Exchange Rate Fluctuations and Macroeconomic Conditions in Indonesia

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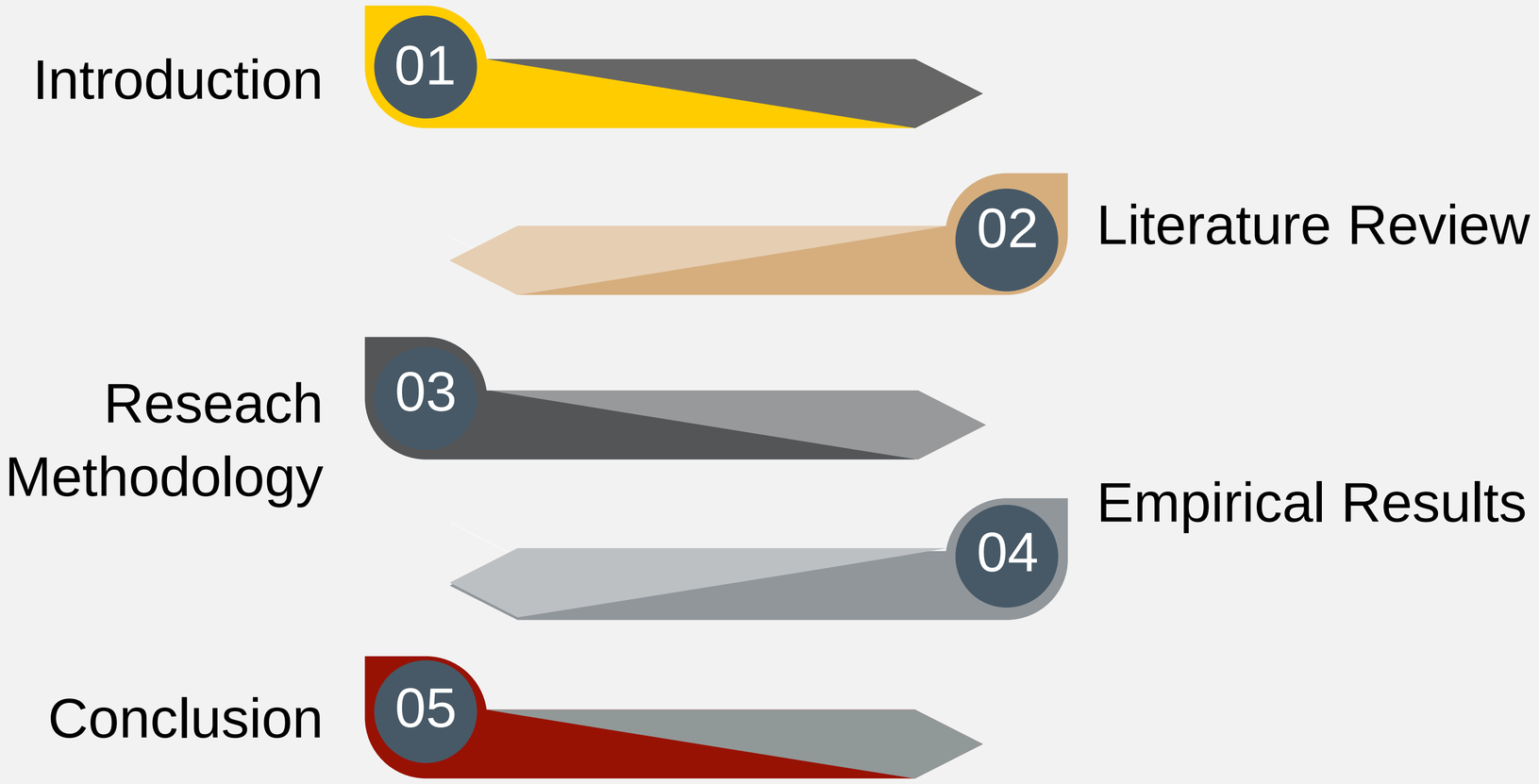
Agenda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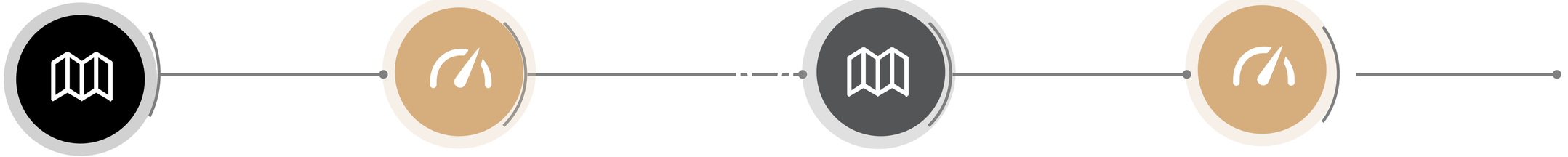
Introduction

“The 2007 global financial crisis sourced from the US and lately compounded by the trade war between the US and China have consequences for macroeconomic fluctuations in Indonesia”



2008

Indonesia were affected by the US crisis

2012

Indonesia’s economic recovery

2013

Indonesia’s fluctuations occurred

2017

The continued impact of macroeconomic fluctuations

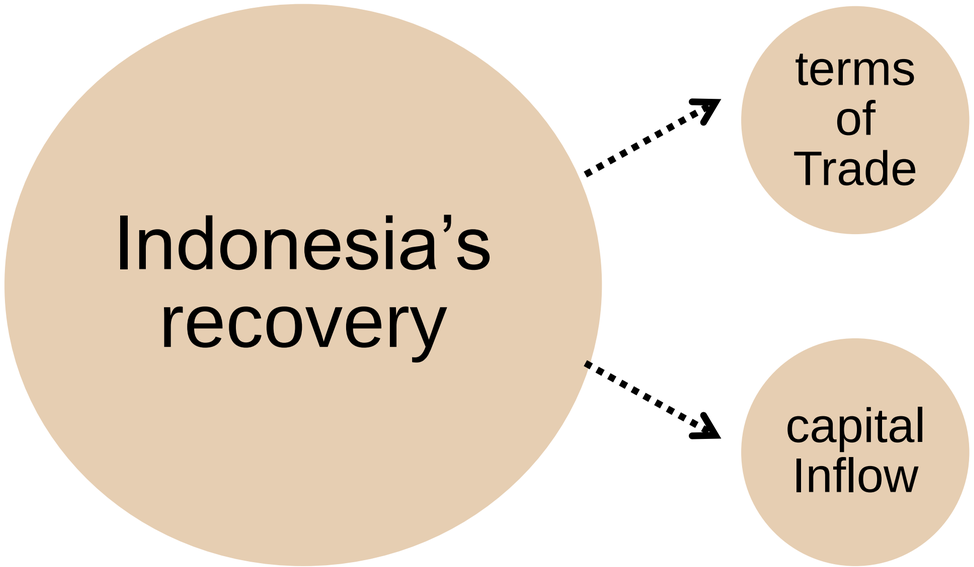
The 2007 Global Financial Crisis and Indonesian Macroeconomic Condition

Internal:	External:
Export started to decline. Economic growth showed a slowdown from 6,3 percent in 2007 to 6,1 percent at the end of 2008. The inflation increased dramatically from 6,59 percent to 11,06 percent in the same period.	Indonesia experienced a depreciation of Rupiah against US dollar. The Rupiah recorded a decline of 5,4 percent at Rp9,666 per US dollar and Indonesia's foreign exchange reserves were only at 51,6 billion US dollars in 2008 (Bank Indonesia, 2008).

