

**BALANCING A PARSIMONIOUS AND COMPLEX MODEL  
IN EMERGING MARKET ECONOMIES:  
CASE OF INDONESIA  
(General Equilibrium Model of Bank Indonesia - GEMBI)**

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BANK INDONESIA**

# The increasing needs of DSGE in Emerging Market

Many central banks have increasingly been interested in DSGE model to guide their monetary policy formulation for some reasons :

- DSGE has strong micro-foundation → all economic agents maximize their objective function subject to their constraint.
- The behavior of economic agents is constructed on the basic of rational expectation → monetary policy formulation is influenced by expectation (forward looking)
- Endogenous policy rule in the DSGE model → some variables of monetary policy (interest rate) and fiscal policy (tax) are determined within the model.
- DSGE model is able to generate economic steady state in the long run owing to dynamic optimization principle of economic agents .

# Issues on DSGE Implementation in Emerging Market

- Market imperfection → price and wage rigidity, adjustment cost, financial market disintermediation and excess liquidity → model become more complicated
- The credibility of monetary and fiscal authorities are still weak → the standard model based on full credibility has to be adjusted.
- Free capital mobility does not fully exist in emerging market due to numerous types of exchange rate arrangements such as managed floating and fixed exchange rate system and some degree of capital control.
- Different economic structure → economic sector model become more relevant to capture the specific and dominant sector → the model has to more disaggregated.
- Statistical data required to estimated parameter in emerging market is less accurate, reliable and availability as compared to developed countries.
- Therefore the construction DSGE model in emerging market should consider the specific features of emerging market economies .

## Trade off between Parsimonious and Complex Model

- The bigger the scale of the model → the larger the number of parameters to be estimated, estimation is more complex.
- The bigger the scale of the model → transmission mechanism is more complex (black box).
- The bigger the scale of the model → more difficult to communicate the result to the policy makers.
- The bigger the scale of the model → more complicated model → the result often can not explain real world phenomena.

# Specific Features of Indonesia DSGE Model: GEMBI

## GEMBI has 6 economic agents:

- 1. Household** → Indonesian household is heterogeneous:
  - Life-time consumers (capitalist)
  - Hands-to-mouths consumers (non capitalist).
- 2. Firms:** → agriculture sector is very important in Indonesia
  - Economic sector : Finished goods non-agriculture producers and Agriculture producers
  - Production process : Finished good, intermediate producers, and Importers
- 3. Financial Institutions/Banks** → Indonesian Banks are not fully perfect competition → need adjustment/transaction cost.
- 4. Fiscal Authority**
  - Non Ricardian Model (current consumption consider budget deficit)
  - Government expenditure consider ratio debt to GDP maximum 60%
- 5. Monetary Authority:**
  - Endogenous policy rule Inflation forecast based output gap Taylor Rule
  - Stock of SBI (Central Bank Certificate) is endogenous to capture excess liquidity
- 6. Rest of the World (external sector)**
  - Uncovered interest rate parity is not fully hold (imperfect capital market)
  - Capital account, current account and foreign exchange reserve are endogenous.

# Emerging Market Imperfection

## Application in GEMBI model

### **IMPERFECTION OF ECONOMIC AGENTS (ADJUSTMENT COST)**

- The preference of all economic agent consider opportunity cost
- Type of adjustment cost:
  - Transaction costs (consumption activities) → cash vs non cash
  - Adjustment cost (investment activities) → time to build
  - Real cost function (bank activities) → cost to manage deposit and credit
- Objectives of adding adjustment cost:
  - Better short-run dynamics
  - Greater flexibility in controlling speed of adjustment
  - Consistent with long-run equilibrium

# Emerging Market Imperfection

## Application in GEMBI model

### **IMPERFECTION IN LABOR MARKET (WAGE RIGIDITY)**

- Labour market in Indonesia is not flexible (rigid) → the existence of wage rigidity → market clearing doesn't fully work.
- Rigidity in labour market can generate wage inflation that further explain the dynamics on labour market.
- Due to wage rigidity → we can have better short-run output and inflation dynamics.

