

CHAPTER IV

EMPIRICAL RESULT

This chapter expresses the result of the Vector Autoregression Model used to analyze the interactions among variables related with the short-term capital flow such as covered interest parity differentials, restrictions of capital flow, exchange rate, relative returns on stock market and forward rate. In order to achieve the purpose of this chapter, 2 sections are analyzed respectively.

In this study, short-term capital flow or hot money is treated as a main endogenous variable. The effects of this study depend on the nature of macroeconomic instabilities changes in surge of net flows in the Bank of Thailand's capital and financial accounts so first section is focused on classification of hot money and cool money.

The next section is data analysis by using the Vector Autoregression Model and interpretation result by using Impulse Response Function to capture the shock effects of variables.

4.1 Classification of short-term capital flows

The behavior of the capital flows would reflect the behaviors over time of the underlying macroeconomic instabilities. A question is raised whether different types of flow will have different ultimate causes and that the causes have different time-series properties. For our analysis, we distinguish capital and financial accounts as 5 categories such as direct investment, equity securities, debt securities, loans and currency and deposits (included Nonresident Baht Accounts). The focus of this analysis is on the net

capital flows because our concern is net financing. A list of characteristic of data used is in table 5 that provide means, standard deviations, and other descriptive statistics.

Table 5: Characteristic of capital and financial accounts

Characteristic	Direct investments	Equity securities	Debt securities	Loans	Currency and deposits
Mean	60815.13	22079.68	-4413.547	-62024.67	6676.334
Median	58107.11	11297	-3897	-68914	1433.405
Maximum	141946.2	104444.4	35390.02	131022.1	70595
Minimum	12020	-2984	-43357	-186586	-28684
Std. Dev.	25764.99	28026.49	19671.11	66302.8	21422.98
Skewness	0.922894	1.701456	0.208579	0.547983	1.045062
Kurtosis	4.492066	4.946609	2.821558	3.708904	4.348965
Jarque-Bera Probability	8.449788	23.05364	0.308793	2.555527	9.282486
	0.014627	0.00001	0.856932	0.27866	0.009646
Sum	2189345	794868.3	-158887.7	-2232888	240348
Sum Sq. Dev.	2.32E+10	2.75E+10	1.35E+10	1.54E+11	1.61E+10
Observations	36	36	36	36	36

In order to use short-term capital flows along with the model correctly, I do have to distinguish between long-term capital flows (cool money) and short-term capital flows (hot money)—Classens, Dooley and Warner (1995) emphasized that we should not classify whether hot or cool money by looking at the name or label. The straight way to distinguish among them is to capture behaviors of each flow whether they commit or do not commit to stay in the recipient countries to enhance growth with long periods or they may rapidly flow out whenever arbitrage opportunities start to play out.

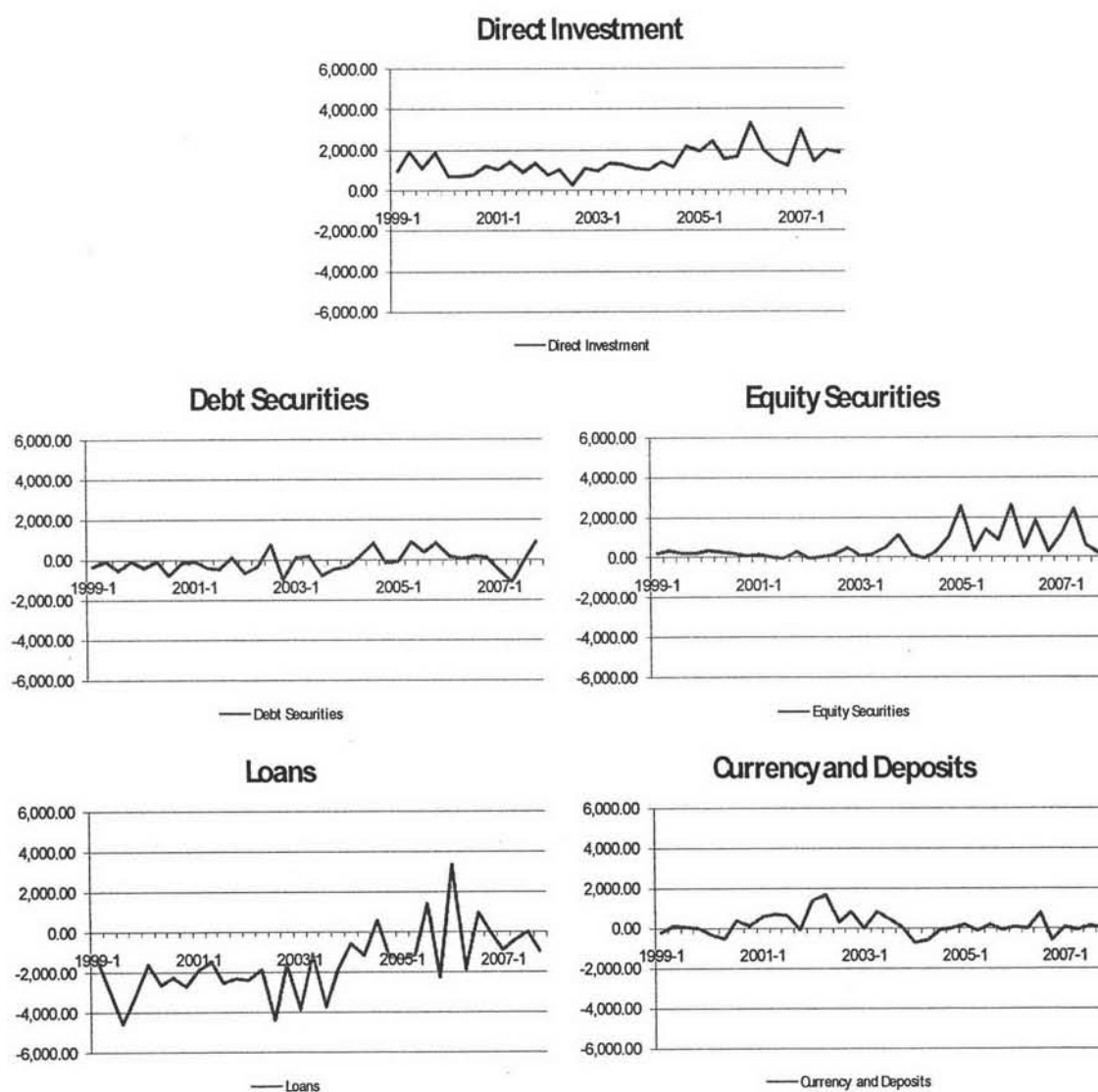
The straight forward direction that we can classify hot flows from cool flows is to focus on historical behaviors of each flow. The 3 classifications will be pursued in order to distinguish hot and cool money that are graphing the flows and comparing volatility with trend, using coefficient of variations and autocorrelation method.

