

# Demand for Money in Dollarized, In-transition Economy: The Case of Vietnam

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## Outline

- Introduction
- Theoretical and Empirical Framework
- Models and Analyses
- Conclusions

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# Introduction

- **Simple Correlation between Growth rate of M2 and Inflation** (Quarterly data)

	M2
1/93-4/04	0.609
3/97-4/04	-0.438

- **Puzzle:** the growth rate of broad money was negatively correlated with inflation

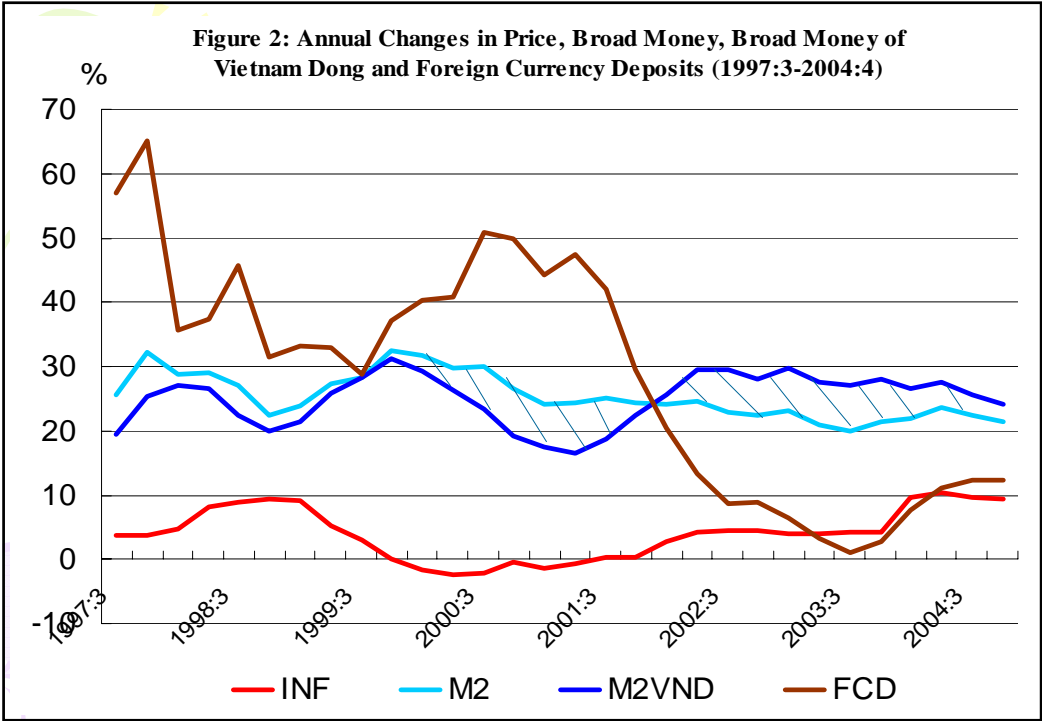
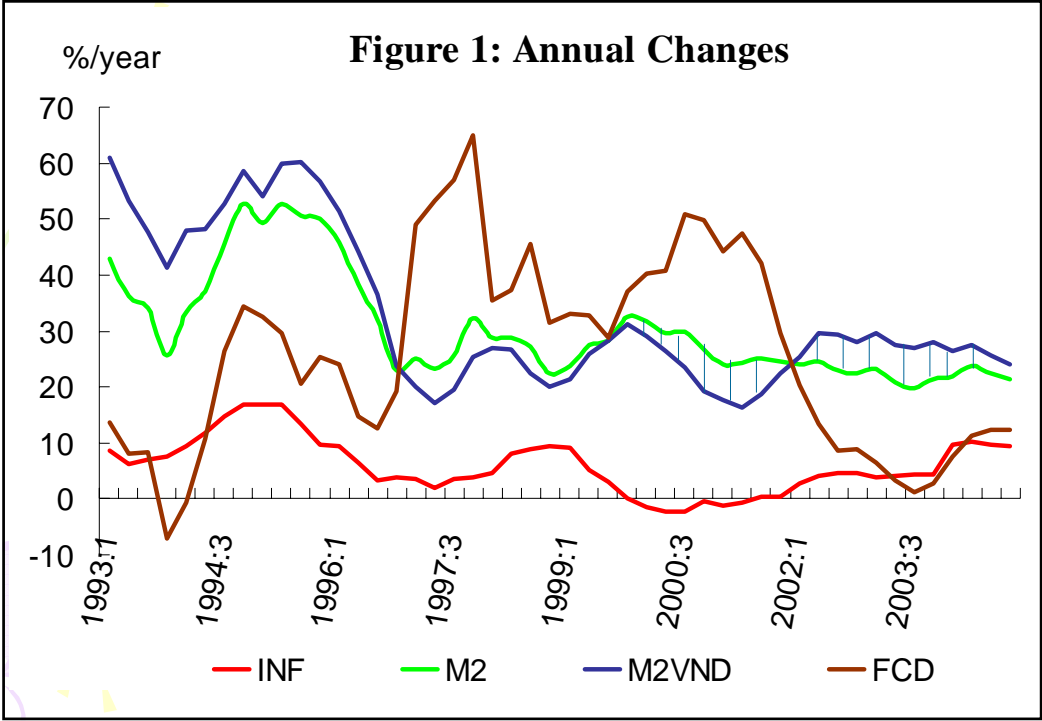
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- **Simple Correlation: Growth rate of Broad Money and Inflation**