# Emerging Market Imperfection

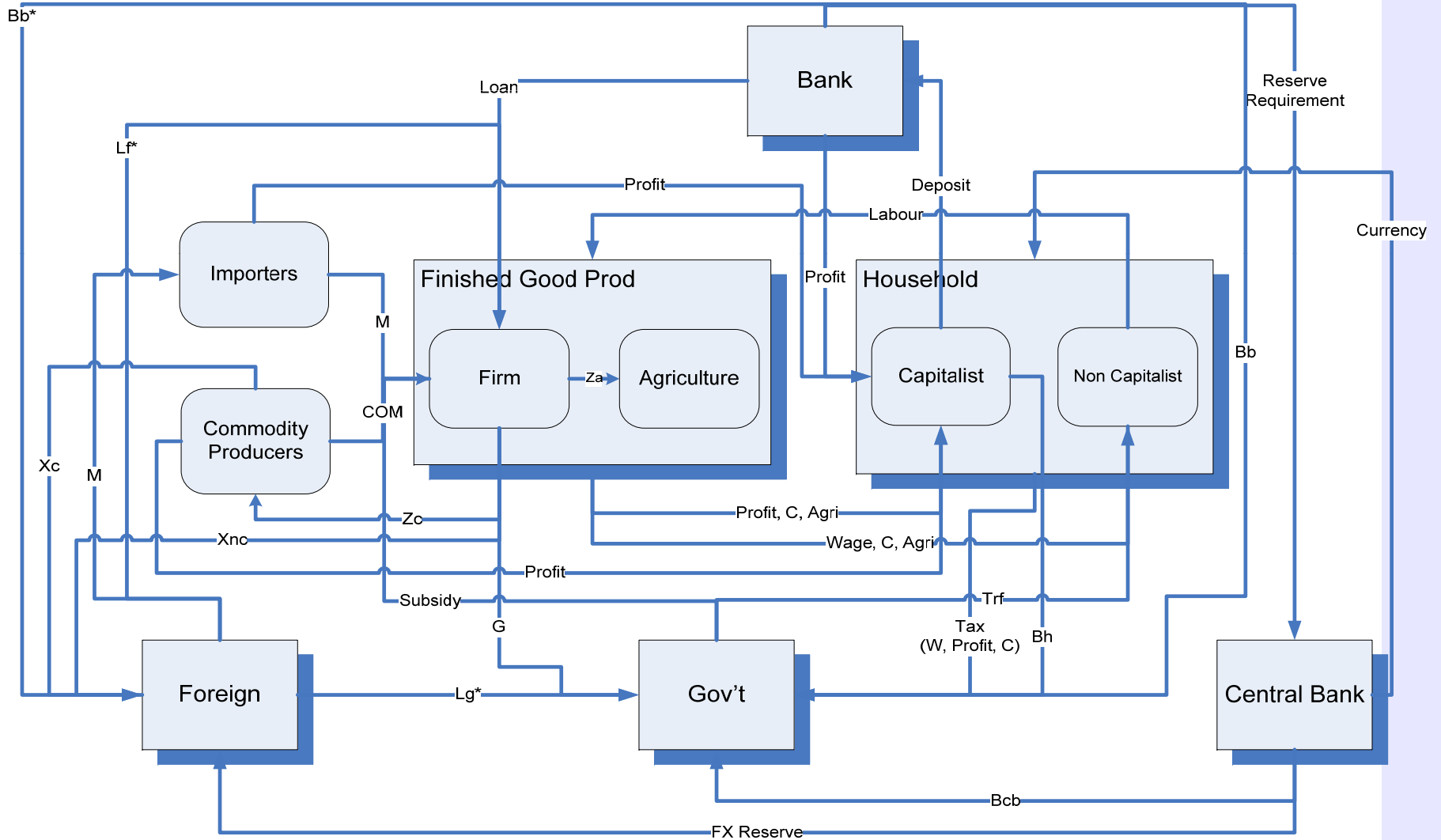
## Application in GEMBI model

### **IMPERFECTION IN EXTERNAL SECTOR**

1. Interest Parity is not sufficient to explain the dynamics of exchange rate in Indonesia → need to add risk premium variable in the model.
2. Interest Parity is not sufficient to explain the movement of capital flows → need to add cost of portfolio.