1) Graphing and comparing volatility and trend

The tradition view is to graph each type of the capital flows and look at volatility and trend of them as follow:

Figure 11: Behavior of flows

(Unit: Million USD)



Source: Bank of Thailand

We can see from figure 9 that direct investment¹⁶ has low volatility during 2000-2004 and become volatile at the end period. Both portfolio investments¹⁷ move to the same direction and move along with zero line, especially equity securities flow represents low volatility since 1999 to 2003 and start to swing at the same time that US exchange rate was expected devaluation (it may imply that hot money would penetrated Thai economy through this channel), debt securities flow is less volatility. Other investment flows¹⁸ are more fluctuation, included loans as well as currency and deposits accounts. Loans is only one account that most volatile over time. Currency and deposits, included Nonresident Baht Accounts, is the accounts that much more volatile and has become the target channel of speculators since crisis in 1997 but we can see that after 1999, this accounts are less volatile. The reason may be the Bank of Thailand attempt to control by ruling many policies in order to prevent crisis again.

2) Coefficient of variations (CVs)

The second direction for testing behaviors of foreign capital flows is to use coefficient of variation (CVs) to provide an indication of the relative magnitude of these flows compared with the total capital and financial accounts.

This measurement depicts that long-term flows have low coefficient of variation (CVs) or low volatility and short-term flows always represent high coefficient of variation (CVs) or imply that huge volatility. High relative volatility is one of the notions

¹⁶ Direct investment is defined as an incorporated or unincorporated enterprise in which a direct investor, who is resident in another economy, owns 10 percent or more of the ordinary shares or voting power (for an incorporated enterprise) or the equivalent (for an unincorporated enterprise).

¹⁷ Portfolio investment includes, in addition to equity securities and debt securities in the form of bonds and notes, money market instruments and financial derivatives such as options. Excluded are any of the aforementioned instruments included in the categories of direct investment and reserve assets.

¹⁸ Other investment includes trade credits, loans, currency and deposit, and other investments.

that has been associated with hot money. A related notion is that a hot-money inflow is likely to disappear or reverse itself in the near future, whereas a cool-money inflow is more likely to persist, by contrast, hot flows are associated with low persistence and high fluctuation. Common formula of coefficient of variation (CVs) is ratio of standard deviation as a percentage of mean, the result always represent on absolute term.

Table 6: Coefficient of variation (CVs)

Types of capital flow	Mean	Standard Deviation	Coefficient of Variation
Direct investments	60815.13	25764.99	42.36608554*
Equity securities	22079.68	28026.49	126.9334066
Debt securities	-4413.547	19671.11	445.6984371
Loans	-62024.67	66302.8	106.8974652
Currency and deposits	6676.334	21422.98	320.8793928

* low CVs represents that direct investment tends to be cool money

Source: Bank of Thailand

We can see from table 6 that direct investment represents the lowest CVs value so it can imply that direct investment is cool money. The rest represents high CVs value, especially debt securities is the highest one.

3) Autocorrelation

The efficient way to distinguish between short-term and long-term capital flows from an idea of persistence is to calculate “Autocorrelations” for each type of capital flow. A persistence flows will express positively auto-correlated, whereas a transitory capital flows will have a low or negative autocorrelation. Normally, the classic case of classification between hot and cool flows is cool money will be a flow that is highly positive auto-correlated but hot money will displays far lower positive or negative correlation.