2012

Indonesia’s recovery after global financial crisis 2008

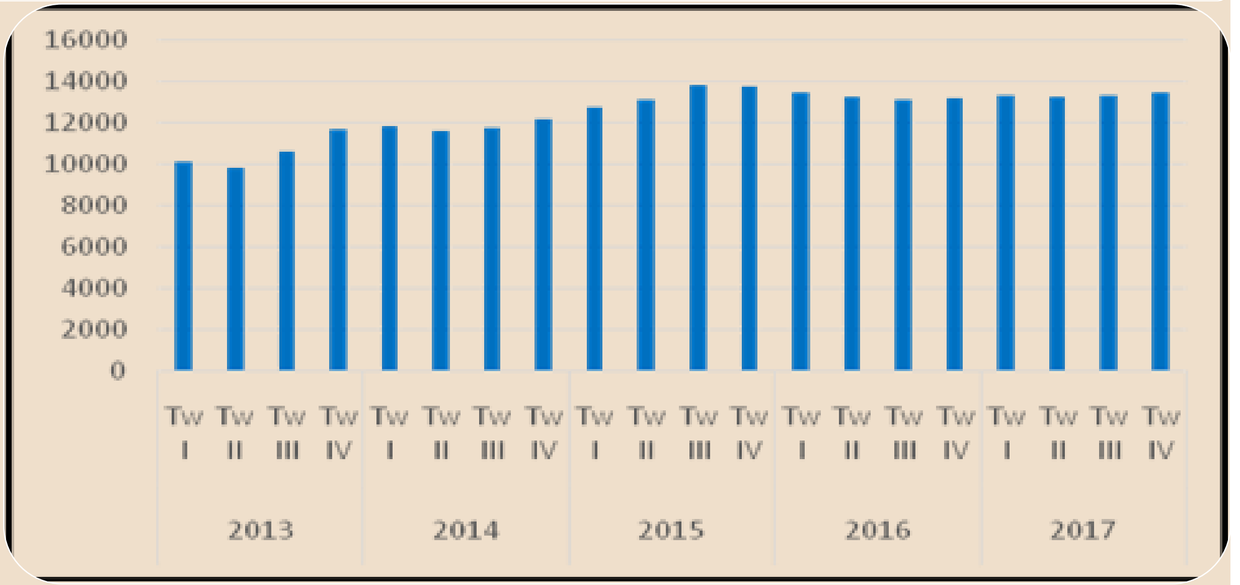
Internal:	External:
The economic growth is steady at 6,2 percent level. Inflation rate is about 4,3 percent.	Rupiah was still depreciated in the range of Rp 9,358 per US dollar, nevertheless foreign exchange reserves had achieved more than double from the crisis period, i.e. 112,8 billion US dollars until the end of 2012.



2013

Indonesia economy has decline dramatically

External



Internal

Economic growth dropped sharply at 5.58 percent from the previous yearwhich reached 6.23 percent in 2012 and 6.5 percent in 2011.

In the third quarter of 2013, the inflation reached 7,66%. This inflation realization was far higher than in 2012 which was only 3,66%.

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Table 1. External Sustainability Indicators in 2012-2017

Indicator (%)	2012	2013	2014	2015	2016	2017
The ratio of foreign debt to GDP	27.4	29.1	32.9	36.1	34.3	34.7
The ratio of net foreign debt to current account receipts	36.5	49.3	56.9	70.5	37.0	33.2
The ratio of net direct investment liabilities to GDP	24.7	27.4	25.8	27.2	28.0	25.5
The ratio of non-debt creating inflows to GDP	35.6	35.9	37.3	37.0	38.2	36.6

Source: Bank Indonesia (2017)

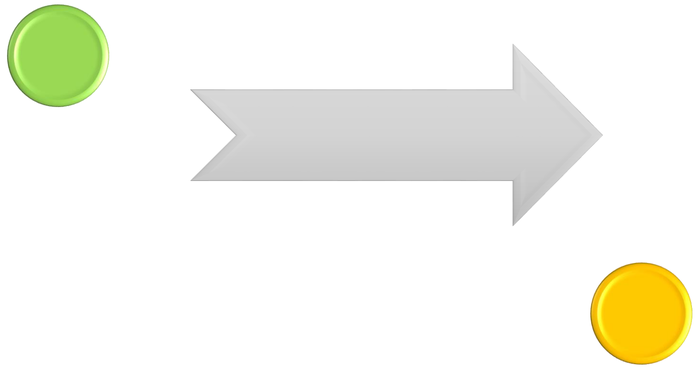
In terms of the ratio of the foreign debt to GDP has seen to increase from the period 2012 - 2017. While the ability to pay the foreign debt net of current account seen decreased dramatically from 2015 in the amount of 70.5 percent to 33.2 in 2017. Role direct investment in the domestic economy fluctuates from 2012 until 2017. The capital inflow of non-debt to finance domestic economy increased during 2012 through 2016, but began to decline in 2017 to 36.6 percent.

“There is still debate about what factors are the most dominant influencing foreign exchange rates fluctuations”

Empirical studies and theories show many factors determining the exchange rate fluctuations such as money supply, real output, interest rates, inflation, capital inflow and several other macro variables but have not identified the most dominant factor (Krugman, 2015; Cover 2012).

Research Questions

What this research wants to know?



Identifying the shocks and the most dominant shock that causes the fluctuation of exchange rate and macroeconomic conditions in Indonesia.

Literature Review

Exchange Rate

Asset Approach

Monetary Approach

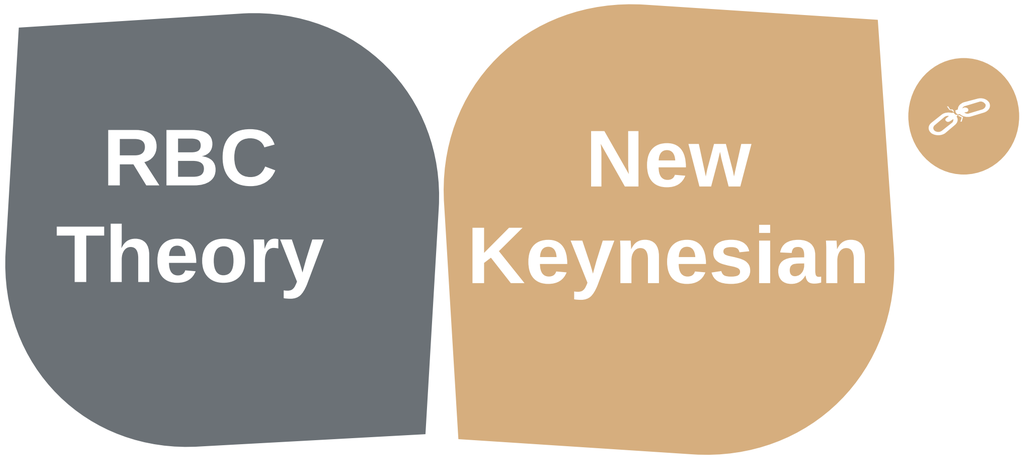
The main factors that influence exchange rate fluctuations are the magnitude of the rate of return from domestic assets, foreign assets, and expectations of appreciation or depreciation of the domestic currency against foreign currency. If the rate of return from domestic assets rises, the domestic currency will experience appreciation with the assumptions that the expectations are considered fixed, vice versa **(Krugman, *et al.*, 2015).**

Money market is a factor that affects the exchange rate. Money supply is assumed to be fixed while money demand will determine the equilibrium interest rate. If the money supply is greater than the money demand, the interest rate will decrease and will cause domestic currency to depreciate. The Purchasing Power Parity (PPP) approach shows that if domestic interest rates are raised, then real money demand decreases, so the domestic currency experiences depreciation

Teoritical Review

This study uses the approach of Real Business Cycle (RBC) and the New Keynesian. The RBC theory explains that economic conditions that experience periodic expansion or recession are natural events. Weakening economic conditions resulted in fluctuations output and employment is the result of the various shocks that have hit the real economy and markets make adjustments quickly to maintain balance **(Insukindro, 2015; Shirota, 2019).**

Supply shocks cause the macroeconomic fluctuations (Chugh, 2015)



- A market failure in the economy that causes inefficient business cycle fluctuations, so that the output produced is lower than the potential GDP
- The government plays a role to overcome economic problems (Chugh, 2015; Scarth, 2014; Romer, 2012).