# INTERACTIONS AMONG ECONOMIC AGENTS IN COMPLEX GEMBI



# BANKS AS ONE ECONOMIC AGENT IN COMPLEX GEMBI

Banks maximizes profit with respect to its asset and liabilities

$$\text{Max } E_t \sum_{s=t}^{\infty} \beta_{t,s} \Pi_{i,s}^B$$

Constraint (Bonds, Deposit and Loans)

$$\begin{aligned} \Pi_t^B + B_{B,t} + Sbi_t + e_t B_{B,t}^* + Loan_t - (1 - \alpha_B - \alpha_R) D_t &= (1 + i_{t-1}) B_{B,t-1} + (1 + i_{t-1}) Sbi_{t-1} \\ &+ (1 + i_{t-1}^*)(1 + \theta_{t-1}^*) e_t B_{B,t-1}^* + (1 + i_{t-1}) Loan_{t-1} - (1 - \alpha_B - \alpha_R + i_{dt-1}) D_{t-1} - P_t A_t C^B(Loan_t, D_t) \end{aligned}$$

Where  $C^B(Loan_t, D_t)$  is the cost of portfolio adjustment,

$$C^B(Loan_t, D_t) = \frac{1}{2} \left( \frac{\Omega_L Loan_t - \Omega_D D_t}{P_t A_t} \right)^2$$

# FISCAL AND MONETARY AUTHORITY IN COMPLEX GEMBI

- Constraint for Fiscal Authority (transfer, subsidy, and foreign debt)

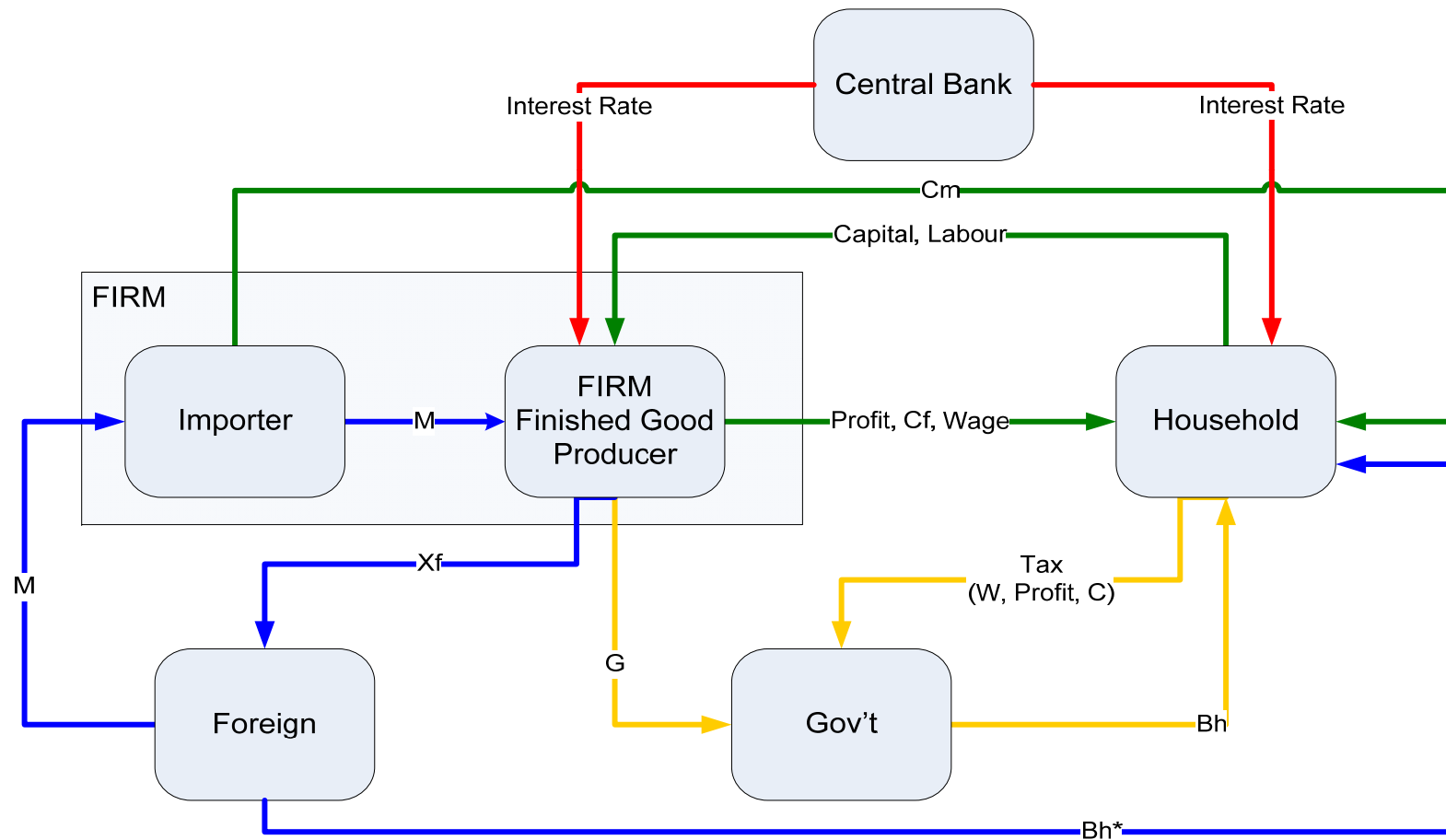
$$B_{G,t} + e_t L_{G,t}^* = P_t G_t + s_t^c P_{COM,t} COM_t^d + Trf_t + (1 + i_{t-1}) B_{G,t-1} \\ + (1 + i_{t-1}^*)(1 + \theta_{t-1}^*) e_t L_{G,t-1}^* - \tau_c P_t^C C_t - \tau_w W_t L_t - \tau_\Pi \Pi_t$$

