0$, it is Cobb-Douglas production function and When $\theta \rightarrow -\infty$,it is Leontief production function.

Because $K^t = I^t - p^t z$, so optimal GDP in the period of t is:

$$y^t = \max f\left(I^t - p^t z, z\right) \qquad (6)$$

According to the first-order conditions, we get：

$\psi'(p) = -(\Phi(p) - 1)\psi(p)/p\,\Phi(p)$；
$y^t = \psi(p^t)I^t$

And

$\Psi(p^t) = A\Phi^{(1-\theta)/\theta}, \Phi(p^t) = 1 + \left(p^t\right)^{\theta/(\theta-1)}\gamma^{1/(\theta-1)}$

Dynamic equations for W_B^t is:

$$W_B^{t+1} = (1-a)\left[e + \left[(1+\mu)\Psi p' - \gamma\mu\right]W_B^t\right] \qquad (7)$$

According to formula (7), we will have:

$$dW_B^t/dW_B^{t+1} = (1-a)\left[\frac{(1+\mu)\psi(p)}{\Phi(p)(1-\theta)+\theta} - \gamma\mu\right](8)$$

When $\theta \rightarrow -\infty$, $dW_B^t/dW_B^{t+1} \rightarrow -(1-a)\gamma\mu$, $-(1-a)\gamma\mu < -1$ is also the necessary conditions for Long-term fluctuations

B. How Open FDI effect on the real exchange rate and economic growth

First we need to distinguish FDI out from all capital flows. Razin (1998) definite FDI as: FDI refers an investment that share ratio is more than 10%[4].Based on this definition, we Also assume that inflows of FDI have infinite elastic in a fixed rate of return $\gamma + \delta$,This means that $\gamma + \delta$ is the discontinuous point of FDI inflows. In the situation of less than $\gamma + \delta$, FDI inflows is 0; while more than $\gamma + \delta$, FDI inflows is totally elastic, at this time FDI can completely replace the domestic investment.

Aghion(2001,2004) have researched on how opening FDI influence relevant economic parameter in a closed Leontief economies. Assume the return rate of balanced domestic market is σ, the formula of real exchange rate P is:

$$P^* = (1+\mu)/(\gamma + \delta + \mu\sigma) - a \qquad (9)$$

As the FDI enters, real exchange rate P will increase. However, the real exchange rate, economic growth will not have long-term fluctuation. Based on this view, we consider a economy only open the FDI. Then the equilibrium condition is:

$$\psi(p) = (\gamma + \delta + \mu\sigma)/(1+\mu) \qquad (10)$$

From formula（10）, we can get the equilibrium value of P. The real exchange rate P will have an upward moving step but can not continue for a long time, so FDI open will not cause financial instability.

Based on the analysis of the economy, we get that equilibrium condition are unable to calculate real FDI value. Among the formula, (W_B+FDI) will not have long-term fluctuations, but W_B may have reversed fluctuations with the volatility of the FDI and lead to instability of domestic economic growth. Therefore, the economic growth can be stable through the interior modulation of (W_B+FDI).When FDI change, W_B must change accordingly. That means, when the FDI inflows changes, Domestic macroeconomic must have corresponding regulation, otherwise, it will lead to the volatility of the macroeconomic growth[5]. When FDI is large, long-term continuous increase, if the domestic economy does not adjust to warm up at the same time,

the overall economy will have a serious imbalance.

If open FDI is restricted by domestic policy and system, the FDI inflows can not exceed χ percentage of Domestic wealth WB, as $FDI \leq \chi W_B$. Due to the constraints of inflows, FDI inflows no longer has full flexibility and the enter cost also increase. So, we have reason to suppose that the investment return is greater than $\gamma+\delta$, equilibrium real exchange rate $P^t>0$。

At this time, $L^t = \mu\left(W_B^t + FDI^t\right)$, If the domestic market has sufficient attractiveness, $FDI=\chi W_B$. The dynamic equation is:

$$W_B^{t+1} = (1-a)[e + \frac{(1+\mu)\psi\left(p^t\right)W_B^t}{1+x} - \gamma_d\mu(1+x)W_B^t] \tag{11}$$

