

Foreign Direct Inflows and Impact of Credit Policy with respect to India: A Review

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Abstract

This paper investigates reaction of Indian credit policy to foreign financial inflows. For this sterilization coefficient which measures degree of independence of domestic credit policy is calculated by analyzing monthly data on net foreign exchange assets, net domestic assets, month end exchange rate of Indian rupee in terms of US dollar, index for industrial production, wholesale price index as endogenous variables and monthly dummies as exogenous variables. The present study uses the data for the period from May 1993 to December 2005. The study found that value of 'sterilization coefficient' based on 'vector error correction model' implies only partial sterilization of domestic credit policy to control adverse impact on domestic inflation of foreign financial inflows. The study concludes that credit policy is neither completely independent nor fully sterilized from the impact of foreign financial inflows. The study suggests that monetary authorities should work out policies for reducing the adverse impact of foreign financial inflows.

Keywords: FDI, RBINDA, IIP and NFEA

Introduction:

Capital Inflows and Domestic Credit Policy of RBI

Emerging economies experienced surge in capital inflows due to liberalization of capital account. The huge volume of capital inflows has a significant impact upon domestic monetary policy via appreciation of exchange rate. Growth in capital inflows may result in either accumulation of foreign exchange reserves or current account deficit depending upon

exchange rate regime. In case of floating exchange rate regime increase in capital inflows would lead to widening current account deficit. But, if the exchange rate regime is fixed one, then central bank of the country would intervene to offset the appreciation in exchange rate. This intervention of central bank in determination of exchange rate will be reflected in accumulation of foreign exchange reserves. Although in India, exchange rate regime is floating one, however, the trend in accumulation of foreign exchange assets with RBI clearly indicates that from time-to-time RBI has aggressively intervened in determination of exchange rate of Indian rupee. Thus, flexibility permitted by RBI for free determination of exchange rate of Indian rupee has been limited. Under the pressure of open economy dynamics, the smooth conduct of monetary policy has become a real challenge. The interlinkage between exchange rate of Indian rupee on the one hand and capital inflows on the other is directly in conflict with independent monetary policy aimed at stabilizing domestic economy.

Under open economic system, with unprecedented capital inflows, central bank will have to attain the twin objectives of resisting exchange rate appreciation and also at the same time controlling inflation. But central bank's intervention in foreign exchange market to prevent currency appreciation would be in direct conflict with credit policy of the country to control inflation. Thus, under the open economic system, a real challenge that a central bank has to face is to co-ordinate central bank's intervention in exchange rate determination with its credit policy. This co-ordination could be achieved by means of sterilization. But practically full co-ordination of sterilization with credit policy is hard to achieve. This has been supported by many earlier studies. According to Mundell (1961), a key insight of open economy macro economics, is the idea of 'impossible trinity'- states that no country can simultaneously have an open capital account, a fixed exchange rate regime and a monetary policy targeted on domestic economy. Thus, once capital account is open and exchange rate is fixed one, monetary policy is driven solely by the need to uphold the fixed exchange rate. Saha (2000) analysed that during the period of 1990 to 1999, Reserve Bank

of India intervened aggressively in the foreign exchange market as a net purchaser of the greenback, resisting the absorption of capital inflow and building up its reserves. Also, RBI, indulged in sterilization to offset expansionary impact of its forex market intervention on monetary system, by discontinuing traditional credit lines available to various domestic agents. Kohli (2001) analysed the impact of surge in capital inflows upon domestic monetary management. It revealed fiscal led monetary expansion in India which leads to the problem of aggravating inflationary impact of capital inflows. These pressures result in complicated macroeconomic management. The only variable that can be varied to control inflation under such circumstances is domestic private sector credit. Shah and Patnaik (2008) found that monetary policy regime has consisted of a pegged exchange rate to US dollar throughout. Increased openness on capital account, coupled with exchange rate pegging, has led to substantial loss of monetary policy autonomy. The result of Patnaik (2004) suggests that RBI directly intervened in currency market by a reduction in net domestic assets. However, the extent of sterilization was large but not complete. Waheed (2007) observed for Pakistan changes in credit resulted in very small offsetting of foreign exchange inflows. The sterilisation coefficient (-.50) confirms that SBP only partially sterilized the foreign exchange inflows.