Aggregate Demand and Aggregate Supply

This approach is used to see the relationship between variables in the economy

Fluctuations in foreign exchange rates are also determined by demand and supply aggregate dynamic. Basically there are three markets involved, called the output market, money market and foreign exchange market.

This approach is used to analyze the link between variables used in this research model, in which the model consists of (1) an IS curve that reflects the balance in the goods and services market, (2) an MP curve that illustrates the monetary policy of the Central Bank, and (3) a PC curve that represents the Phillips (Modified New Keynesian Phillips Curve) curve that describes the short-term relationship between the output gap (the difference between actual GDP and potential GDP) and inflation (**Cover, 2012; Giese and Wagner, 2007)**.

If the output gap is positive, it means that there is an expansion in the economy, the unemployment rate will decline, and the inflation will likely rise.

Literature Review

Name	Title	Objective	Method	Result
Peersman (2011)	The Relative Importance of Symmetric and Asymmetric Shocks: The Case of United Kingdom and Euro Area	• To identify symmetric and asymmetric supply,demand and monetary policy shocks in an estimated two-country structural VAR for the UK and Euro area • Whether the reaction of monetary policy to symmetric shock has historically differed between the two countries • How to identify the role of the exchange rate in the process of economic adjustment.	SVAR The research period was carried out after the Bretton Woods agreement in the UK and the Euro Area 1974-2008	• *Symmetric shock plays an important role in explaining the variability of the business cycle in the UK and the Euro Area.* • *The exchange rate is an independent source of shock in the economy.*
Cover, et all (2012)	Identifying Sources of Macroeconomic and Exchange Rate Fluctuations in the UK	To identify the types of shocks responsible for macroeconomic fluctuations in the UK economy	Estimated with SVAR Using quarterly data for the period 1985:1–2011:1	• Two shocks (called the technology and IS shocks) are relatively more important than other shocks • Monetary policy is not responsible for a meaningful share of output and employment fluctuations

Literature Review

Name	Title	Objective	Method	Result
Batini et al (2005)	An Open-Economy New Keynesian Phillips Curve for the U.K	• Estimate *pricing equation* or *new Keynesian Phillips curve*(NKPC) obtained from *structural dynamic model of price* • Estimate *sticky prices* di US and extended to *capture employment adjustment costs* and the openness of UK. • To analyse the relationship between inflation and marginal cost	Cobb Douglas analysis	• *Inflation in UK is explained both by changes in employment dan by changes in real import prices and real oil prices.* • *External competitive pressures also seem affect U.K. inflation*
Ireland (2004)	Technology Shocks in The New Keynesian Model	• This paper reexposes and further explores this link between the current generation of New Keynesian models and the previous generation of real-business-cycle models • it examines the importance of technology shocks within the New Keynesian framework	Estimated with Maximum Likelihood Using quarterly data for the period 1948:1–2003:1 Variable: Real GDP, GDP deflator, *three-month* U.S.Treasury *bill rate*.	• Monetary policy shocks as a major source of instability in output growth, particularly in the period before 1980 • The markup, or cost-push, shock emerges as the most important contributor to movements in inflation • The technology shock plays only a modest role • Federal Reserve officials have often faced difficult trade-offs in

Literature Review

Name	Title	Objective	Method	Result
Garrat et al (2003)	A long Run Structural Macroeconometric Model of The UK	The aim is to develop a model with effective exchange rate, and real money balances in small open economy	Unrestricted VAR Using quarterly data for the period 1965.1-1999.4 and 9 variables: domestic and foreign outputs, prices and interest rates, oil prices, the nominal effective exchange rate, and real money balances.	Monetary contraction causes appreciation of the exchange rate but with UIRP condition it causes depreciation
Arintoko & Insukindro (2017)	Effect of Exchange Rate, Foreign Direct Investment and Portfolio Investment on the Indonesian Economy	Develop a macroeconomic model based on the New Keynesian Phillips Curve	Structural Cointegrating Vector Autoregression Approach Using quarterly data for the period 2001.1 – 2013.4	Exchange rates have a long-term relationship with macro variables in Indonesia (output gap, price levels, interest rates, current accounts, FDI, and portfolio investment

Research Methodology

Data and Variables

Data

- Quarterly data, 2007-2017.
- Data obtained from CEIC (Accurate Macro & Micro Economic Data) and SEKI (Indonesian Economic and Financial Statistics) Bank Indonesia

Variable

- Unemployment
- Output Gap
- Output
- Inflation
- INDIR (domestic interest rate)
- USIR (foreign interest rate)
- Exchange Rate Rp/US Dollar
- BI rate
- Expected Exchange Rate Depreciation Rp/US Dollar
- DIR (Difference between domestic and foreign interest rate)

Definition of Variable

Notation	Variable	Definition	Unit	Source
u_t	Unemp	Open unemployment rate	people	CEIC Database
$y_t - y_t^n$	OutputGap	Difference between real output and potential output	percentage	CEIC Database
y_t	Output	The amount of GDP measured from the expenditure side with at constant price 2010	Billion Rupiah	CEIC Database
p_t	Inflation	Price increases in general and continuously	percentage	SEKI, BI
i_t	INDIR (*domestic interest rate*)	3 months deposits interest rate (Rupiah)	percentage	SEKI, BI
i_t^f	US-IR *(foreign interest rate*)	3 months deposits interest rate (Dollar)	percentage	SEKI, BI
q_t	*ER*	Exchange Rate Rp/US Dollar	Rp/US	CEIC Database
q_t^e	*Exper*	*Expected Exchange Rate* De*preciation* Rp/ US Dollar	Rp/US	CEIC Database
DIR	*DIR (Interest Rate Differential)*	Difference between *domestic* dan *foreign interest rate*	percentage	SEKI, BI
BIRate	BIRate	Central Bank Interest Rate that reflect monetary policy *stance*	percentage	SEKI, BI

Macroeconomic Model Specification

$$\mu_t = \mu_{t-1} - \alpha_1(y_{t-1} - y_{t-1}^n) + \varepsilon_t^P$$ Productivity

$$y_t = \beta_1\mu_t + \beta_2 p_{t-1} + \beta_3 i_{t-1} + \varepsilon_t^{IS}$$ IS

$$p_t = \mu_1\mu_{t-1} + \mu_2\,(y_{t-1} - y_{t-1}^n) + \mu_3 q_{t-1} + \varepsilon_t^{AS}$$ Phillips Curve

$$i_t = \lambda i_{t-1} + (1-\lambda)\left[\gamma_1 p_t + \gamma_2(y_t - y_t^n)\right] + \varepsilon_t^{MP}$$ Monetary Policy Rule

$$q_t = \kappa_1 q_t^e + \kappa_2(i_t - i_t^f) + \varepsilon_t^q$$ UIRP Exchange rate equation