		M2	M2VND	FCD
1/93-4/04	Inflation	0.609	0.693	-0.321
3/97-4/04	Inflation	-0.439	0.154	-0.438

- **Puzzle:**  
However, M2VND is positively correlated with inflation.

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## Simple Correlation: Growth rate of Broad Money and Inflation

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**Puzzle:** However, M2VND is positively correlated with inflation.

The negative correlation between M2 and inflation is caused by the negative correlation between FCD and inflation

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## Introduction (cont)

- Monetary policy still lack money demand model, what is a key tool to use money supply for controlling inflation.
- In view that Vietnam is highly dollarized, the above observations indicate that, in order to solve the puzzle, we should look at M2 components: M2VND & FCD, instead of looking at M2 as a whole.
- Only a few researches about money demand in highly dollarized economies.
- However, there is no empirical research generating the money demand model by taking fully into account the dollarization situation in financial system in Vietnam.

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## Introduction (cont)

- Objective:
  - Aims to estimate the money demand function of Vietnam and studies the characteristics of the economy.
  - Arising from the puzzle of negative correlation between growth rate of broad money and inflation, the paper develops and estimates the money demand model by formulating demand for real M2VND and demand for real FCD.
  - Conducts some analyses to research empirically the economy.
- Quarterly data from 1993:1-2004:4.
- Cointegration, error correction model, impulse response and variance decomposition.

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## II. Theoretical and Empirical Framework

- Many tried to theorize and empirical research the money demand: Fisher, Pigou, Keynes, Tobin, Friedmand
- Money as a part among a portfolio of assets including money with other financial and real assets. the standard money demand equation:

- $$\frac{M}{P} = f(S, OC)$$

M/P: Real money

Y/P: real economic activities

OC: opportunity cost of holding money.

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## II. Theoretical and Empirical Framework (cont)

- In highly dollarized economies: Branson and Henderson (1985) shows that it is necessary to separate broad money into domestic and foreign money :

$$m = f(y^+, i^+, p^-, i^*, \Delta e^-)$$

$$m^* = f(y^+, i^-, p^+, i^*, \Delta e^+)$$

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## General Empirical Research about Money Demand

- A large stream of empirical researches have been dedicated to demand for money, especially in developed countries.
- One important factor fuelling the empirical researches on money demand is big advancements in time series analysis in the past decade.
- To get the meaningful results, the two most important points in modeling demand for money:
  - i) Framework of model: both cointegration and error correction model proved to be useful tools in money demand research

Cointegration popularly to capture the long run equilibrium  
Error-correction model reflect the short run dynamic of money demand

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## ii) Selection and representation of variables.