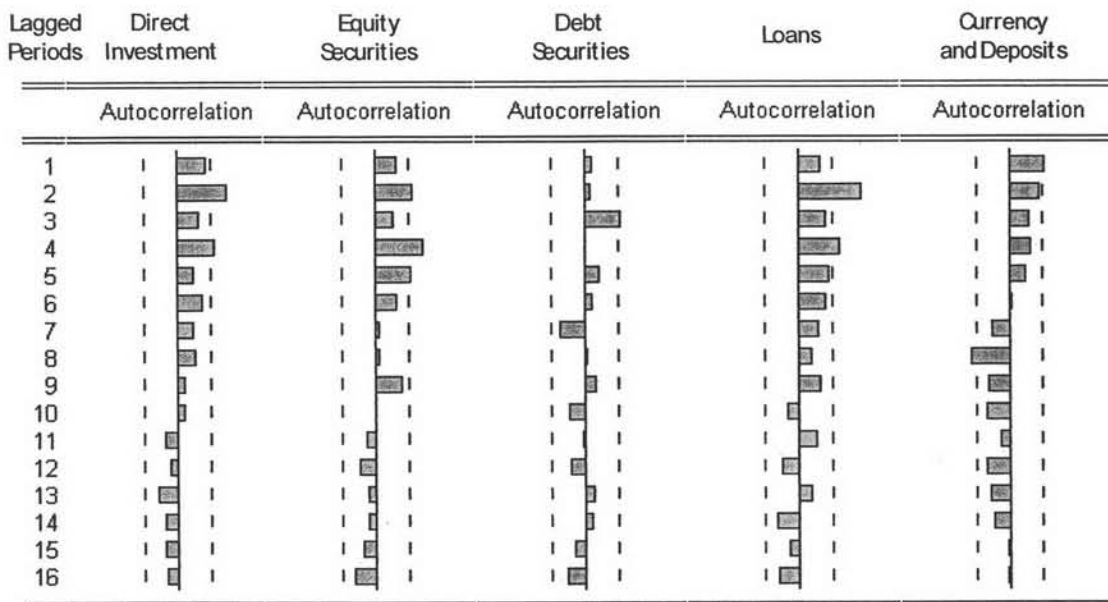
In order to test whether the nature of capital flows would be alike 2 precedent methods, we will adopt autocorrelations approach to capture whether recent capital flows are either hot or cool. The hypothesis of autocorrelations approach is:

H_0 : Net foreign flows are stationary

H_1 : Net foreign flows are non-stationary

The correlogram figures, in figure 9, which constructed from autocorrelation functions represent continuous positive correlation in net foreign investment and currency and deposits. We might conclude roughly that the net flow of direct investment and currency and deposits in correlogram tend to be long-term capital flow or cool money. Equity securities and loans locate in gray area that they might be either hot or cool. Debt securities show relatively high negative autocorrelation through the lagged periods that lead to be the hot one.

Figure 12: Correlogram of capital flows



Remark: Data collected during 1999-2007

An outcome from autocorrelation testing represents that the combination of foreign capital flow from 5 types that was chosen lie between hot and cool money.

In order to separate hot money from cool money, the next alternative is the net flow of private financial account¹⁹. The net flow of private financial account will be divided as 5 types²⁰, like precede classification (see characteristic of 5 flows in table 7) and the 3 classification methods (graph in figure 13, CVs in table 8 and Autocorrelation in figure 14) will be pursued to distinguish behavior of flows as follows:

Table 7: Characteristic of private financial accounts

Characteristic	Direct investments	Equity securities	Debt securities	Loans	Currency and deposits
Mean	16692.14	3223.875	-3730.587	-4614.415	-8970.524
Median	15731.55	1243.5	-1754.5	-5337	-9028
Maximum	73217.78	84180.97	25774	32732.9	106734.5
Minimum	-14508.43	-55192.15	-65028.82	-28709.76	-191686.3
Std. Dev.	11664.65	16372.09	10459.49	12644.31	40428.72
Skewness	1.350601	0.848076	-3.370661	0.709356	-0.605758
Kurtosis	8.702529	9.857204	20.32888	3.328385	6.57222
Jarque-Bera Probability	179.169 0	224.5418 0	1555.809 0	9.5426 0.008469	64.02839 0
Sum	1802751	348178.5	-402903.4	-498356.8	-968816.6
Sum Sq. Dev.	1.46E+10	2.87E+10	1.17E+10	1.71E+10	1.75E+11
Observations	108	108	108	108	108

¹⁹ The net flow of private financial account is included net capital flows in term of banking and non-banking sectors, regardless net flows invest in government and monetary authority.

²⁰ The net flow of private financial account comprises of bank and non-bank. Non-bank section consists of direct investment, loans, equity securities, debt securities and so on. Banking section is all about the other foreign transaction such foreign currency deposits.