To analyze the effect of structural shocks on Indonesian macroeconomic conditions, a model consisting of productivity equation, IS equation, Phillips Curve equation, *monetary policy rule* equation, and UIRP *exchange rate equations is used.*

Structural shocks in this model consist of *technology shocks, IS shocks, AS shocks*, *monetary policy shock*, dan *exchange rate shock* (Cover, 2012)

S V A R S p e c i f i c a t i o n

SVAR model based on VAR model, used when there is a suspected reverse causality between variables. There is bivariate system (Sims, 1980; Enders, 2015):

$$Y_t = a_{10} - b_{12}X_t + \gamma_{11}Y_{t-1} + \gamma_{12}X_{t-1} + e_{Yt} \quad (1)$$

$$X_t = a_{20} - b_{21}Yt + \gamma_{21}Y_{t-1} + \gamma_{22}X_{t-1} + e_{Xt} \quad (2)$$

e_{Yt} *and* e_{Xt} are assumed as *whitenoise* and not correlated

Basic Model : $\boldsymbol{Z_t = A_0 + A_1Z_{t-1} +...+ A_pZ_{t-p} + \epsilon_t}$ (3)

$$\boldsymbol{\epsilon_{1t}} = (e_{Yt} - b_{12}\, e_{Xt})/(1-b_{12}b_{21}) \quad (4)$$

$$\boldsymbol{\epsilon_{2t}} = (e_{Yt} - b_{12}\, e_{Xt})/(1-b_{12}b_{21}) \quad (5)$$

From the above equation, it can be seen that the error terms are composite errors, namely error terms containing shocks from X and shocks from Y.

Structural VAR is expected to explain the dynamic changes in the Indonesian economy caused by *structural shocks*

The model wants a stable equation system (eigenvalue < 1) which is located in a unit circle or stationary even though Sims do not require differencing to be stationary because it will remove a lot of information

Because shocks occur simultaneously, the orthogonalized IRF was then used to see the effect of X shocks on Y

Impulse Response Function

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \bar{Y} \\ \bar{X} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}(i) & \phi_{12}(i) \\ \phi_{21}(i) & \phi_{22}(i) \end{bmatrix}^{i} \begin{bmatrix} e_{Yt-i} \\ e_{Xt-i} \end{bmatrix}$$

$$\Phi_i = \frac{A_1^i}{1 - b_{12}b_{21}} \begin{bmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{bmatrix}$$

It can be described as follows:

$$Z_t = \mu + \sum_{i=0}^{\infty} \Phi_i e_{t-i}$$

There are four Φ_{jk} elements called *impact multipliers* (*impulse response functions*). For example Φ_{12} (0) is the effect of 1 unit of change in the e_{Xt} shocks on Y_t in which others are assumed to be constant.

Forecast Error Variance Decomposition

In order to see the main determinants that explain variations of Indonesia's macroeconomic variables, variance decomposition is used as follows:

$$\textit{The basic model: } Z_t = A_0 + A_1 Z_{t-1} + \epsilon_t$$

The forecast value for one period ahead:

$$E_t\,[Z_{t+1}|Z_t] = A_0 + A_1 Z_t$$

The forecast error for one period ahead:

$$Z_{t+1} - E_t Z_{t+1} = e_{t+1}$$

Using the moving average representation as follows:

$$Z_{t+n} - E_t Z_{t+n} = \sum_{i=0}^{\infty} \emptyset_i e_{t+n-i}$$

The above equation shows the proportion of changes in own shocks towards other variables. If X_t does not explain forecast variance from Y_t, the Y_t variable is exogenous and vice versa.

Structural VAR Model

$A(L)\, y_t = A_0\ (I_n - B_1L - B_2L^2 \ldots\ldots B_pL^p)\, y_t = A_0 e_t = B\varepsilon_t$

Where:

ε_t = n x n column vector of structural shocks

e_t = n-column vector of reduced form shocks

A_0 = n x n matrix of contemporaneous effects between variables

A(L) = matrix lag polynomials

- The next step is to identify the procedure for *recovering structural shocks*. *Impulse response functions* use restrictions on *contemporaneuous structural parameters*.

SVAR Restriction Matrix

Structural VAR emphasizes on restrictions on responses from variables and predicts the impact of intervention. A number of assumptions are based on economic theory and literature review (Cover, 2012; Krugman, 2015; Hubbard, 2012; Arestis and Sawyer, 2008):

- The unemployment rate is affected by output gap shocks and is not directly affected by inflation and exchange rate shocks
- Output is affected by inflation, unemployment, and interest rates shocks
- The inflation rate is influenced by output gap, unemployment, and exchange rates
- The BI Rate is influenced by inflation and output gap shocks
- Exchange rate is affected by interest rate differential shocks
- Domestic interest rate is affected by Expected Exchange Rate Depreciation shocks

$$\begin{bmatrix} Output \\ Inflation \\ BIRate \\ Unemp \\ ER \\ INDIR \\ DIR \\ OutputGap \\ Exper \end{bmatrix} = \begin{bmatrix} 1 & a_{12} & 0 & a_{14} & 0 & a_{16} & 0 & 0 & 0 \\ 0 & 1 & 0 & b_{24} & b_{25} & 0 & 0 & b_{28} & 0 \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & c_{38} & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & d_{48} & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & e_{57} & 0 & e_{59} \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & f_{69} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & g_{79} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{Output} \\ \varepsilon_{Inflation} \\ \varepsilon_{BIRate} \\ \varepsilon_{Unemp} \\ \varepsilon_{ER} \\ \varepsilon_{INDIR} \\ \varepsilon_{DIR} \\ \varepsilon_{outputGap} \\ \varepsilon_{Exper} \end{bmatrix}$$

One of the components of the matrix is 0, for example $a_{13} = 0$ means that the long-term response of the output variable towards the BI Rate variable shocks is zero

Empirical Results

Unit Root Test

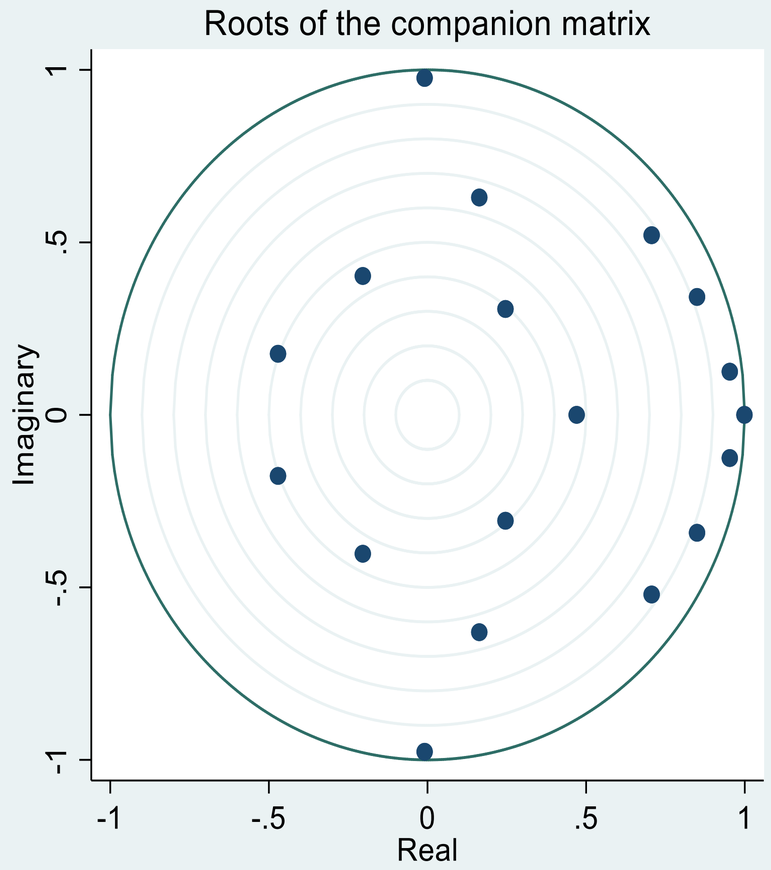
The Unit Root Test with ADF Test

The results show that the variables are stationary in the first degree of integration