- Constraint for Central Bank ( Currency, Reserves and outstanding SBI)

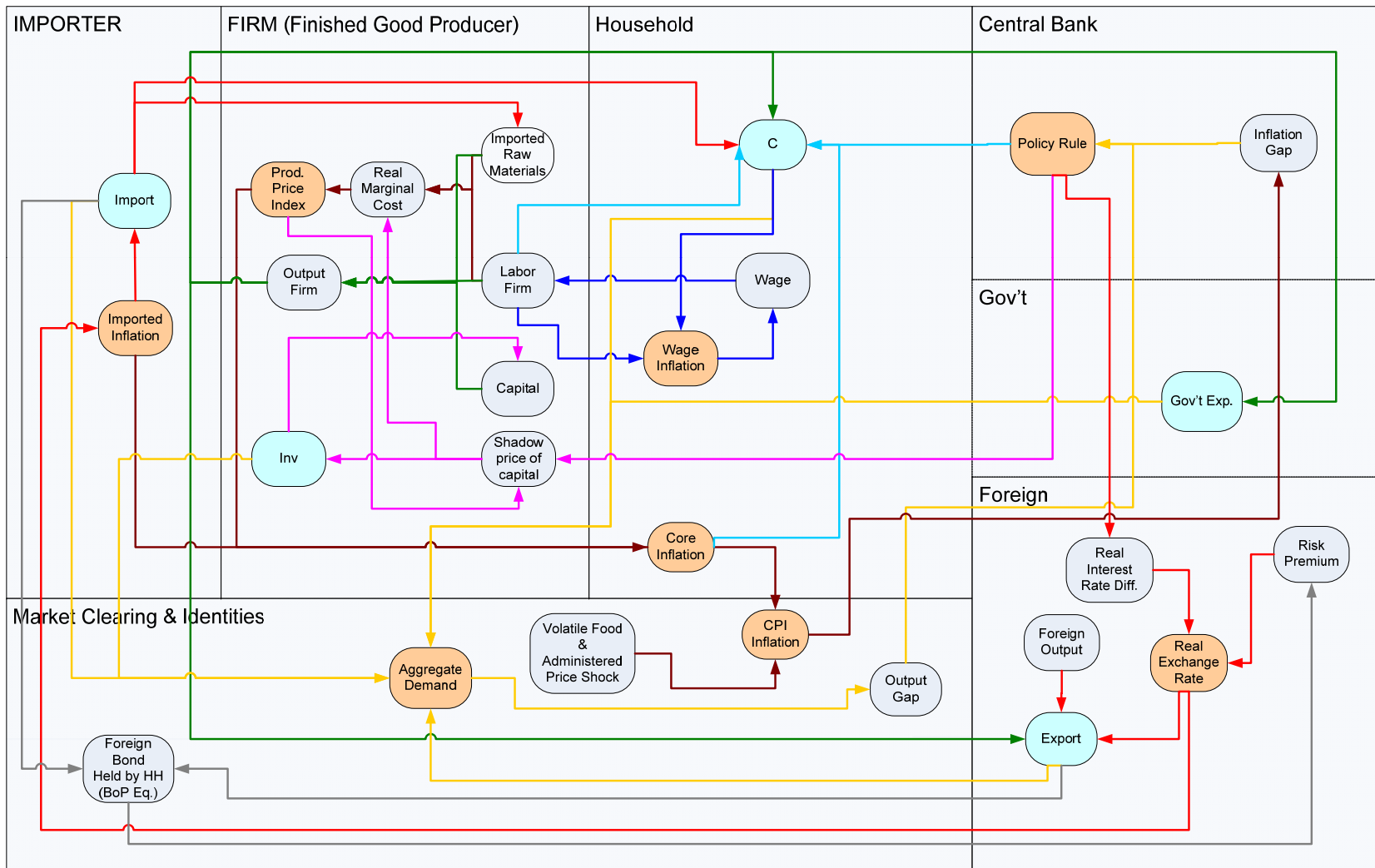
$$X_t - X_{t-1} = B_{CB,t} - (1 + i_{t-1}) B_{CB,t-1} + e_t R_t^* - (1 + i_{t-1}^*) e_t R_{t-1}^* - Sbi_t + (1 + i_{t-1}) Sbi_{t-1} - \alpha_R (D_t - D_{t-1})$$