RBI and Sterilisation:**Table 1: Credit to various domestic agents of RBI.**

	RBI claims on						
		Commercial	Reserve				
Year	Govt.	sector	money	NFEA	NFEA/Res	CS/Res	G/Res
1993	98449	6220	110779	22647	20.4	5.6	89
1994	99300	6445	138672	51422	37.08175	4.647658	71.60782
1995	101478	6593	169283	74720	44.1391	3.894662	59.94577
1996	121349	6855	194457	74092	38.102	3.525201	62.40403
1997	124181	6247	199985	94817	47.41206	3.123734	62.09516
1998	135160	8186	226402	115890	51.18771	3.615692	59.69912
1999	152539	12226	259286	137954	53.20534	4.715257	58.8304
2000	150486	15270	280555	165880	59.12566	5.442783	53.63868
2001	156696	13286	303311	197175	65.00753	4.380323	51.66183
2002	157323	5929	337970	263969	78.10427	1.754298	46.5494
2013	124210	3048	369061	358244	97.06905	0.82588	33.65568
2018	52295	2061	436512	484413	110.9736	0.472152	11.9802
2020	61970	1390	489135	612790	125.2803	0.284175	12.6693

The values in table are as on 31st March of each year.

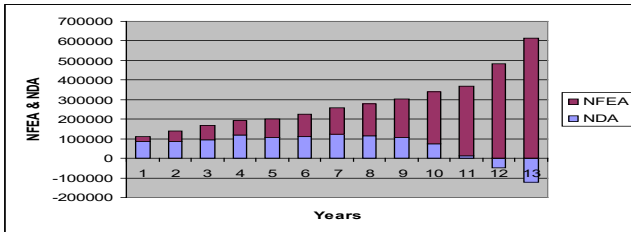
Source: RBI

In the light of foreign exchange inflows RBI focused on sterilization measures to prevent appreciation of exchange rate of rupee. As a move toward sterilization in the light of heavy capital inflows Reserve Bank of India, reduced the availability of credit to its domestic agents. Major domestic agents of RBI consist of RBI's claims against Government and commercial sector. These domestic agents constitute domestic assets of RBI.

Table 1 indicates ratio of commercial sector credit to reserve money which has declined from 5.6% in Mar., 1993 to .28 in Mar., 2015. Similarly, G/Res ratio of Government credit to reserve money has also declined from 89% in Mar., 1993 to 12.67% in Mar., 2005. Total reserve money of RBI thus consists of Net Domestic Assets (NDA) and Net foreign exchange assets (NFEA). The Net domestic assets are difference between reserve money and Net foreign exchange assets of RBI. The

proportion of Net Domestic Assets and Net foreign exchange assets is shown in graph 1. Graph reveals that since 1993, proportion of NDA is declining and that of NFEA is rising.

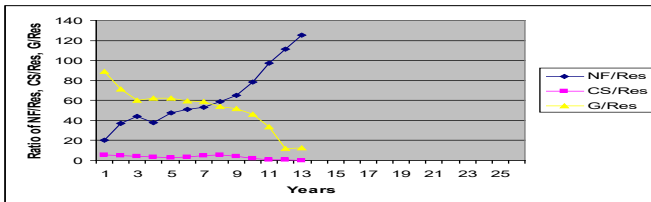
Graph 1: proportion of NDA is declining and that of NFEA is rising.



Source: RBI

In graph 2 ratios of RBI credit to its domestic agents has been plotted. Graph shows that ratio of Net foreign exchange assets to RBI reserves (NF/Res) is increasing. But, on the other hand, ratio of commercial sector credit to reserves (CS/Res) and government sector credit to reserves (G/Res) has shown a falling trend. Thus, both of these graphs and table clearly indicate the RBI has indulged in sterilization measures. Considering these efforts of RBI, present study is an effort toward estimation of degree of sterilization and impact of this sterilization on autonomy of RBI.

Graph 2: Impact of this sterilization on autonomy of RBI.