Figure 13: Behavior of flows in private financial account

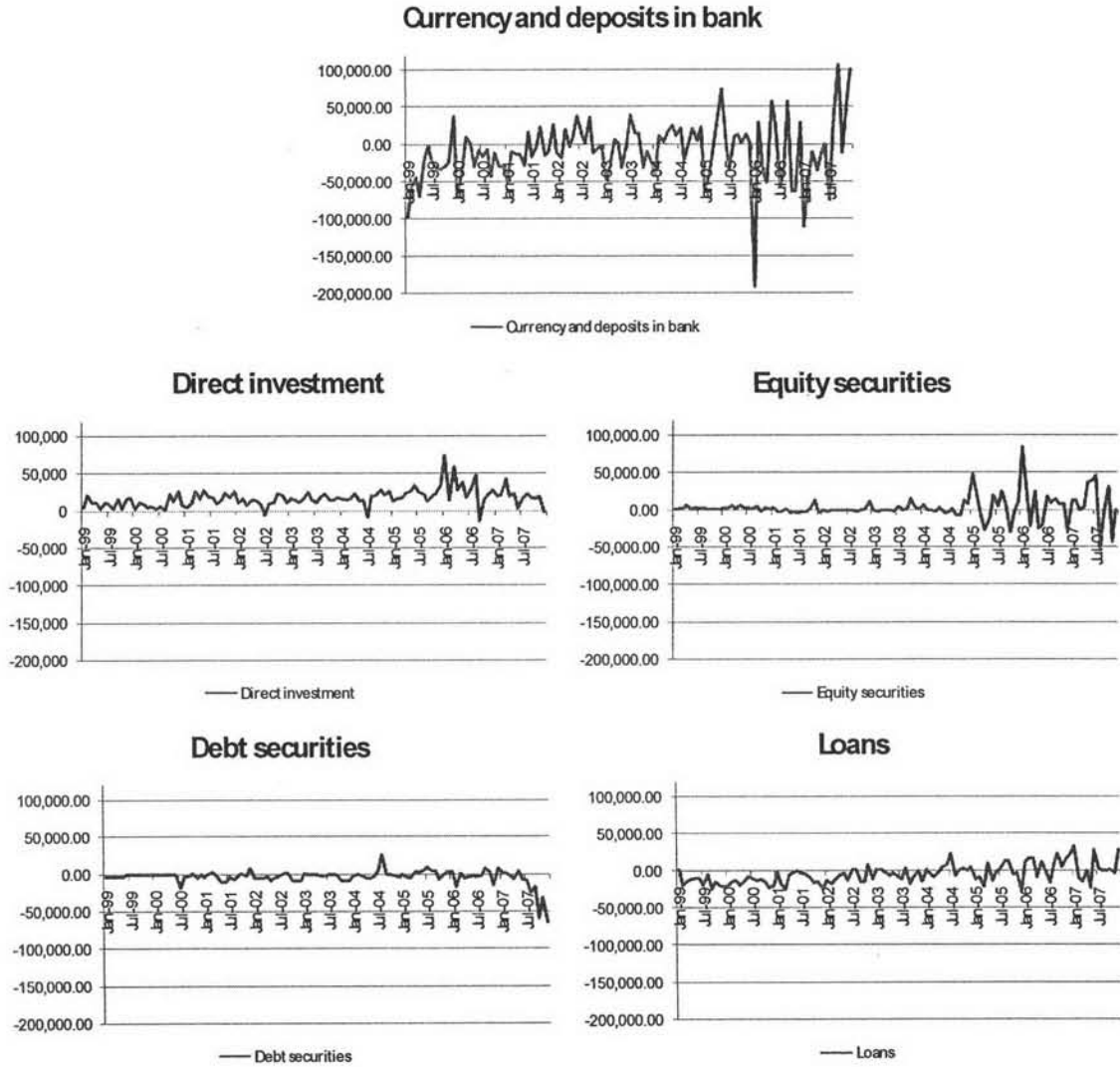
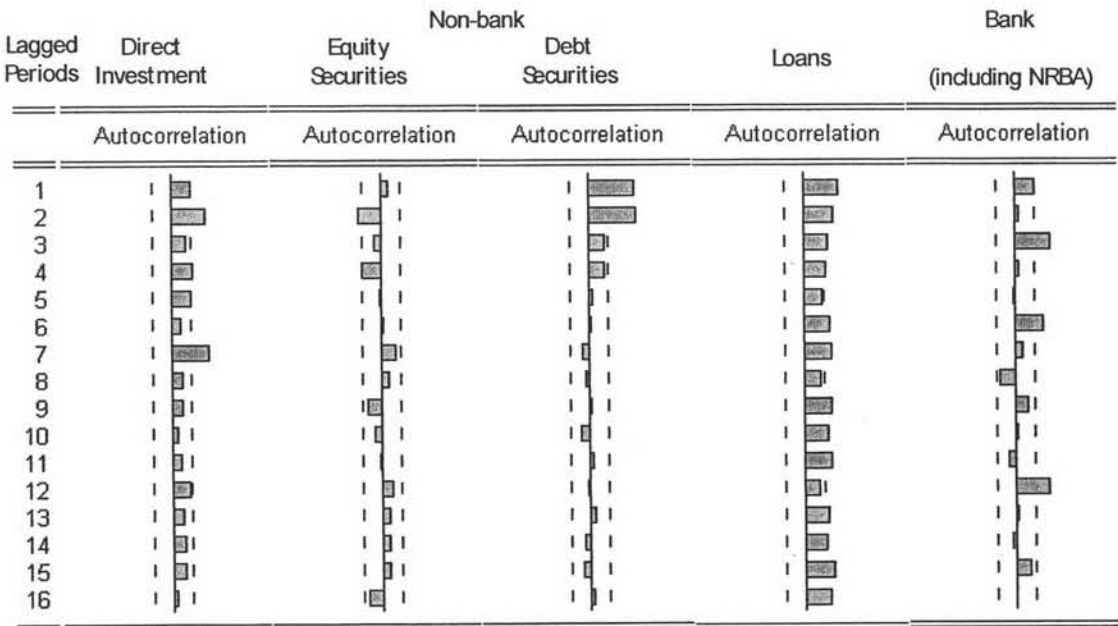


Table 8: Coefficient of variation (CVs) of private financial account

Types of capital flow	Mean	Standard Deviation	Coefficient of Variation
Direct investments	16692.14	11664.65	69.88109374*
Equity securities	3223.875	16372.09	507.8388585
Debt securities	-3730.587	10459.49	280.3711587
Loans	-4614.415	12644.31	274.0176165
Currency and deposits	-8970.524	40428.72	450.6840403

* low CVs represents that direct investment tends to be cool money

Figure 14: Correlogram of capital flows in private financial account



From outcomes in all method show that direct investment represents itself as cool money. Autocorrelation estimation shows that loans are hot money but it is contrary to CVs test. Nevertheless, autocorrelation are reliable method so loans will be count as cool

money. Equity securities, debt securities from non-bank and currency and deposits in banking section are statistically significant as hot money or short-term capital flow that we are interested in.

4.2 Vector Autoregression framework

In the time-series analysis, it is compulsory to determine stationarity of variables used in the model –Vector Autoregression Model– before carries on estimation. Augmented Dickey Fuller (ADF) is a criterion for testing unit root whether a time-series variable is stationary. Hypothesis testing of unit root test is:

H_0 : Existing of Unit root test in each variable

H_1 : Not existing of unit root test in each variable

From testing stationary of variables by running unit root test, we can obtain the computed ADF (τ) value which help us for making decision whether accept or reject the null hypothesis. If the computed ADF is greater than the critical ADF at the 5% confidence interval, we will reject the null hypothesis, this means that the variable has no unit root and becomes stationary. By contrast, if the computed ADF is lower than the critical ADF at the 5% confidence interval, we will accept the null hypothesis, this means that the variable is non-stationary. Moreover, this variable is needed to be differentiated backward until all unit root problem is eliminated from the system.