# Need for more parsimonious model?

Need for a simplified version, thus SIMPLE GEMBI



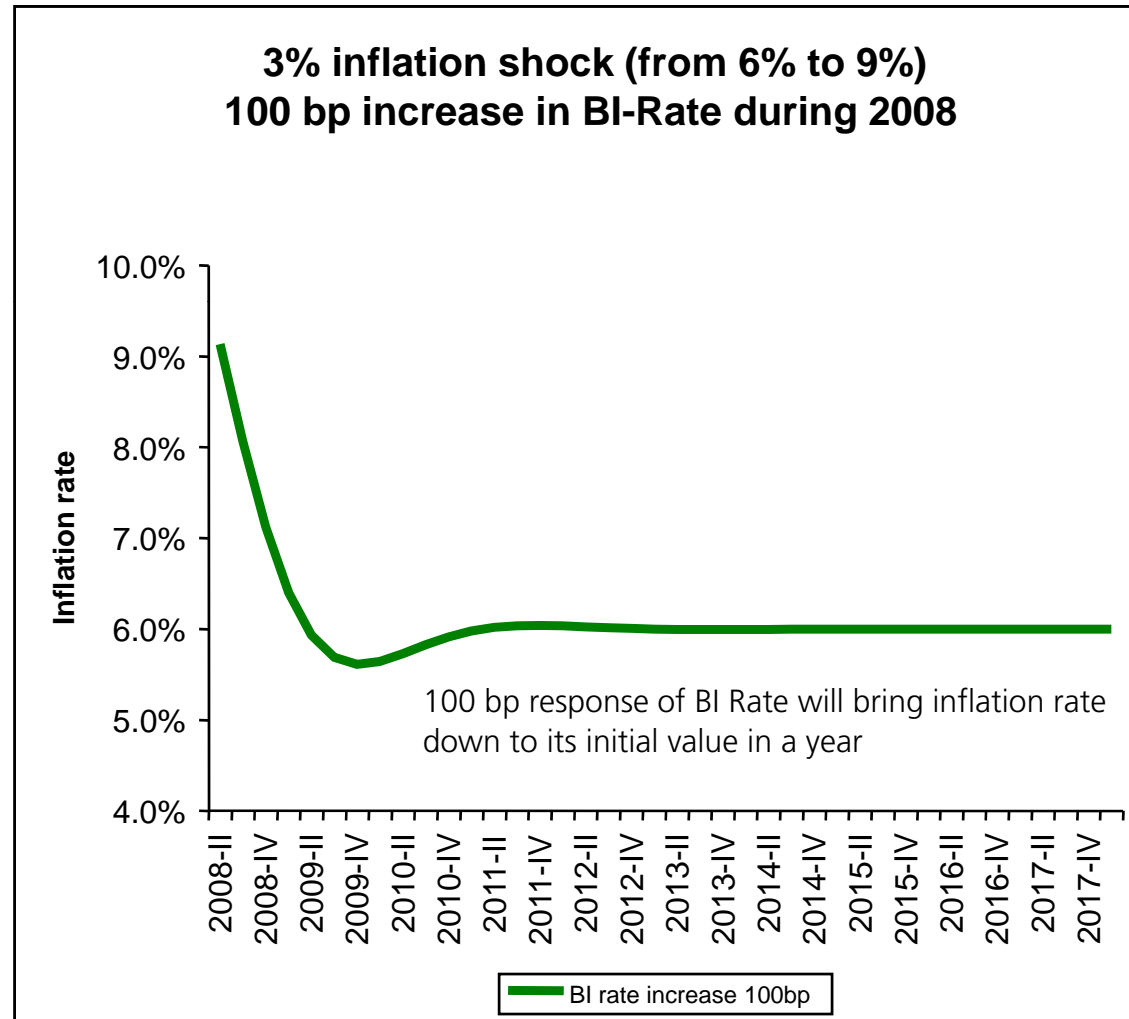
# Transmission Mechanism of simple GEMBI