γ_d is domestic interest rate. According to formula (11)，the total value of wealth in $t+1$ period is：

$$W_B^{t+1} + xW_B^{t+1} = (1-a)\left[e(1+x) + (1+\mu)\psi\left(p^t\right)W_B^t - \gamma_d\mu W_B^t(1+x)^2\right]$$

Derivative of W_B^t is：

$$d\left(1+x\right)W_B^{t+1}/dW_B^t = (1+a)\left[(1+\mu)\psi\left(p^t\right) + (1+\mu)\psi'\left(p^t\right)W_B^t - \gamma_d\mu(1+x)^2\right] \tag{12}$$

Because：

$$\psi\left(p^t\right) = A\Phi^{(1-\theta)/\theta} > 0$$
$$\psi'\left(p\right) = -\left[\Phi(p)-1\right]\psi\left(p\right)/p\Phi\left(p\right) < 0$$

So in formula (12), $\left(1+\mu\right)\psi\left(p^t\right)>0$, Economy will be long-term fluctuations when $d\left(1+x\right)W_B^{t+1}/dW_B^t < -1$.

Bring $x = FDI^t/W_B^t$ into formula (12), derivative of FDI^t is：

$$d\left(1+x\right)W_B^{t+1}/dFDI^t = (1-a)e/W_B^t + (1+\mu)W_B^t\Theta \delta\left(p^t\right) - 2\gamma_d\mu\left(1+FDI^t/W_B^t\right) \tag{13}$$

In formula (13), Θ is a constant; $\delta\left(p^t\right)$ is Dirac function, reflects forward change of p^t.

From formula (13), we can get that the influence of FDI^t is uncertain. If the domestic economy is in rise

period, W_B^t is big, $d(1+x)W_B^{t+1}/dFDI^t$ is likely greater than 0, FDI open will accelerate the domestic economic overheating ; If the domestic economy is in down period, W_B^t is small, then $d(1+x)W_B^{t+1}/dFDI^t$ is likely less than 0, FDI open will add the economic recession. The results suggest that if FDI works as a supplement of domestic direct investment, it is likely to deepen the volatility of macroeconomic growth, thus will cause unstable of the whole economy and even economic crisis.

III.   THE EMPIRICAL ANALYSIS

This research mainly adopts the measurement of the cross-sectional data model, for cross-sectional data model, the important thing is their estimate results could pass the test of heteroscedasticity, test this paper used including:

1)   HCSE test: This test gives heteroscedasticity-consistent standard errors and the result of t-statistics (Eicker, 1967; White, 1980)

2)   HACSE test: This test gives related standard deviation and t-statistic, the result can be used to analyze heteroscedastic- ity of Cross-sectional data and self-correlation of model residual (Andrews，1991)

3)   JHCSE test: The corresponding standard deviation of this test called Jackknife revised standard deviation (MacKinnon and white, 1985). This Statistics test is based on HCSE test.

Establish the cross-section data model about FDI open influence the macroeconomic; the panel date includes 30 countries as samples:

$$\begin{cases} REER\text{-}VOL^i = \beta_0 + \beta_1 FDI^i + \beta_2\chi^i + \varepsilon^i \\ GDP\text{-}VOL^i = \beta_0 + \beta_1 FDI^i + \beta_2\chi^i + \varepsilon^i \end{cases} \tag{14}$$

REER is real effective exchange rate; *REER-VOL*[i] is the fluctuation in the sample (2000-2010) REER of country, *GDP-VOL*[i] Is the fluctuation of economic growth after eliminating time trend of sample period. *FDI*[i] is direct investment amount of *GDP* of country i; specific data is the average from 2000 to 2010.