- Money: M0, M1, M2, M3 or broader monetary aggregates or components of theirs;
- Economic transactions: GDP, GNP or Industrial Index
- Opportunity costs: most important factor in getting meaningful results
  - Own rate of money: M0, M1: zero; and broad money: short term deposit interest rate.
  - Substituted assets to money:
    - Domestic financial assets: government bonds, bills,
    - Foreign financial assets: interest rates of FCD or expected rate of depreciation
    - Real assets: inflation

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## Empirical Research about Money Demand in Dollarized Economy

- Dollarization is a situation where one or some foreign currencies serves one or more functions of domestic currency (medium of exchange, accounting and store of value).
- Currency substitution is the situation where foreign currency is used only as means of payment .
- Asset substitution is situation where foreign currencies served as stores of value.

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## Empirical Research about Money Demand in Highly Dollarized Economy

- Rodriguez and Turner (2003) investigated the money demand in Mexico by cointegration technique:

$$\ln\left(\frac{M}{P}\right)_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 \ln i_t + \alpha_3 i_t^f + \alpha_4 \Delta e_t^e + \alpha_5 \pi_t^d + \alpha_6 \ln\left(\frac{M}{P}\right)_{t-1} + u_t$$

$$\ln\left(\frac{eM^*}{M}\right)_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 (i_t - \pi_t) + \alpha_3 (i_t^f - \pi_t^f) + \alpha_4 \Delta e_t^e + \alpha_5 \ln\left(\frac{eM^*}{M}\right)_{t-1} + u_t$$

$\pi^d$  : the difference between the inflation rates of the domestic and foreign economies.

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## Empirical Research about Money Demand in Highly Dollarized Economy

- Porqueras, Serrano and Somuano (1999) about 13 Latin America countries during 1990-1998:

$$\log\left(\frac{R_{it}}{1 - R_{it}}\right) = \log\left(\frac{m_{it}^f}{m_{it}^d}\right) = \gamma_0 + \gamma_1 \log(y_{it}) + \lambda_2 I_{it}^d + \lambda_3 E_{it} + \varepsilon_i$$

$m_t^f, m_t^d$  are real foreign (domestic) money

$E_{it}$  is the exchange rate depreciation

$I_{it}^d$  is interest rate of domestic deposits;

$y_t$  is real national output

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- Aarle Van Bas and Budina Nina (1995) investigated the money demand in six transitional economies in Eastern Europe during 1986-1994 (quickly reforms, huge shocks in price and sharp increase in dollarization):
- Following Cagan Model (hyperinflation):

$$\ln(m_t) = c + \delta D_t - \chi \pi^e + \gamma E^e + \eta D_t E^e + \varepsilon_t$$

$$\ln\left(\frac{e_t M_t^*}{P_t}\right) = \ln m_t^* = d + \chi D_t - \alpha \pi^{*e} + \delta E^e + \phi D_t E^e + \varepsilon_t$$

$D_t$  is the dummy variable representing the financial liberalization in transitional economies during 1990s.

$\pi^e$  is expected inflation rate

$E^e$  is expected rate of depreciation

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## Empirical Research about Money Demand in Highly Dollarized Economy

- Considering that Vietnam is highly dollarized, this paper investigates the money demand in Vietnam by separating the broad money into broad money of domestic currency and foreign currency deposits and estimate the money demand for each of these monetary aggregates.
- The explaining variables will be carefully chosen based on the analysis of financial operations in Vietnam.

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### III. Models and Analyses

$$RM2D_t = \ln\left(\frac{M2ofVND_t}{CPI_t} * 100\right) \quad RFCD_t = \ln\left(\frac{FCD_t}{CPI_t} * 100\right)$$

$$RGDP_t = \ln\left(\frac{NGDP_t}{GDPdeflator_t} * 100\right)$$

DEPO<sub>t</sub>: 6 month VND deposit nominal interest rate

$$INF\_A_t = (\ln CPI_t - \ln CPI_{t-1}) * 4$$

$RF_t = DEPOF_t + E_t^f$  rate of foreign returns = 6 month USD deposit nominal interest rate plus depreciation rate

$DIFFER_t = RF_t - DEPO_t$  differences between rates of returns of USD and VND deposits