After pursuing ADF test and eliminating unit root from each endogenous variable, we can obtain the result of each variable that will be used to the Vector Autoregression Model (VAR) as followed:

Table 9: Stationary of variables used

Variables	Definition	Level	Critical ADF at 5 % significant	Computed ADF	Probability
ST_GDP	Ratio of short-term flow as a percentage of GDP	0	-3.453179	-4.742487	0.0011
CIPD	Covered interest parity differentials	0	-3.452764	-1.163701	0.9122
		1	-3.452764	-15.9286	0.0000
LXR	Spot exchange rate	0	-3.452764	-1.754212	0.7199
		1	-3.452764	-7.535787	0.0000
CCI	Capital control index	0	-3.453179	-3.050969	0.1238
		1	-3.453179	-8.534007	0.0000
ROS	Relative returns on Thai stock to US stock	0	-3.452358	-10.95445	0.0000
LUS1M	US forward rate	0	-3.452764	-2.126573	0.5249
		1	-3.452764	-15.18065	0.0000

The result can be concluded as follow:

1. ST_GDP is stationary with the first level difference (I(0)).
2. CIPD is stationary with the first level difference (I(1)).
3. LXR is stationary level (I(1)).
4. ICC is stationary with the first level difference (I(1)).
5. ROS is stationary at the level (I(0)).
6. LUS1M is stationary with the first level difference (I(1)).

The crucial condition is to select the lagged length in unrestricted VAR. The procedure begins with the longest lag length and then tests whether the lagged length can

be shortened. The important statistic instrument for lagged length testing is Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).

Table 10: Appropriation of lagged length in unrestricted VAR

Lag interval of endogenous	1	2	3	4	5	6	7	8
AIC	-7.868*	-7.611	-7.425	-7.310	-7.464	-7.059	-7.209	-7.123
SIC	-6.767*	-5.567	-4.437	-3.378	-2.588	-1.239	-0.446	0.583

From Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) of testing a Vector Autoregression model indicates that AIC and SIC increase over time when lag expanded. The appropriate lagged value that we obtain is lag “1”.

The Vector Autoregression Estimation from using appropriate lagged length is shown in table 11.

Table 11: Vector Autoregression Estimation

Vector Autoregression Estimates

Date: 04/16/08 Time: 03:40

Sample (adjusted): 1999:03 2007:12

Included observations: 106 after adjustments

Standard errors in () & t-statistics in []

	ST_GDP	D(CIPD)	D(LXR)	D(CCI)	ROS	D(LUS1M)
ST_GDP(-1)	0.114717 (0.09840) [1.16585]	0.000148 (0.00032) [0.46370]	3.35E-05 (0.00024) [0.14170]	-0.019787 (0.03836) [-0.51577]	0.000531 (0.00125) [0.42369]	-6.13E-05 (0.00044) [-0.13907]
D(CIPD(-1))	-23.54873 (49.5121) [-0.47562]	-1.161926 (0.16074) [-7.22870]	0.027785 (0.11881) [0.23386]	-8.071180 (19.3039) [-0.41811]	-0.008662 (0.63099) [-0.01373]	0.901578 (0.22196) [4.06188]
D(LXR(-1))	-27.45969 (57.9711) [-0.47368]	1.223819 (0.18820) [6.50278]	0.283639 (0.13911) [2.03893]	1.532179 (22.6019) [0.06779]	0.013974 (0.73879) [0.01891]	-0.908113 (0.25988) [-3.49433]

D(CCI(-1))	-0.205043 (0.25433) [-0.80620]	0.000758 (0.00083) [0.91789]	0.000856 (0.00061) [1.40232]	0.273317 (0.09916) [2.75630]	-0.003900 (0.00324) [-1.20328]	-7.01E-05 (0.00114) [-0.06150]
ROS(-1)	-10.91469 (8.45848) [-1.29038]	-0.038847 (0.02746) [-1.41470]	-0.032559 (0.02030) [-1.60408]	0.250009 (3.29782) [0.07581]	-0.090577 (0.10780) [-0.84026]	0.012186 (0.03792) [0.32136]
D(LUS1M(-1))	-43.47714 (39.4879) [-1.10102]	-0.598238 (0.12820) [-4.66663]	0.023581 (0.09476) [0.24885]	-4.182929 (15.3957) [-0.27170]	-0.091157 (0.50324) [-0.18114]	0.253053 (0.17702) [1.42949]
C	-1.459252 (0.63023) [-2.31544]	0.000678 (0.00205) [0.33121]	-0.000527 (0.00151) [-0.34827]	0.120818 (0.24571) [0.49170]	0.012867 (0.00803) [1.60209]	-0.001201 (0.00283) [-0.42507]
R-squared	0.052216	0.435805	0.163670	0.081271	0.022391	0.276316
Adj. R-squared	-0.005226	0.401612	0.112983	0.025591	-0.036858	0.232456
Sum sq. resids	3639.063	0.038353	0.020955	553.1699	0.591032	0.073134
S.E. equation	6.062855	0.019683	0.014549	2.363805	0.077266	0.027180
F-statistic	0.909025	12.74523	3.229052	1.459603	0.377920	6.299992
Log likelihood	-337.8177	269.5832	301.6189	-237.9755	124.6267	235.3742
Akaike AIC	6.505995	-4.954400	-5.558846	4.622179	-2.219372	-4.308947
Schwarz SC	6.681882	-4.778512	-5.382959	4.798066	-2.043485	-4.133060
Mean dependent	-1.806705	-0.000368	-0.000891	0.235849	0.009948	-0.000472
S.D. dependent	6.047075	0.025444	0.015448	2.394644	0.075880	0.031023
Determinant resid covariance (dof adj.)		1.18E-11				
Determinant resid covariance		7.83E-12				
Log likelihood		452.9591				
Akaike information criterion		-7.753945				
Schwarz criterion		-6.698621				

In order to analysis the dynamic relationships among the variables in the system, we employ principle tools which is Impulse Responses Functions (IRFs).