No	Variable	ADF Test
1	Output	-14,112*
2	Inflation	-3,656*
3	BIRate	-3, 850*
4	Unemp	-5,302*
5	ER	-5,167*
6	INDIR	-4,251*
7	DIR	-3,075**
8	OutputGap	-12,489*
9	Exper	-5,288*

*) indicates that the variable is stationary at a critical value of 1%,
**) indicates that the variable is stationary at a critical value of 5%,

Stability Test Unit Circle



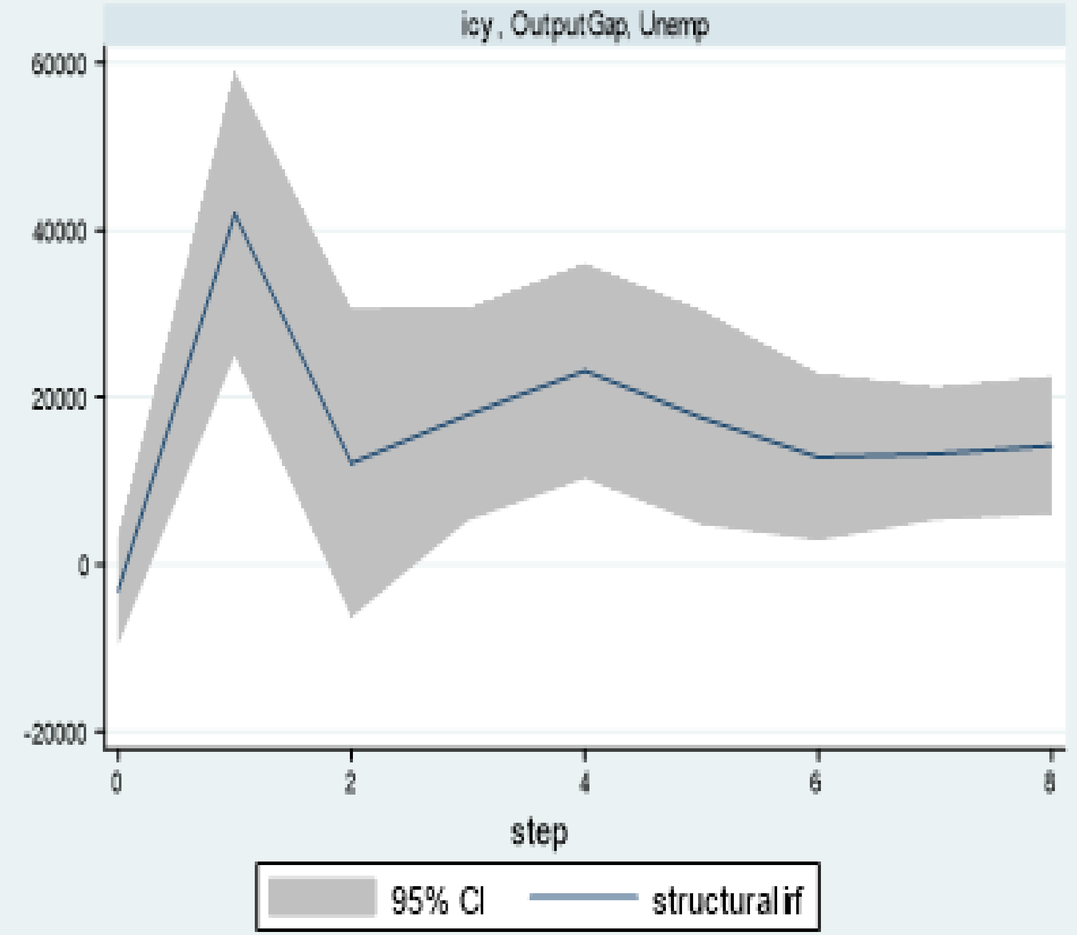
The calculation results also show a stable equation system (eigenvalue <1) located in the unit circle.

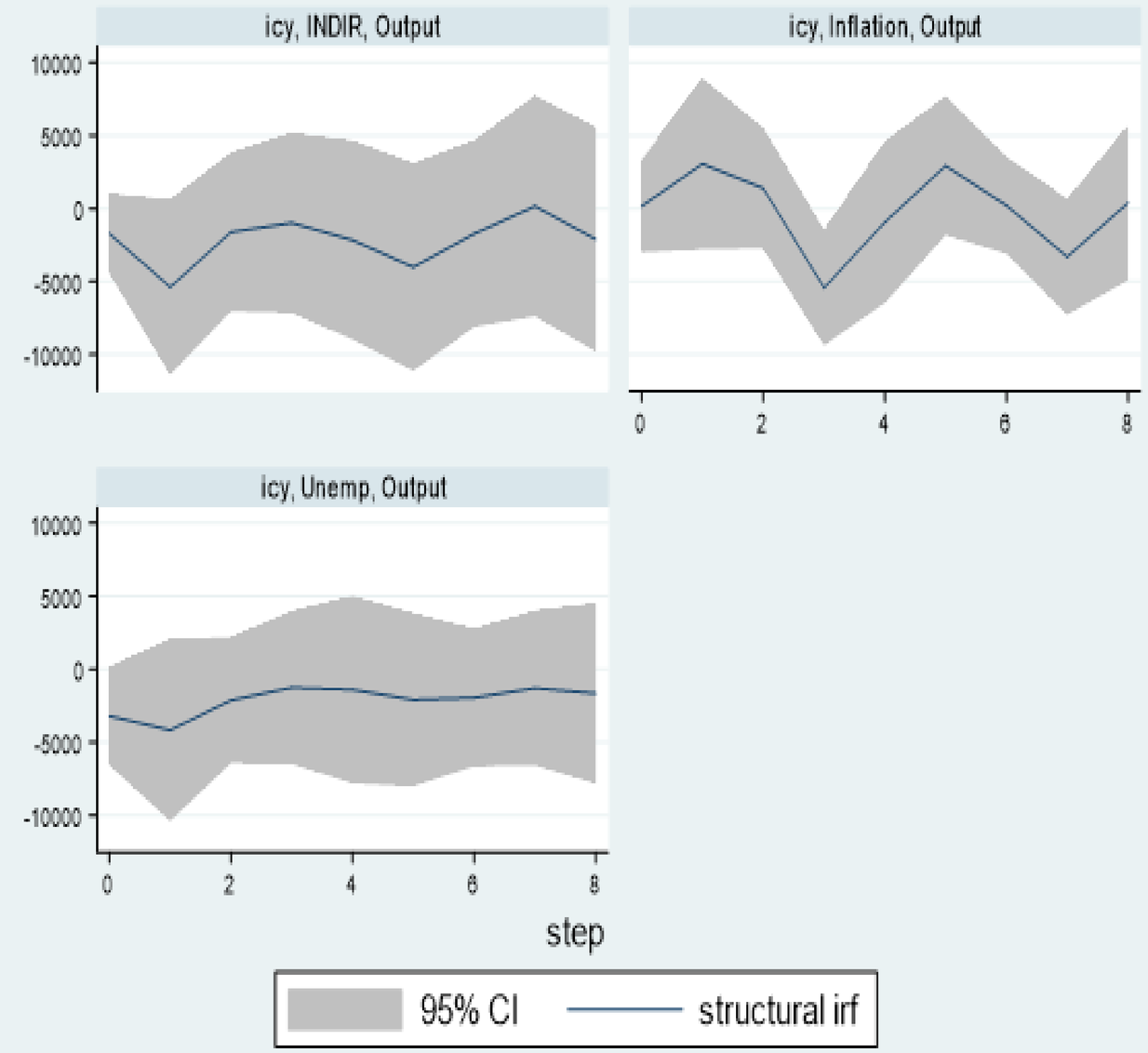
Besides, this model passed another diagnostic test, namely the normality test, autocorrelation.