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### III. Models and Analyses (cont)

$$RM2D_t = \beta_0 + \beta_1 RGDP_t + \beta_2 DEPO_t + \beta_3 INF\_A_t + \beta_4 RF_t + \varepsilon_t$$

(+)
(+)
(-)
(-)

$$RFCD_t = \gamma_0 + \gamma_1 RGDP_t + \gamma_2 DIFFER_t + \varepsilon_t$$

(+)
(+)

- *Expected Signs:*

- RGDP: transaction effect (+)
- DEPO: own rate of return on money (+)
- INF\_A: substituted real asset (-)
- RF: substituted foreign financial assets (-)
- DIFFER: speculation between VND and USD (+)

- Quarterly data from 1993:1-2004:4

- data availability
- inflation is exceptionally high during 1991 and 1992

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## Unit Root Test

	Lags	ADF statistics	1 <sup>st</sup> Differences	Lags	ADF statistics
RM2D	1	-2.48	$\Delta$ RM2D	0	-3.36**
RFCD	1	-0.88	$\Delta$ RFCD	2	-2.98**
RGDP	0	-2.26	$\Delta$ RGDP	5	-1.45
			$\Delta\Delta$ RGDP	3	-5.87***
INF_A	3	-2.67	$\Delta$ INF_A	2	-3.37**
RF	1	-2.36	$\Delta$ RF	2	-4.29***
DEPO	1	-1.67	$\Delta$ DEPO	0	-5.19***
DIFFER	1	-2.55	$\Delta$ DIFFER	1	-6.69***

- (\*\*), (\*\*\*) : significant at 5%, and 1% levels
- Tests use lags length from 1 to 10. The reported result is chosen with minimum AIC or Schwarz criterion.
- All are I(1), except RGDP is I(2) (48 observations). However a general knowledge is that GDP should be I(1). Based on general knowledge to<sub>22</sub> consider RGDP as I(1).

## Cointegration Test

- If a linear combination of some non-stationary data series is stationary, it is called cointegrated.
- considered as long-run equilibrium relationship among the variables.
- Tests begins with eight lags and repeated by reducing consecutively one lag at a time until the lag length reaches one.
- Data are seasonally adjusted: no seasonal dummy
- A dummy variable in RFCD equation to reflect the strong VND depreciation during Asian crises.

DUM=1 during 1997:1-2 and 1997:4-1998:4

DUM=0 for the others.

# Cointegration Test

Equation	Ho	Trace Statistics					Maximum Eigenvalue				
		r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
	HA	r ≥ 1	r ≥ 2	r ≥ 3	r ≥ 4	r ≥ 5	r ≥ 1	r ≥ 2	r ≥ 3	r ≥ 4	r ≥ 5
RM2D		<b>76.51*</b>	46.27	17.67	6.27	0.16	30.23	<b>28.59*</b>	11.39	6.12	0.15
RFCD		<b>48.7**</b>	5.55	0.014			<b>43.2**</b>	5.54	0.014		
5% Critical Value											
RM2D		<b>69.81</b>	47.85	29.79	15.49	3.84	33.87	<b>27.58</b>	21.13	14.26	3.84
RFCD		<b>29.79</b>	15.49	3.84			<b>21.13</b>	14.26	3.84		
Probability (%)											
RM2D		<b>1.32</b>	6.98	59	66.26	69.2	12.79	<b>3.7</b>	60.75	59.76	69.24
RFCD		<b>0.01</b>	74.7	90.34			<b>0</b>	67.22	90.34		

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# Cointegration Test

$$\text{RM2D} = 2.76 \cdot \text{RGDP} + 4.26 \cdot \text{DEPO} - 3.16 \cdot \text{INF\_A} - 1.94 \cdot \text{RF}$$

(8.5)                      (1.8)                      (-3.9)                      (-3.2)

$$\text{RFCD} = 1.876 \cdot \text{RGDP} + 18.502 \cdot \text{DIFFER}$$

(4.074)                      (7.890)

- High income elasticity: the economy is in the monetization process. ([China.doc](#))
- DEPO and INF have strong impacts on money demand.
- RF coefficient is lower than DEPO coefficient: domestic interest rate is still more important than rate of foreign return in determining demand for RM2D  
DEPO partly absorbed RF effect.
- Speculation effect (DIFFER) is strong: asset substitution is really a matter in Vietnam.