4.3 Impulse Responses functions

The impulse response function (IRFs) provides the information on how the variable response over time to various shock (any given shock on any given variable) to the variables of the system. The analysis in this will be classified into 3 parts. The first part is to investigate reactions of key economic factors to rising short-term capital flow under capital restriction. The key variables are interest rate differentials, spot exchange rate and relative returns on stock market. The second part is to examine the response of short-term capital flow to key economic variables such as interest rate differentials, levels of restriction on capital control, relative returns on Thai stock market and spot exchange rate. The last part is to observe the depreciation of the forward rate leads to inflow of short-term capital to Thailand.

4.3.1 Reactions of key determinant factors to rising short-term capital flow

Figure 15: Reactions of covered interest parity differentials to short-term capital flow

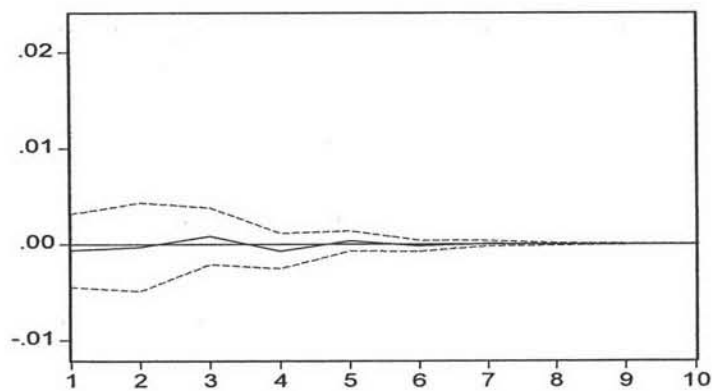


Figure 15 represents the impulse response function of covered interest parity differentials to short-term capital flow. We can see that inbound of short-term capital

flows can create just a very tiny shock at initial period to the parity and the shock effect is ousted with in 6 months.

Figure 16: Reactions of THB/USD exchange rate to short-term capital flow

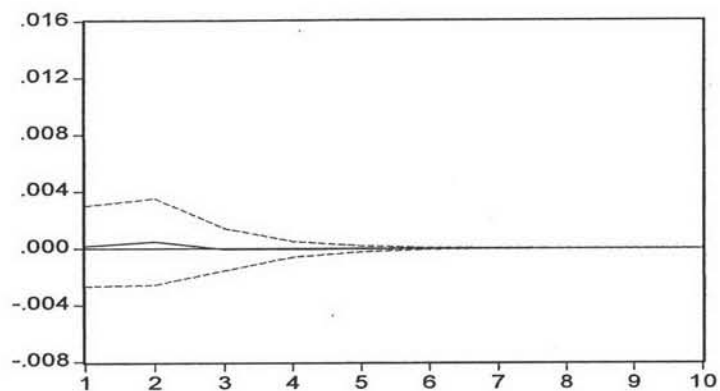
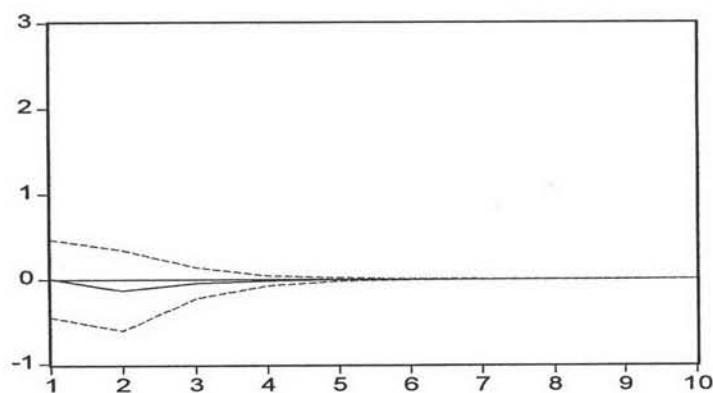


Figure 16 represents that short-term capital flow into Thai economy do not create any effect to Thai Baht. The spot exchange rate is not appreciated from surge of short-term foreign flow.

Figure 17: Reactions of capital controls to short-term capital flow



From figure 17, the impulse response function of capital controls to short-term capital flow, we can see that controls on capital flows by monetary authority does not interact to the quantity of short-term capital flow which has visited Thailand.