Impulse Response Function

Unemployment Response to *Production Shocks*

- From the IRF results, it can be seen that the production shocks affect the unemployment rate in Indonesia.
- The figure shows an increase of 42014.1 people in unemployment because of the production shocks originating from the output gap of one standard deviation in period 1 (Okun's law).
- The model captures production shocks from the supply side in the economy (Chugh, 2015, Cover & Mallick, 2012, Romer, 2012, Hubbard, 2012).

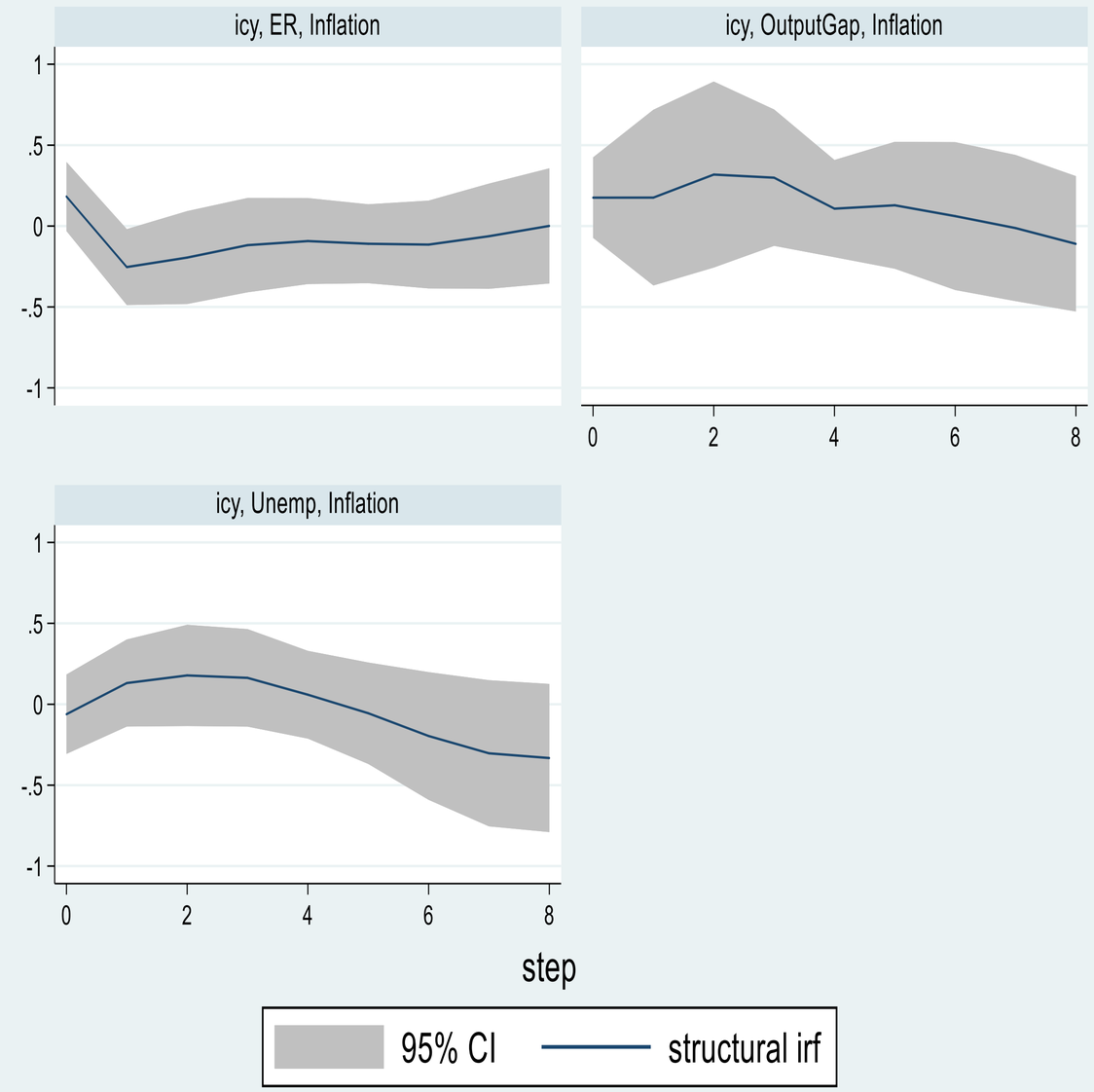




Impulse Response Function

Output Response to *IS Shocks*

- The figure shows a decrease in output due to the IS shock
- Changes in the income received by the labor affect the demand for faster output
- The inflation shocks will cause real money demand to fall, domestic interest rates to rise, investment to fall, which lead decrease in output
- The domestic interest rates shocks resulted in a decrease in output of 1710.94 billion Rupiah (Goodhart, 2007).