Source: RBI

Objectives of Study:

1) To determine monetary policy autonomy while controlling money supply in the light of foreign exchange inflows. This objective is attained by estimating offset coefficient.

2) To determine impact on each of the endogenous variable with respect to other variables in the model using impulse response functions.

Database and Methodology:

In order to fulfil the objectives of present study monthly data from May1993 to Dec. 2005 on Net Foreign Exchange Assets of RBI, Net Domestic assets, month end exchange rate of Indian rupee, index for industrial production and wholesale price index is taken from Reserve Bank of India's publication on handbook of statistics on Indian economy. Thus, data consists of 153 monthly observations in each of these series, large enough to allow for application of sophisticated econometric techniques.

To prevent currency appreciation due to huge capital inflows, central bank makes foreign currency purchases and the same are financed by sales of home currency. It results in exchange of foreign currency assets for domestic currency assets which in turn results in increase in monetary base. The impact of increase in monetary base is sterilized by the central bank by selling domestic currency denominated bonds to squeeze the initial rise in monetary base.

The extent of sterilization of monetary policy aimed at preventing rupee appreciation in terms of dollar and to control inflation can be econometrically estimated by using the following monetary policy reaction function:

$$NDA = \alpha + \beta \text{ NFEA} + \beta_1 \text{ WPI} + \beta_2 \text{ IIP} + \beta_3 \text{ MER} + \mu$$

This monetary policy reaction function consists of five endogenous variables, like

NDA: Net Domestic Assets- difference between reserve money and net foreign exchange assets of RBI

NFEA: Net Foreign Exchange Assets

WPI: Wholesale Price Index

IIP: Index for Industrial production

MER: Month End Exchange Rate of Indian Rupee

Besides these endogenous variables, monthly dummies have also been considered in the model as exogenous variables to account for the impact of seasonality in the data. The sterilization coefficient is determined using monthly data from May 1993 to Dec. 2005 by vector error correction model. Monetary policy is influenced by a number of factors i.e. both internal economic variables as well as external economic variables. Since, the main objective of the present study is to determine the impact of accumulation of net foreign exchange assets on net domestic assets of RBI. Thus, other variables considered in the monetary function such as IIP, WPI and MER are more relevant for determining impulse response function to understand the monetary policy dynamics as a result of open economic system following financial liberalisation. RBI's efforts with regard to sterilization of capital inflows and intervention in foreign exchange market are the major concerns consequent to capital account liberalization.

The empirical analysis based upon Vector Error Correction Model proceeds through following four steps:

Firstly, each endogenous variable is tested for stationarity applying unit root test on all the series to find out whether the series are stationary or non-stationary. Since most of the time series are non-stationary or not integrated of order zero, therefore these series have been checked for stationarity to avoid the spurious regression. For this purpose following types of Augmented Dickey Fuller (ADF) regression has been applied:

$$\Delta Y_t = \alpha_1 Y_{t-1} + \sum_{m=1}^n \beta_m \Delta Y_{t-m} + u_t \quad (1)$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{m=1}^n \beta_m \Delta Y_{t-m} + u_t \quad (2)$$

Where:

μ_t is white noise. The additional lagged terms have been included to ensure that errors are uncorrelated.

The following hypotheses have been tested by applying unit root test:

H_0 : Y_t is not I (0) [Y_t is not integrated of order zero].

H_1 : Y_t is I (0) [Y_t is integrated of order zero].

If the calculated ADF statistics insignificant then the null hypothesis (H_0) is accepted and the series are taken as non-stationary or not integrated of order zero. Hence, unit root exists. Alternatively, if the calculated ADF statistics are insignificant then the alternate hypothesis (H_1) is accepted and the series are taken as stationary or integrated of order zero. Hence, unit root does not exist.

Secondly, all the five endogenous variables are put to co-integration test applying Johansen's methodology (Johansen, 1991). Most of the time series are non-stationary but a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary series are said to be cointegrated. The stationary linear combination is called cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. The purpose of cointegration test is to determine whether a group of non-stationary series is cointegrated or not. Since unrestricted Vector Auto Regression (VAR) cannot be applied in case the non-stationary time series are cointegrated, the presence of cointegration relationship forms the basis of Vector Error Correction (VEC) specification, which is the alternative technique available to analyse causality relationship among, cointegrated variables (Johansen, 1991).