Figure 18: Reactions of returns on stock market between Thai and US to short-term capital flow

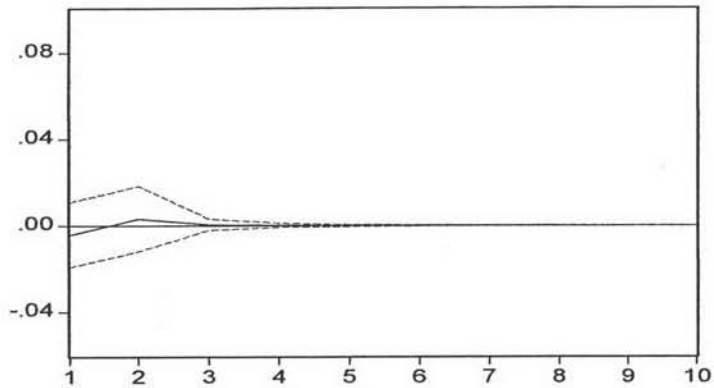
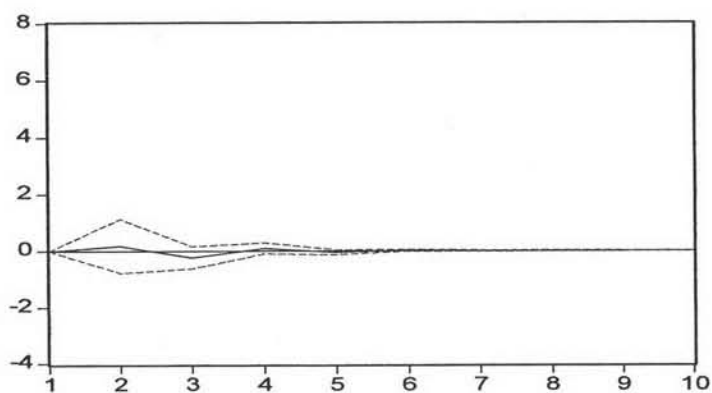


Figure 18 shows that short-term capital flow can not raise significant effect to relative returns on stock market.

4.3.2 Reactions of short-term capital flow to key economic variables

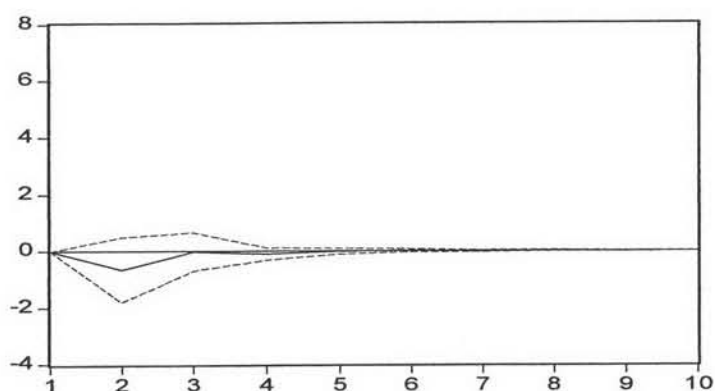
Figure 19: Reactions of short-term capital flow to covered interest parity differentials



The impulse response function of short-term capital flow to covered interest parity differentials is displayed as figure 19. We can see that parity of exchange rate and interest rate between Thailand and the United States do not attract short-term capital flow

to Thailand. Even through, change in exchange rate is greater than interest rate changed. It might be implied that magnitude of transactional costs or uncertainties are greater than profits earned from undertaking the arbitrage transactions.

Figure 20: Reactions of short-term capital flow to THB/USD exchange rate



From figure 20 shows that appreciation in THB/USD exchange rate can raise amount of short-term capital flow in next 2 periods and disappear in the third period.

Figure 21: Reactions of short-term capital flow to relative returns between Thai and US on stock market

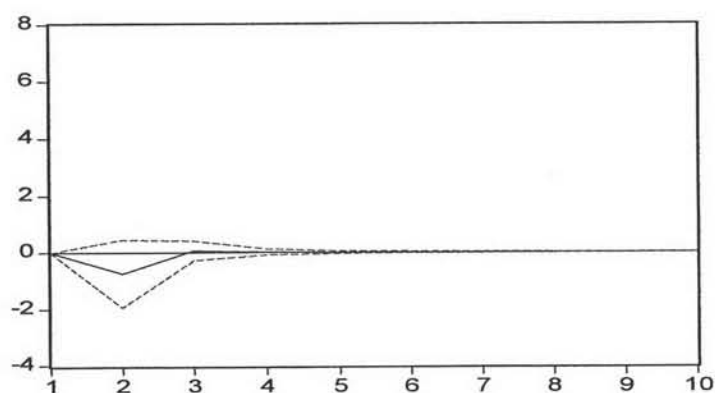


Figure 21 represents the impulse response function of short-term capital flow to relative returns between Thai and the United States. We can see that relative returns do not attract much hot money to come to Thailand.

Figure 22: Reactions of short-term capital flow to capital controls

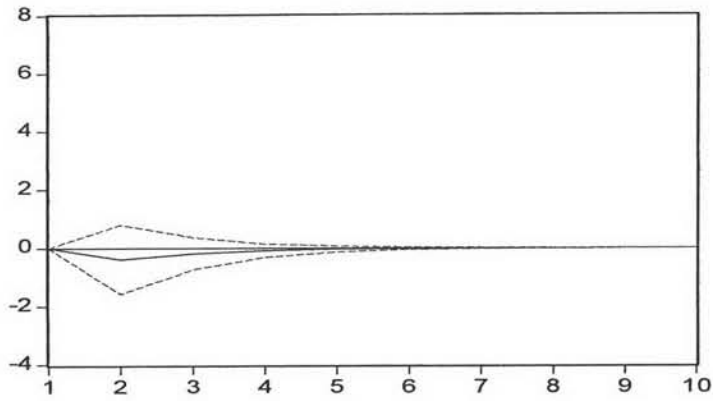
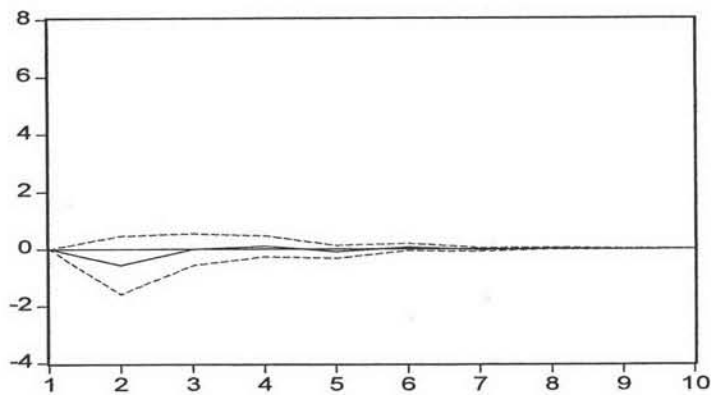


Figure 22 shows that under tightened controls on capital flow do not have any influence to short-term capital flow.