Inflation Response to *AS Shocks*

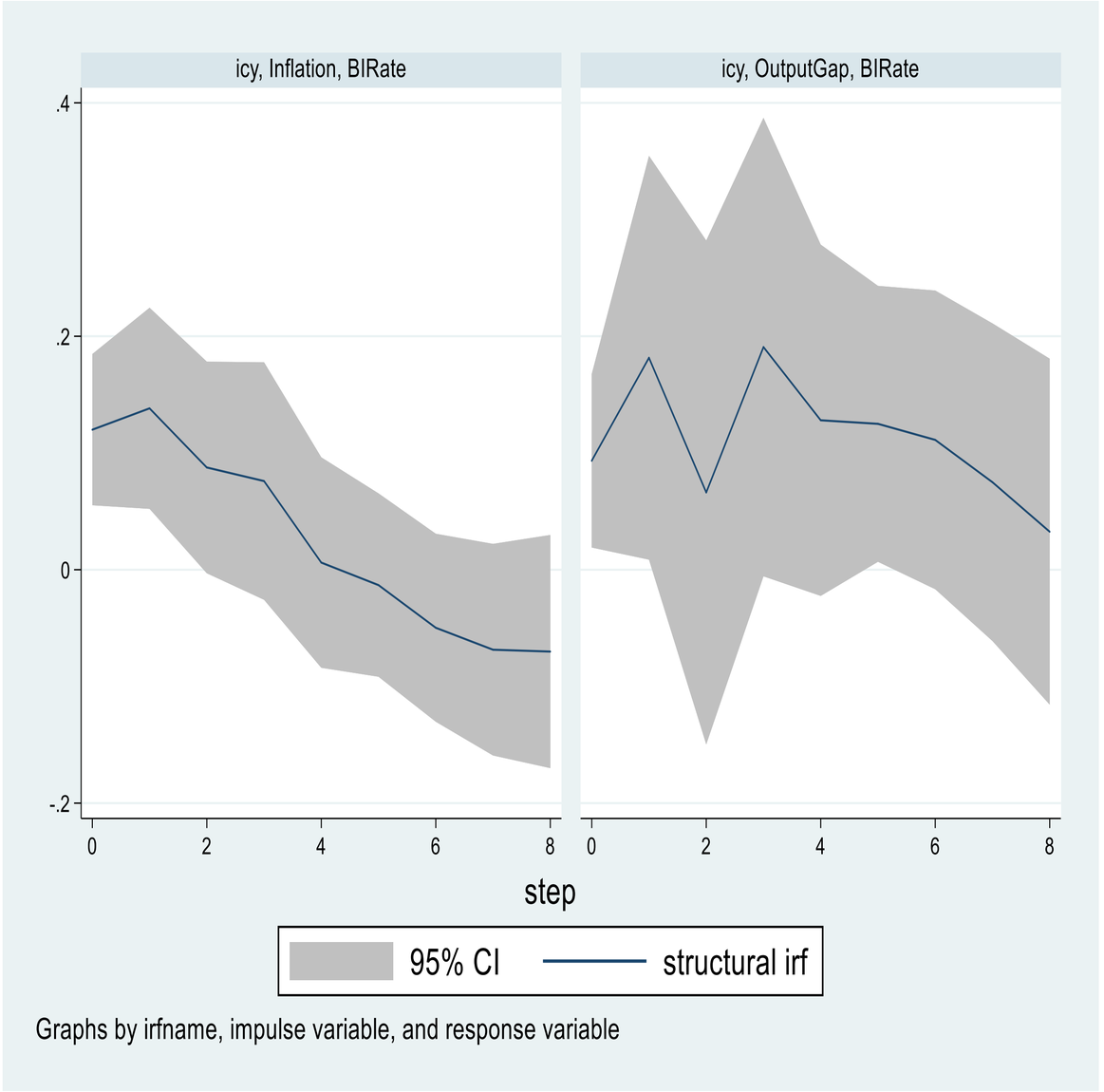
- The figure below generally shows an increase in inflation due to the AS shock originating from unemployment, output gap, and exchange rate of one standard deviation in the first quarter.
- The existence of unemployment shocks results in a general Increase of inflation by 0.06 percent. This result is in accordance with the theory stating that if the unemployment shocks exist, then the demand aggregate will fall and further resulting in the fall of the output
- The output gap shocks resulted in an increase in inflation by 0.176 percent at the beginning of the period
- The exchange rate shocks resulted in an increase in inflation. Besides, the shocks result in depreciation, increase in exports, foreign exchange, income, purchasing power, consumption, which then lead to inflation that comes from the demand pull inflation by 0.18 percent (Batini et al, 2015).

BI Rate Response to Monetary Policy Shocks

From the IRF results, it can be seen that monetary policy shocks affect the BI Rate level in Indonesia.

The figure shows inflation shocks resulted in an increase in the BI Rate by 0.12 percent. In this case, the central bank has to raise the BI Rate interest rates to control the inflation rates (Goodhart, 2007).

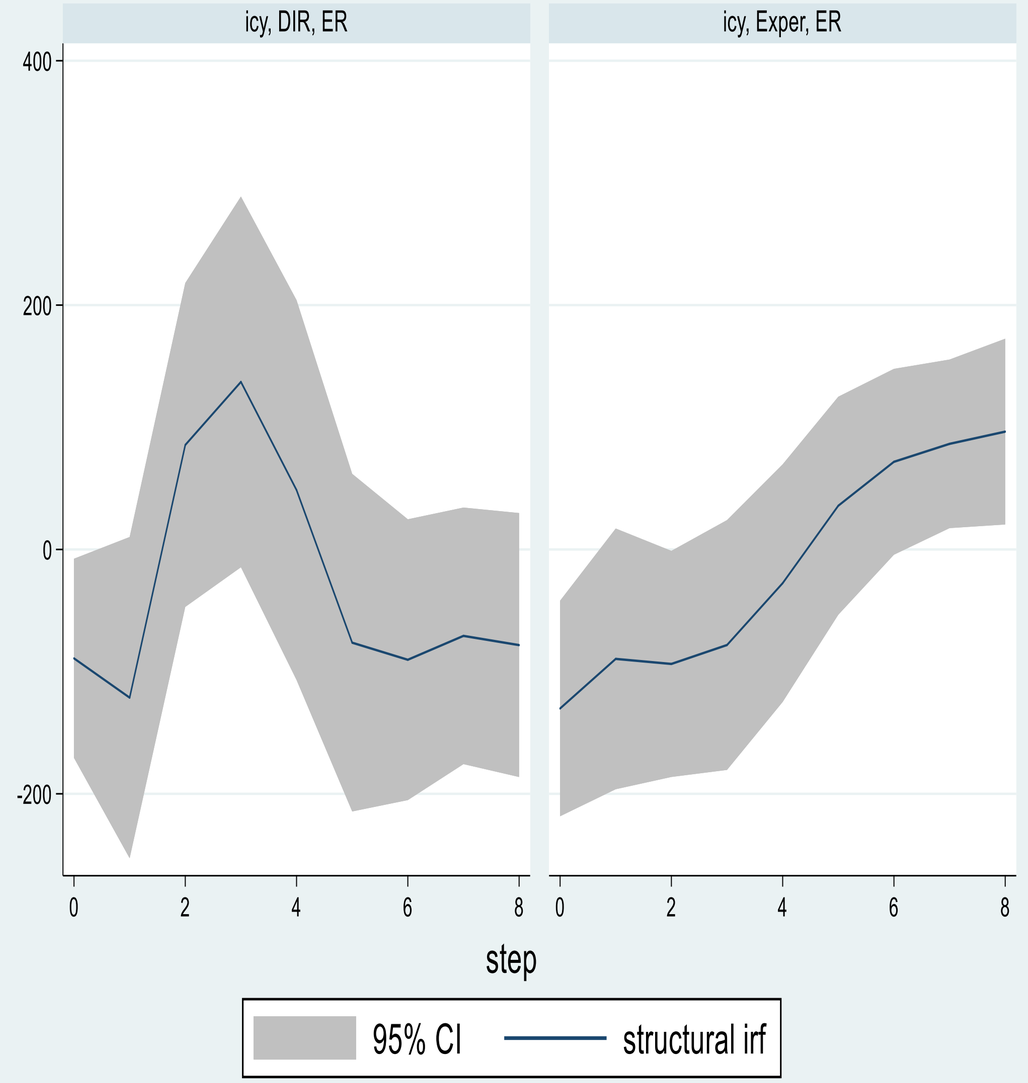
The output gap shocks resulted in an increase in the BI Rate by 0.09 percent at the beginning of the period. Hence, can attract capital inflows that can drive the economy (Garrat, 2003)



Exchange Rate Response to *Exchange Rate Shocks*

The figure shows that the exchange rate shocks affect the exchange rate fluctuations in Indonesia. The presence of DIR shocks result in an exchange rate depreciation of Rp 89.1 per Dollar. The differential interest rate results in an arbitrage between countries, which leads to the capital flight and then the exchange rate depreciation