For this a VAR of 'p' order is considered and is specified as below:

$$Y_t = A_1 Y_{t-1} + \dots + A_p Y_{t-p} + X_t + e_t \quad (3)$$

Where Y_t is k vector of non-stationary I(1) variables, X_t is d vector of deterministic variables, and e_t is vector of innovations. This can be rewritten as

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \beta X_t + e_t \quad (4)$$

where:

$$\Pi = \sum_{i=1}^p A_i - I, \quad \Gamma_i = - \sum_{j=i+1}^p A_j$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist $k^* \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta'Y_t$ is $I(0)$. Where r is the number of cointegrating relations and each column of β is cointegrating vector. The elements α are known as adjustment parameters in the VEC model.

Thirdly, having determined number of co-integrating vectors in step second, VECM (Vector Error Correction Model) is estimated to determine offset (sterilization) coefficient and impact of each endogenous variable on net domestic assets. A vector error correction (VEC) model is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long run behaviour of endogenous variables to converge to their cointegrating relationships while allowing for short-term adjustment dynamics. The cointegration term is known as error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Here a simple case consisting of two variable system with one cointegrating equation and no lagged difference is stated as follow:

$$Y_{2,t} = \beta Y_{1,t} \quad (5)$$

The VEC model is specified as below:

$$\Delta Y_{1,t} = \alpha_1 (Y_{2,t-1} - \beta Y_{1,t-1}) + e_{1,t} \quad (6)$$

$$\Delta Y_{2,t} = \alpha_2 (Y_{2,t-1} - \beta Y_{1,t-1}) + e_{2,t} \quad (7)$$

In equations (6) and (7) only right-hand side variable is the error correction term. In the long run equilibrium, this term is zero. However, if Y_1 and Y_2 deviate from long-run equilibrium, the error correction term will be non-zero and each variable adjusts to partially restore the equilibrium relation. The coefficient α_i measures the speed of adjustment of i^{th} endogenous variable towards the equilibrium.

Fourthly, impulse response functions are derived to understand the operation of monetary policy under the influence of open economy dynamics as a result of capital account liberalization.

Results and Discussion:

Results of VEC Model consisting of above mentioned four steps are discussed below:

The results of Dickey-Fuller Tests for unit roots are presented in table 2. Table reveals that all the five variables i.e. NDA, NFEA, IIP, WPI and MER are non-stationary at levels. This implies the presence of unit root in all the variables. Then by considering the first differences of all the variables it was found that all the variables are significant at 5% critical value of ADF. Thus first differenced series indicate absence of unit root. Hence, it is clear that all the five variables are integrated of I (1) order.

Table – 2 Augment Dickey Fuller Unit Root Test

Series	ADF Values at levels	P-values	ADF values (1 st differenced)	P-values
NEFA	4.75	1.00	-9.47*	.0000
NDA	1.18	.99	-13.02*	.0000
IIP	1.47	.99	-2.7**	.007
WPI	.26	.97	-10.6*	.0000
MER	-1.4	.33	-11.9*	.000

Note: * indicates significant at 5% level of significance

Having found that order of integration is same for all the selected variables, the results of cointegration are determined and presented in table 3. Cointegrating vector consists of five

variables namely, NDA, NEFA, IIP, WPI and MER. Johansen's cointegration test determines the number of cointegrating vectors r , specified under null hypothesis (H_0) and alternate hypothesis (H_a). Comparing trace statistics and maximum eigen values with their corresponding 5% critical values, it is clear that number cointegrating vectors are 2. For instance, both max eigen values and trace statistics are higher than their corresponding 5% critical values when H_a is $r \geq 1$ and $r \geq 2$. But, the same are less than their corresponding 5% critical values when H_a is $r \geq 3$ and $r \geq 4$. Hence, it is concluded that number of cointegrating vectors are 2.