Strong VND depreciation shift VND deposits and real assets to USD, decreasing demands for goods and reducing inflation leading to a strong increase in RFCD.

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## Cointegration tests

- It is interesting to see that the long-term money demand is existing in Vietnam. Previously, it was well believed that it is difficult to find a model for long run demand for money in Vietnam.
- The cointegration tests identified only one cointegration for real broad money of domestic currency and one unique cointegration for foreign currency deposits.

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## Error Correction Model

- ECM provides information about how adjustment is taking place to restore the equilibrium in the long run money demand in response to the short run deviation.
- Based on the limited number of observations, the maximum number of lags should not exceed four.

Based on the minimum AIC, The number of lags in RM2D equation is chosen to be 4 and lags length in RFCD equation is chosen to be 1.

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## RM2D Error Correction Model

Variable	Coefficient	Standard Error	t-Statistic
C	0.0291	0.0072	3.994***
ECT(-1)	-0.0693	0.0129	-5.344***
RM2D(-1)	0.4642	0.094	4.934***
RM2D(-2)	0.5347	0.0947	5.643***
RM2D(-3)	-0.3179	0.1205	-2.637**
RM2D(-4)	-0.2383	0.0997	-2.390**
RGDP(-2)	0.9837	0.3189	3.084***
RGDP(-3)	-0.8447	0.3433	-2.459**
DEPO(-1)	1.1303	0.2158	5.236***
INF_A	-0.2228	0.0375	-5.940***
INF_A(-4)	0.125	0.0398	3.139***
RF	-0.0966	0.0447	-2.156**
RF(-4)	-0.0804	0.035	-2.294**

R2 = 0.876

Adjusted R2 = 0.826

DW = 1.765 28

(\*\*\*) and (\*\*) significant at the 1 and 5% levels.

## RM2D Error Correction Model

- ECT is negative and very significant (0.01% level), validating the long run relationship in the cointegration test.

The adjustment takes about 15 quarters. This result is in line with the traditional view that money is largely passive in socialist economies (Aarle and Budina, 1995).

- In short run, interest rate has the strongest effects on RM2D.

The coefficient of DEPO in short run model (1.13) is smaller than that in the long run model (4.261), thus reflecting lags in monetary transmission mechanism (needs some periods to pass the full effect of the increase in interest rate on to money demand).

## RFCD Error Correction Model

Variable	Coefficient	Standard Error	t-Statistic	Prob.
C	0.0266	0.007	3.775***	0.0005
ECT(-1)	-0.0147	0.0061	-2.381**	0.0219
DUM4	0.0636	0.018	3.530***	0.001
RFCD(-1)	0.425	0.1147	3.702***	0.0006
DIFFER(-1)	0.3654	0.1237	2.952***	0.0052

R2 = 0.575      Adjusted R2 = 0.534      DW = 1.736  
(\*\*\*) and (\*\*) significant at the 1 and 5% levels.

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## RFCD Error Correction Model

- ECT is negative and significant at 1% level, validating the long run relationship in the cointegration test.
- In short run, RGDP doesn't play an important role in determining demand for money.

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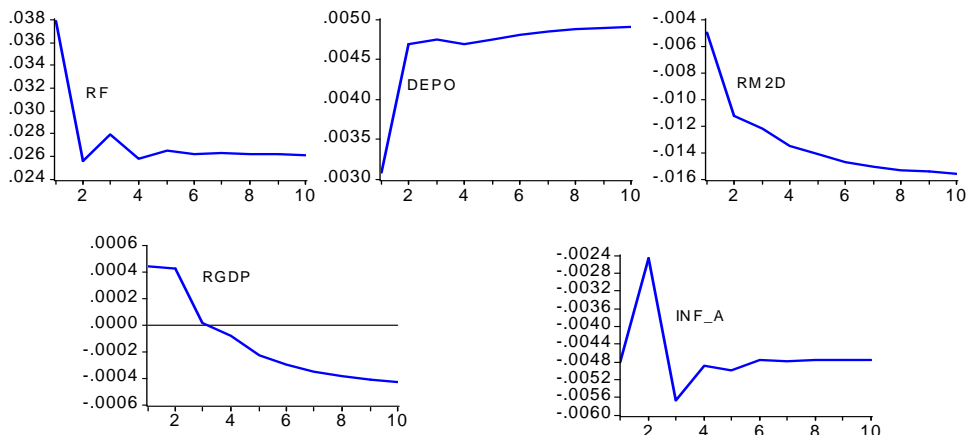
# Impulse Responses