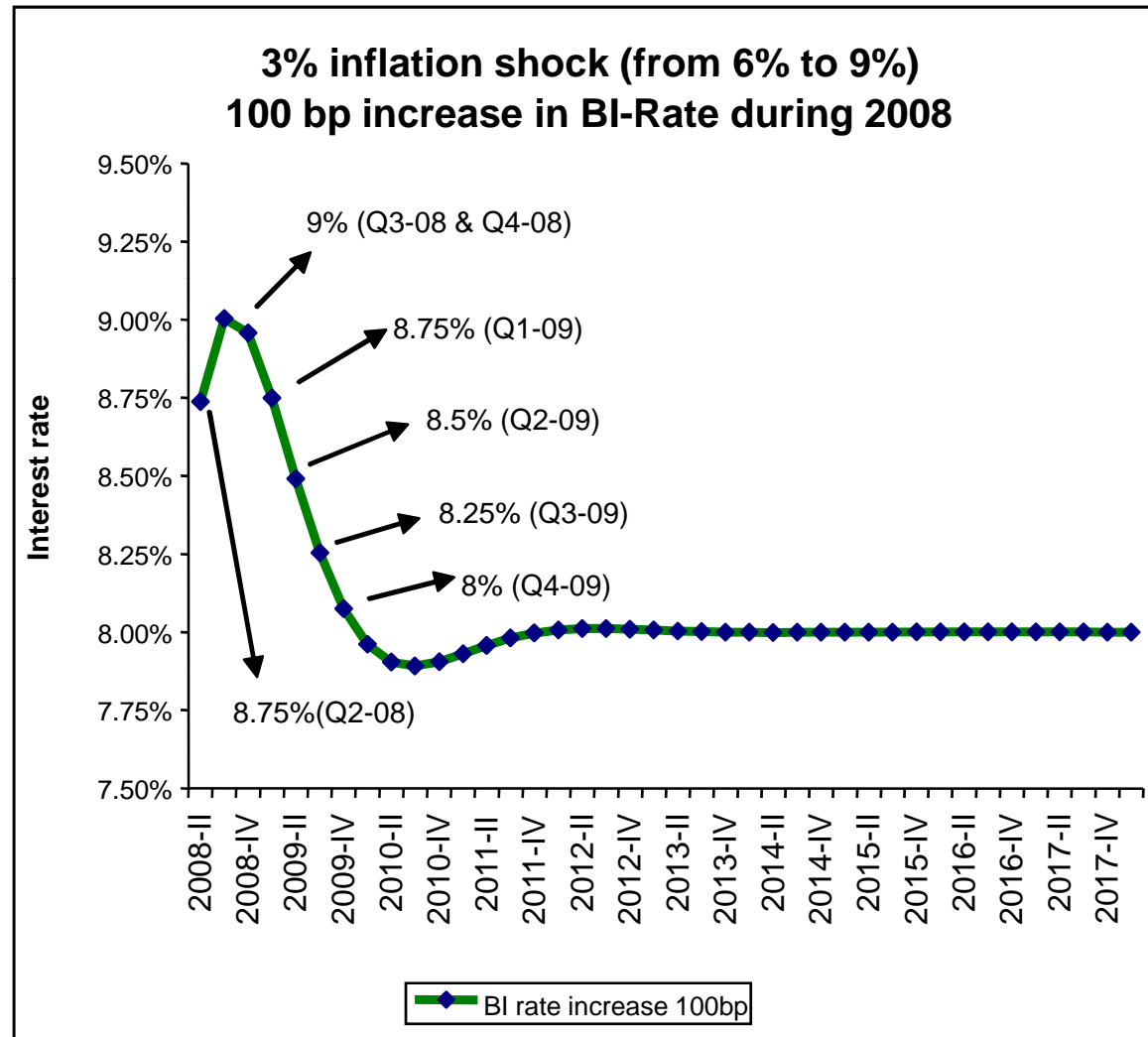
# GEMBI simulation for monetary policy : Imported Inflation Shock

1. Measuring monetary policy response to an inflation shock as well as its impact to economic growth and exchange rate.
2. Inflation shock is assumed 3% on top of its steady state value of 6%.
3. In this simulation, BI-rate is an endogenous variable as a function of inflation deviation from its target and output deviation from its potential value (Taylor rule).