Table - 3 Johansen's Co-integration Test

H_0	H_a	Trace statistics	5% critical value of trace statistics	P-values	Max. Eigen Value	5 % critical value	P-values
$r=0$	$r \geq 1$	92.5*	69.81	.000	38.37*	33.87	.01
$r \leq 1$	$r \geq 2$	54.12*	47.85	.011	29.47*	27.58	.82
$r \leq 2$	$r \geq 3$	24.65	29.79	.174	12.92	21.13	.45
$r \leq 3$	$r \geq 4$	11.72	15.49	.170	8.97	14.26	.09

On the basis of the results of cointegration analysis, vector Error Correction model is estimated to calculate offset (sterilization) coefficient. This model also determines the nature of impact of NFEA, IIP, WPI and MER on NDA. There are various concerns that need to be given due attention preceding the application of VECM model such as (a) chosen lag length must ensure white noise residuals. In the study chosen lag length is 12 on the basis of Akaike's Information Criteria (AIC) to ensure whiteness of residuals (b) other concern is regarding drift term and trend generating process of underlying data. The assumption with regard to this second concern is no deterministic trend in underlying data generating process. Both of these assumptions with regard to VEC model are specified in Johansen's co-integration test and vector error correction model. The number of cointegrating vectors as determined under cointegration test is incorporated in VAR. Thus, the results of Vector Error Correction Model (VECM) are:

$$\text{NDA} = -2411.64 - .66 \text{NFEA} - 653 \text{IIP} + 1771.31 \text{WPI} + 4334.46 \text{MER}$$

$$(-.22) \quad (-2.9) \quad (-.62) \quad (1.21) \quad (2.13)$$

$$r^2 = .74 \quad \text{Adjusted } r^2 = .37$$

*The values in brackets are corresponding t-values.

The results of VEC model indicate that sterilization coefficient β is $-.66$, which has anticipated sign and is highly significant. Sterilization is complete when offset coefficient is -1 and thus autonomy of RBI's credit policy is zero. When sterilization coefficient is zero, RBI's credit policy is wholly independent. The results reveal that during the period of study RBI intervened in foreign exchange market and sterilized 66% of capital inflows by accumulating net foreign exchange assets. Thus, the expansionary impact of capital inflows is only partially and not fully sterilized. Results further imply that with increase of Rs. 100 in NFEA, RBI offsets NDA worth Rs. 66 from domestic credit system. This is done by purchase of foreign currency of Rs. 100 by selling government securities worth Rs. 66. This process has an impact domestic inflation and rupee appreciation subsequent to capital inflows.

The coefficient of index for industrial production is of opposite sign to that anticipated one and also insignificant. Hence, index for industrial production has been excluded for the purpose of further analysis. But the coefficient of WPI is positive which is having anticipated sign and but is insignificant. The exchange rate coefficient is also positive and significant indicating that depreciation in rupee value leads to increase in NDA. Alternatively, increase in exchange rate (depreciation of rupee) leads to fall in NFEA, which reflects market sales of foreign currency. Sale of foreign currency has expansionary impact via increase in NDA.

Further if impulse response analysis of exchange rate is considered it reflects that increase in NDA offsets fall in NFEA and vice-versa. Thus, it is clear from the results of vector error correction model that RBI aggressively intervenes in foreign exchange market to control volatility in exchange rate of Indian rupee in terms of dollar. This intervention of RBI to

offset the expansionary impact of capital inflows on domestic credit policy is pursued to attain the macro economic objectives of domestic credit policy. But the results imply that domestic credit policy of RBI is neither fully sterilized nor fully independent. The degree of sterilization (-.66) i.e. 66% is more than the autonomy enjoyed for attainment of macro economic objectives under credit policy of RBI.

Dynamics of domestic credit policy of RBI are further analysed by means of Impulse Response Function, which is based upon one-unit positive shock for response of NDA to NEFA is presented below in table 4. The trend of response of NDA to NFEA and presented in table 4 further supports that RBI's credit policy is not completely independent but is sterilized one. Also, it is partially sterilized with generally high degree of sterilization of more than .60. The degree of sterilization reaches its peak only in eleventh month when it is fully sterilized (i.e., closer to -1). But in the long-run it remains partially sterilized (i.e., degree of sterilization less than -1).