- Impulse response maps the effects of a variable's shock on all variables in the vector error correction model.
- Based on standard macro economic theory, ordering: RF, DEPO, RM2D, RGDP, INF\_A

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- RF Innovation
- Domestic interest rate increases immediately around 0.47 points higher than its pre-shock level reflecting the uncovered interest rate parity

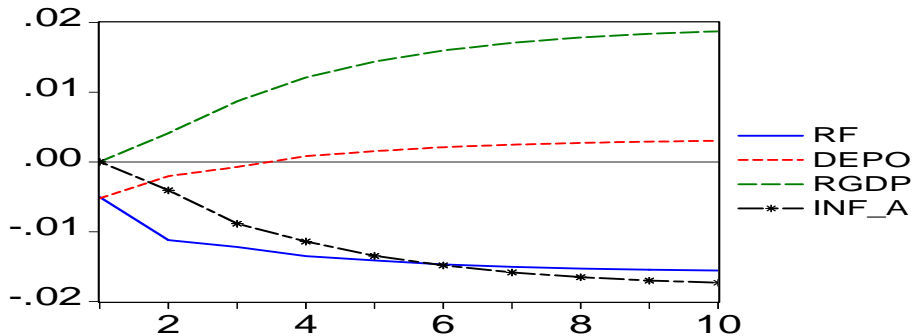
interest rate policy aims to keep a higher interest rate to prevent a currency flight to USD.





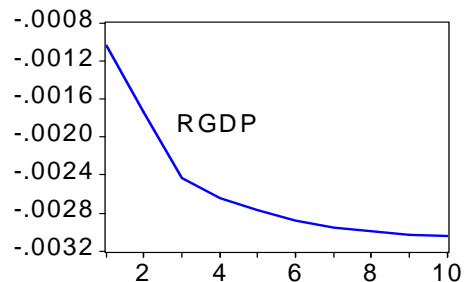
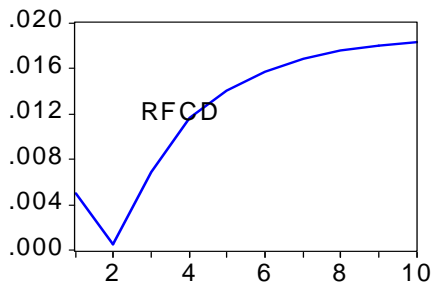
## Responses of RM2D to other Innovations

- RGDP shock leads to increase in RM2D
- Inflation and rate of foreign return influence on RM2D as strong as GDP does but in opposite direction.
- Increase in interest rate or a contractionary monetary policy cause the money aggregate to decrease but this effect lasts only around 3 quarters.



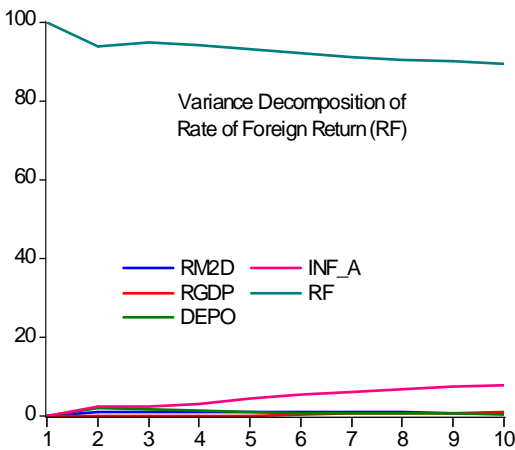
## Responses of RFCD and RGDP to DIFFER Innovation