# GEMBI simulation for monetary policy : Imported Inflation Shock

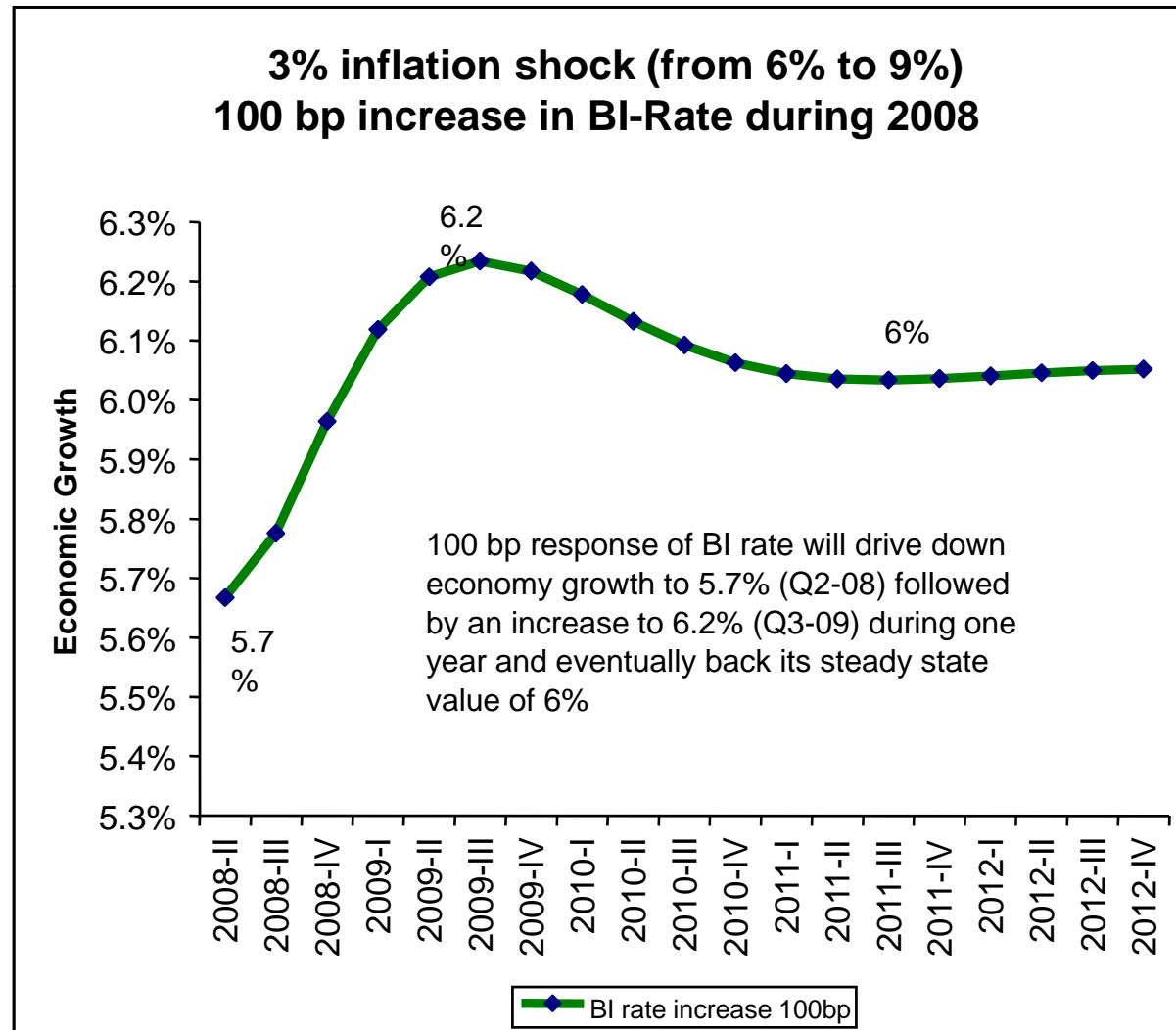


# GEMBI simulation for monetary policy : Imported Inflation Shock and interest rate response

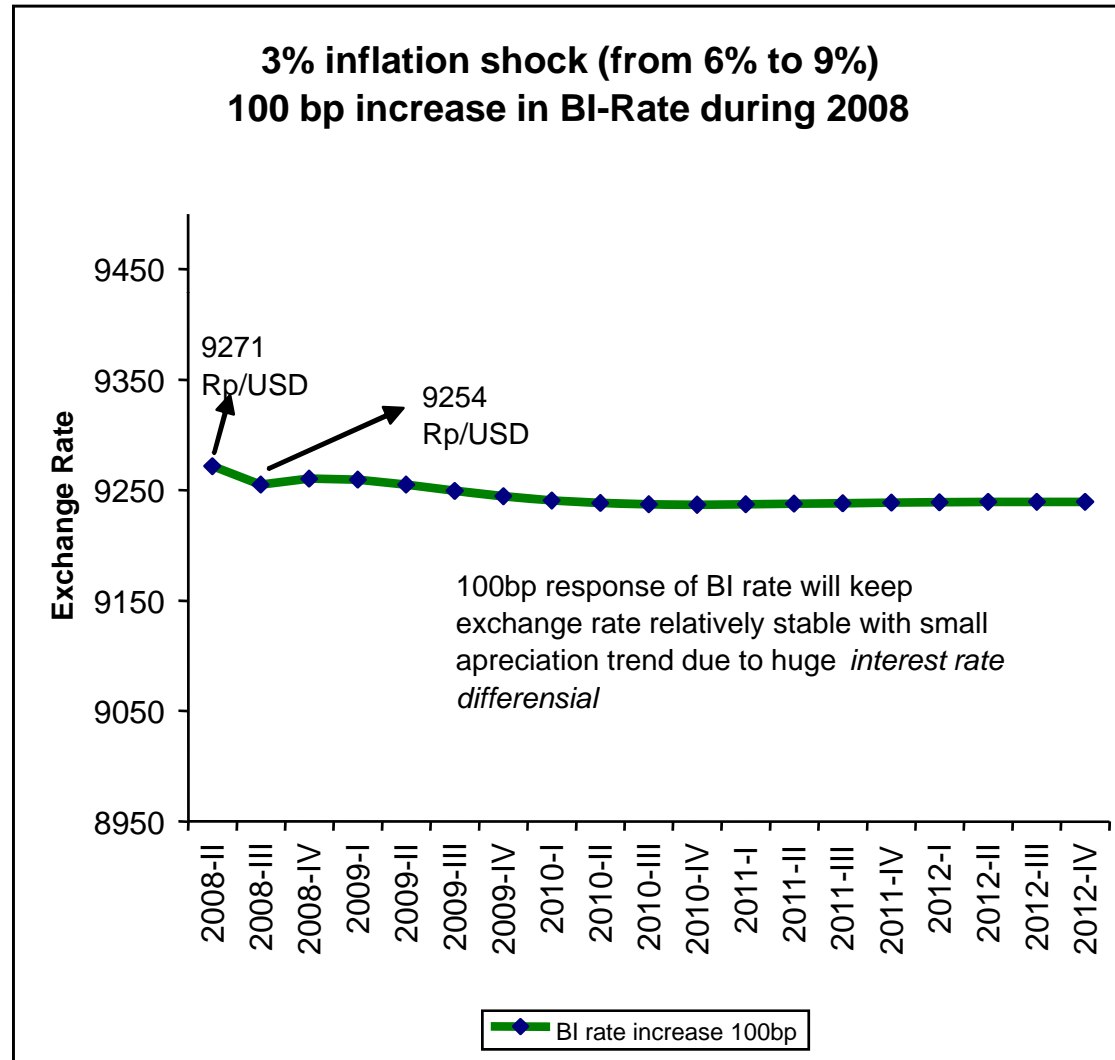




# GEMBI simulation for monetary policy : Imported Inflation Shock and impact on economic growth



# GEMBI simulation for monetary policy : Imported Inflation Shock and impact on exchange rate



# Conclusion

- Although we moved to simple GEMBI some emerging market features are still maintained (open economy, production stages, price and wage rigidity, and import dependant nature of economy)
- Simple GEMBI had been used to simulate monetary policy response for various shocks such as : exchange rate appreciation, imported inflation shock and review of medium term inflation target
- However, some problems are persist, such as :
  - Some theoretical-inconsistent simulation (need for TA)
  - Unsatisfactory forecast result (need for TA)
  - Communication to policy makers

THANK YOU  
TERIMA KASIH