X^i Includes other explanatory variables as:

$IMEXGDP =$ SUM of Export and import divided by GDP;

$GSGDP =$ Government consumption divided by GDP;

$GDPcap =$ GDP formed by unit capital;

$M_2GDP =$ Broad money supply divided by GDP;

CPI = Consumer price index;

$i - diff$ = Balance of interest rates (one-year period);

The original data are from international financial statistics IFS database of the international monetary fund (IMF). In addition, the interpretation of the model also include virtual variable DEX [5] refer to exchange rate system.

$$DEX = \begin{cases} 0, \text{use the floating exchange rate system} \\ 1, \text{use the fixed exchange rate system} \end{cases}$$

According to data sample, we analyze whether the open FDI influence the fluctuation of real exchange rate, the result such as table 1

TABLE I.   Effect of FDI on real exchange rate

dependent variable :REER-VOL					
S.E. of regression	4.087		Sum squared resid	501.2	
Durbin-Watson stat	2.34		Included observation:	30	
Numbers of Parameter	4				
	coefficient	Std. Error	HACES(Std)	HCES	JHCES
FDIGDP	-0.0237	0.0678	0.0304	0.0248	0.0654
IMEXGDP	0.0314	0.0189	0.0263	0.0254	0.0256
GDPCap	1.1430	0.3145	0.4245	0.3421	0.3529
CPI	0.5760	0.1534	0.2365	0.1875	0.2134
DEX	-2.637	1.6342	1.4258	1.6345	1.8942
	coefficient	t-Statistic	HACES(t-Statistic)	HCES	JHCES
FDIGDP	-0.0234	-0.3208	-0.7512	-0.8364	-0.3402
IMEXGDP	0.0356	1.6871	1.3422	1.4823	1.3045
GDPCap	1.2434	3.4563	2.6345	3.5398	3.1245
CPI	0.6583	3.4678	2.5435	3.1032	2.5489
DEX	-2.643	-1.8034	-2.0493	-1.6726	-1.5101

TABLE II.   Effect of FDI on domestic economic growth

dependent variable : GDP-VOL					
Overall model test	F(3,53)=4.711[0.005]**				
Included observation	30		Numbers of Parameter 4		
	coefficient	Std. Error	HACES(Std)	HCES	JHCES
FDIGDP	31.880	13.642	3.4212	3.2456	24.732
IMEXGDP	-181.45	108.34	74.243	75.314	78.342
GSGDP	-1145.1	660.34	680.23	702.93	728.34
Constant	48712	14265	18239	18302	18423
	coefficient	t-Statistic	HACES(t-Statistic)	HCES	JHCES
FDIGDP	31.478	2.3493	9.345	10.431	1.1913
IMEXGDP	-182.34	-1.2359	-2.4642	-2.3704	-2.3283
GSGDP	-1234.1	-1.2359	-1.7424	-1.7392	-1.6934
Constant	49230	3.4256	2.5739	2.6368	2.6453

From table1, we find that open FDI of capital account does not produce significant influence to real effective exchange rate, this result is consistent with the model .In addition, DEX in 10% significant level will influence exchange rate fluctuations. In general, effective exchange rate fluctuate less in the fixed exchange rate system.

According to the data, we analyze whether FDI influence fluctuation of domestic economic growth, the result shows in table 2.

Based on the result of coefficient and residue test, model can through the test of heteroscedasticity in 95% confidence level. Open FDI has significant influence to fluctuation of GDP, coefficient is 31.88. FDI does not have a stable effect on economic growth. Instead, the fluctuations of FDI will deepen fluctuation of the country, cause macro economic instability and cause crisis.

IV. CONCLUSION

In this paper, the result shows that: Open FDI may lead instable consequences to economic growth. In this paper, we use model show that FDI will not cause real exchange rate fluctuations in the long-term, mixed items (W_B+FDI) will keep stable, but W_B may fluctuate with the volatility of the FDI, so economic growth will be unstable.

In addition, government intervention can not eliminate the macro economic instability phenomena. Because FDI decided by exogenous factors, domestic policy makers can not calculate the right FDI value, so the policy makers in fact neither know, also can't make all kinds of capital flow achieve the right level and thus they can't avoid macroeconomic instability. Practice proves that macro-control is not easy, successful macro economic regulation and control only make domestic economic parameter fluctuated following intention of foreign capital investment. But if the policy makers fail to control effectively, the country will face economic bubble and inflation with the rapid increase of the foreign capital；If foreign sudden fall, bubble will burst and deflation appeared. Therefore, open FDI is not a "stabilizer".

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