- Order: DIFFER, RFCD, RGDP



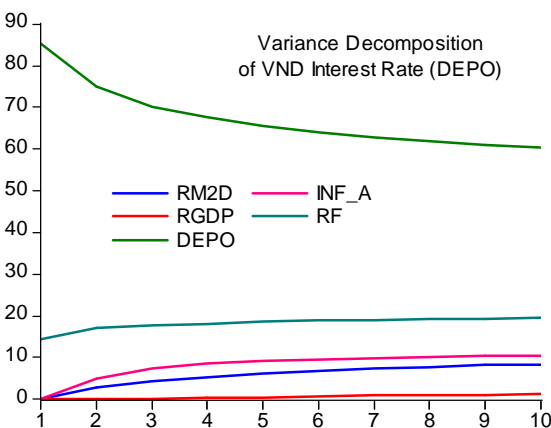
- RFCD at 2nd quarter: overshooting effect  
At the 3rd quarter, people will buy USD to protect money value as they are averse to the uncertainties in the future

# Variance Decomposition



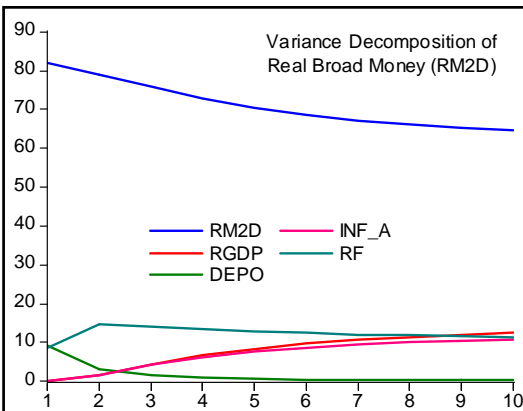
- Variance decomposition splits variance of forecast errors for one variable into contributions of shocks of other variables in VECM, thus stating how important each innovation is in effecting the variables in VECM.
- Most of variances of the forecast errors of RF are explained by shocks in itself.
- That can be explained by the fact that the exchange rate is strongly controlled by central bank, therefore interest rate, output, money demand has small role in influencing exchange rate.
- However, inflation is still an important factor affecting exchange rate, partly reflecting the purchasing power parity.

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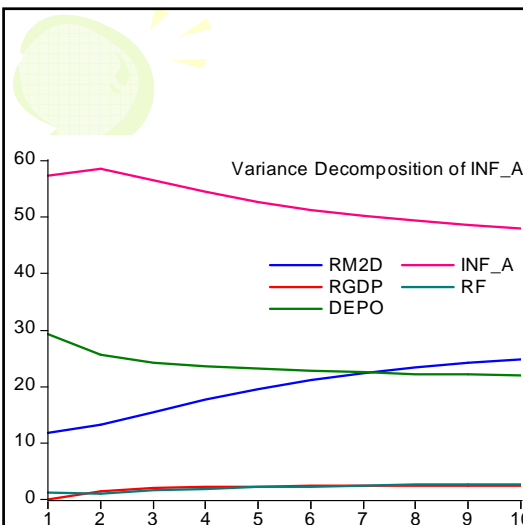
• GDP shock does not affect VND interest rate in short run as well as in longer periods.

- RF has very important effect on domestic rate in short run as well as long run.
- This partly reflects the uncovered interest parity condition. Offsetting RF shock is a very important mission of VND interest rate.
- Overall, the interest rate policy aims at offsetting the RF shock in short run. In a longer run, interest rate policy aims at maintaining exchange rate and price stability and shock from money demand.
- However, the weakness of interest policy is that it has no role in stabilizing output.