4.3.3 The depreciation of US forward rate and effects of short-term capital to Thailand

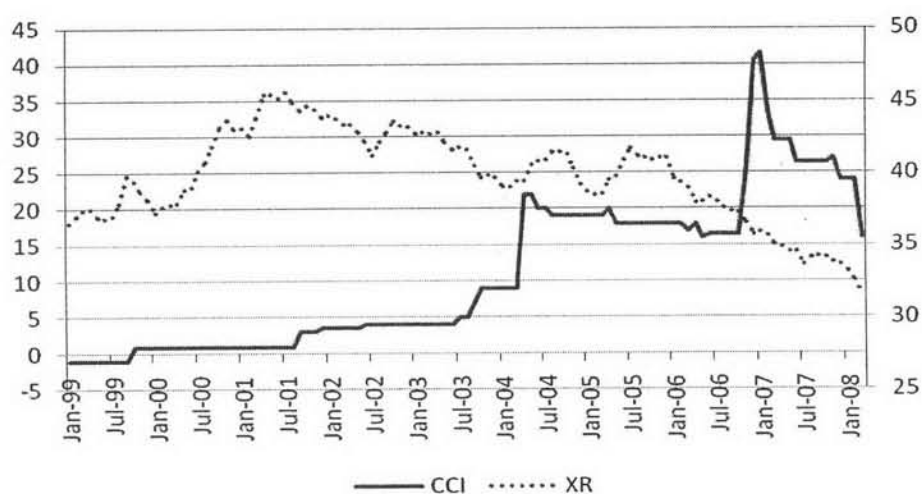
Figure 23: Reactions of short-term capital flow to THB/USD forward rate



From figure 23 tells us that declining in THB/USD forward rate is not a good indicator to determine whether short-term capital flow into Thailand. We can see a tiny shock in the second period and disappear along the whole line.

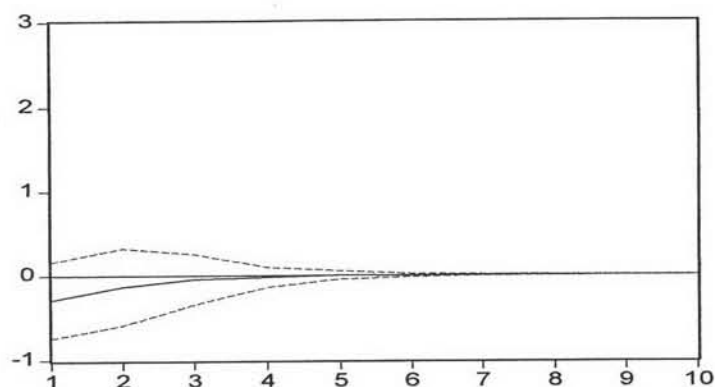
Nevertheless, some argument states that the purpose of unremunerated reserve requirement and other capital control measures aim to slow down the rapid appreciation of Thai Baht that have direct effect to competitive advantage on export more than elimination adverse effect of short-term capital flows.

Figure 24: Relation between Thai Baht and capital control measure



We can see from figure 25 that restriction on capital flows become more relaxation when THB/USD exchange rate is depreciated. So we may come to the conclusion relies on capital control measures that the regulation on capital flows can reduce the undesirable factors that pressure directly on appreciation of Thai Baht.

Figure 25: Reactions of capital controls to THB/USD exchange rate



From above empirical result represents that purpose of capital control measures announced aim to stress on exchange rate but fact finding if the impacts of capital controls can affect to exporting in current account is out of our scope.

However, the long-term capital flow is not far from our study so we would like to understand the relations of exchange rate and capital controls to long-term capital flow. Figure 26 and 27 can show that THB/USD spot exchange rate and capital controls have impact on long-term capital flow. From figure 26 displays that long-term capital flow can make currency appreciation and the shock will prolong for 7 months and figure 27 tells us that capital controls will be tightened when long-term capital flow visit the country in the first period.

Figure 26: Reactions of exchange rate to long-term capital flow

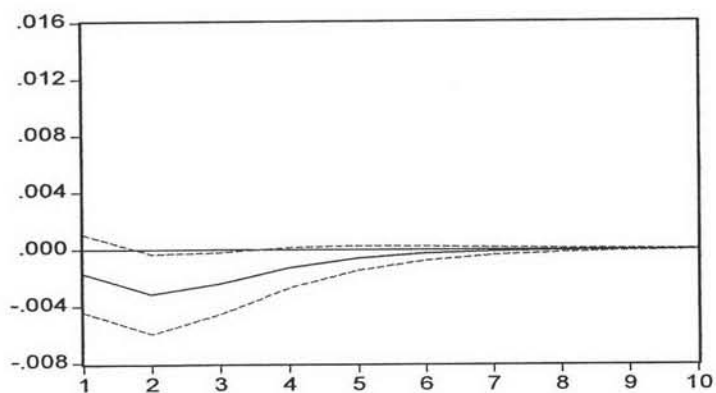


Figure 27: Reactions of capital control index to long-term capital flow