Table 4: Impulse Response Function- NDA to NEFA

Months	Response
1	-.64
2	-.72
3	-.87
5	-.93
8	-1.01
11	-1.04
14	.51
16	.66
18	-.91
22	-1.06
24	-.81

The results of VECM can be used to analyze the impact of shocks to its endogenous variables on other variables in the system using impulse response function analysis. Impulse Response function when considered graphically indicates following reaction:

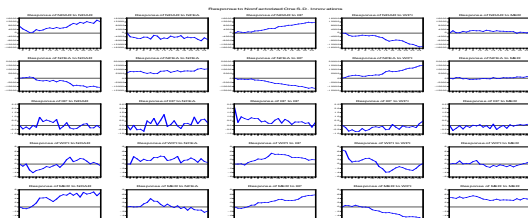
I Response of Net Domestic Assets to Net Foreign Assets: The graph indicates that a positive shock (increase) to net domestic assets has immediate policy reaction since the trend line of Response of Net Domestic Assets to Net Foreign Assets is declining one. This implies that increase in net foreign assets result in a fall in net domestic assets.

II Response of Net Foreign Assets to Net Domestic Assets: Here, also the trend line is moving in downward direction subsequent to a positive shock to net domestic assets. This implies that an increase in net domestic assets is followed by corresponding decline in net foreign assets.

III Response of Net Foreign Assets to Exchange Rate: The trend line here also falls subsequent to a positive shock to exchange rate (increase in exchange rate which can other way be called as depreciation of rupee). It implies that depreciation of rupee leads to fall in net foreign assets reflecting sale of foreign currency assets.

IV Response of Net Domestic Assets to Exchange Rate: Here, the trend is rising one indicating that an increase in exchange rate (depreciation of rupee) is followed by increase in net domestic assets. This reflects initial stage of sterilization to prevent appreciation of rupee. Sterilisation firstly leads to inflationary impact due to increase in domestic assets resulting from sale of foreign currency. Then RBI sells government securities or indulges in open market operations to squeeze the rise in domestic assets and thus controlling inflation. Following graphs represent the one standard deviation innovation impulse response function of each of the endogenous variable with respect to one another:

Graph 3: one standard deviation innovation impulse response function



Conclusion

The results of VECM estimated over a period of May 1993 to Dec., 2005 indicate that in response to large foreign exchange inflows, RBI intervened in foreign exchange market to prevent appreciation of rupee and simultaneously tried to control the monetary effects of such intervention through sterilization. The sterilization coefficient (β -.66), which has anticipated sign and is highly significant. This indicates that during the period of study RBI intervened in foreign exchange market and sterilized 66% of capital inflows by accumulating net foreign exchange assets of RBI. Thus, expansionary impact of capital inflows is only partially sterilized and not fully sterilized. The impulse response function further explains the dynamics of RBI's credit policy in the light of its sterilization efforts indicating the impact of shocks to its endogenous variables upon other variables in the VECM model. A positive shock to net domestic assets is followed by corresponding decline in net foreign assets. Similarly, a positive shock to exchange rate (depreciation of rupee) is followed by increase in net domestic assets. The positive shock to exchange rate of Indian rupee (depreciation of rupee) leads to fall in net foreign assets reflecting sale of foreign currency assets. The results of both VECM model as well as impulse responses indicate that RBI intervenes in exchange rate determination of rupee by selling or buying the foreign currency to fill the temporary demand-supply gaps. The sterilization coefficient indicates that RBI's credit policy is only partially sterilised and fails to control inflationary impact of capital inflows in the long-run.

This explains that in response to increase in net domestic assets initially due to increase in exchange rate is in turn offset by increase in net foreign exchange assets of RBI subsequently. This is achieved by selling government securities or indulging in open market operations. Thus, it is concluded that eventually growth of foreign exchange inflows has an impact on domestic credit and credit policy is driven by the objective of preventing exchange rate appreciation than its objective to control inflation. As a result of these sterilization measures, the competitive strength of Indian industry is also likely to have a set back since these sterilization measures result in

cutting down the various traditional lines of credit available to real sector which is the major domestic agent of RBI.

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