The expected exchange rate depreciation shocks result in the exchange rate depreciation of Rp. 130.2 per dollar. Therefore, the expected exchange rate depreciation shocks increasingly result in the exchange rate depreciation (Peersman, 2011, Arintoko & Insukindro, 2017)

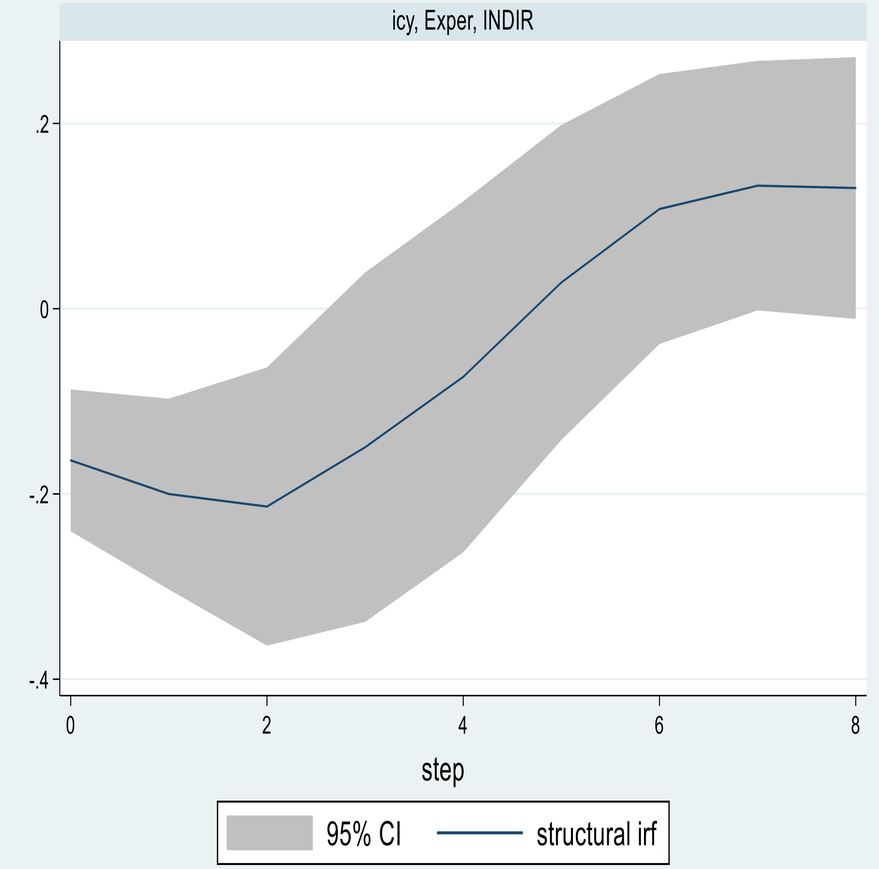


Domestic Interest Rate Response to *Expected Exchange Rate Depreciation*

The IRF results show that the expected exchange rate depreciation shocks (Exper) affect the domestic interest rates in Indonesia.

- The shocks resulted in a decrease in the domestic interest rate of 0.16 percent. If there is an expected exchange rate depreciation shocks, the rate of return of the domestic interest rate will be less attractive to the market players
- If the market is efficient, changes in interest rates can predict changes in exchange rates

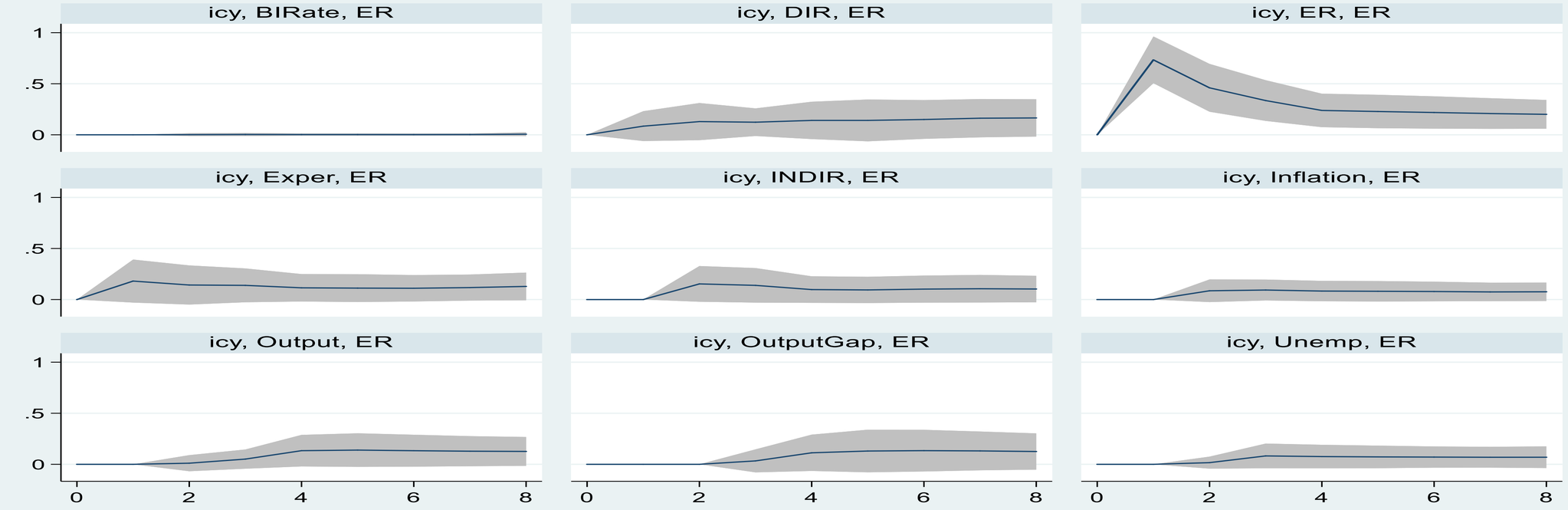
The results of the study showed that structural shocks affect the weakening of economic conditions, in which the unemployment rate increases, the output falls, the inflation is high, and the depreciation of the exchange rate. This is in accordance with the theory of Real Business Cycle (RBC) and New Keynesian which state that a decrease in aggregate demand results in a recession caused by various shocks that hit the economy (Chugh, 2015; Scarth,2014, Garrat, et all, 2003, Krugman, 2015).



Forecast Error Variance Decomposition

Exchange Rate Response to Structural Shocks

The most influential factor in the exchange rate change is the shocks originating from the exchange rate, expected exchange rate depreciation, and interest rate differential with an influence of 73.41%, 18.10%, and 8.49% each in the first quarter(Krugman, 2015)



Conclusion

CONCLUSION

There is a long-term relationship between variables that are consistent with the theory

Structural shocks cause the weakening of the macroeconomic conditions in Indonesia

Shocks from the exchange rate, expected exchange rate depreciation, and differential interest rate are the dominant factors affecting the exchange rate

SUGGESTIONS

The government is expected to create stable economic conditions to minimize the idiosyncratic country risk effects on the macroeconomic variables in Indonesia

For the next study, it is recommended to increase the exchange rate shocks restriction that has a direct influence towards the BI rate

Analyze the effectiveness of monetary policy to stabilize the macroeconomic conditions by using counterfactual simulation

Thank you

EBES Conference Kuala Lumpur,
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