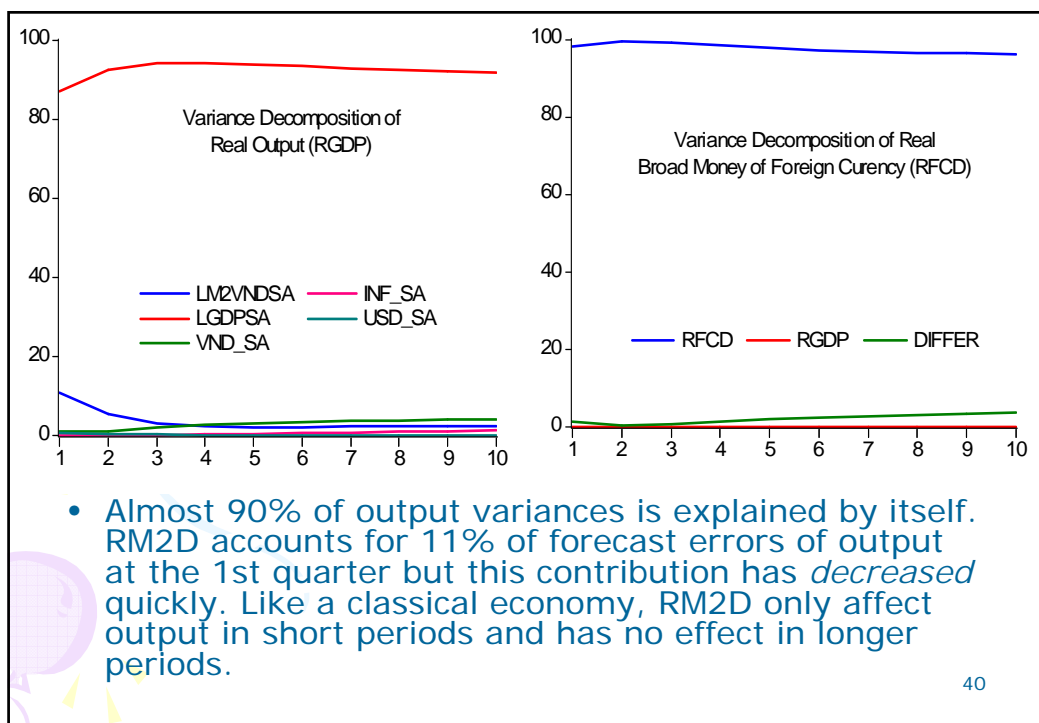


- Shock of VND interest rate only affects RM2D in short run. In long run, it has no considerable effects on RM2D

- RF shock plays the second most important attributes to the variance of RM2D and accounts for around 11.68-14.75% variance.
- This confirms RF innovation as the most important factor affecting RM2D variance, except RM2D shocks itself.
- From 6th quarters, each shock from RGDP, INF\_A and RF accounts for around 10% variances of forecast errors, showing the relative importance of these variable's innovations in affecting RMD2.



- At first quarter, around 29.4 and 11.8% of its variance come from shock of domestic rate and RM2D, respectively.
- After 10 quarters, the contribution of RM2D increases to 24.9%, while that of domestic rate decrease slightly to 22%.
- Monetary policy is responsible for up to 40-45% of the inflation variances.



## Conclusions

- In order to solve the puzzle of negative correlation between M2 and INF, the paper formulates demand for money by estimating demand for RM2D and RFCD
- A number of interesting and very useful analyses of Vietnam economy are also found.
- The semi elasticity of DIFFER is very large, implicating asset substitution is a really matter in Vietnam financial system.
- The income elasticity in both models is around two, explained by the fact that Vietnam is in the monetization process.
- The short run model evidenced that output has no role in determining demand for RFCD in short run.

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## Conclusions (cont)

- Impulse response shows that an unanticipated shock of RF increases VND interest rate (uncover interest parity condition).
- Variance decomposition affirms that the interest rate policy aims at offsetting the shock from RF in the short run.

In the long run, the policy targets maintaining exchange rate and controlling price.

However, the weakness of interest policy is that it has no role in stabilizing output, this can be due to the rigid interest rate policy of central bank.

- Interest rate, output, RM2D has no role in influencing exchange rate. Inflation is the only important factor affecting exchange rate, reflecting the purchasing power parity.

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## Conclusions (cont)

- Output is affected considerably by RM2D only in the first two quarters and this effect will be decreased after that.

The monetary policy has very significant role in controlling inflation, suggesting the current target of monetary policy in Vietnam of stimulating economic growth by a long-lasting expansionary monetary policy seems to be improper.

- Important meaning to Vietnam. The results may help to improve the effectiveness of monetary policy by applying financial programming to control inflation better.
- Realizes the possibility of setting up econometric models to use in analyze Vietnam economy.

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**Thank You!!!**