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THE PROGRESS OF MONETARY, BANKING AND PAYMENT SYSTEM
Quarter I, 2011
Author Team of Quarterly Report, Bank Indonesia

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Monetary Transmission of Persistent Shock to the Risk Premium: the Case of Indonesia
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The Board of Governors Meeting (Rapat Dewan Gubernur/RDG) of Bank Indonesia on 12 April 2011 has decided to maintain the BI rate by 6.75%. This decision does not change the direction of Bank Indonesia’s monetary policy which tends to be strict in an effort to control the inflationary pressures that are still high, amid the government efforts to reduce inflationary pressure from volatile foods group. The Board of Governors considered that the strengthening of the rupiah so far can reduce these inflationary pressures, particularly from the rising price of international commodities (imported inflation). In addition, to minimize the negative impact of short-term foreign capital flows on monetary stability and financial system, the Board of Governors also has decided to replace the one-month holding period on SBI to six-month holding period, which shall take effect on May 13, 2011. Looking ahead, Bank Indonesia assessed that the possibility of the BI rate level adjustment is still open to dampen the incoming inflationary pressures. Bank Indonesia believed that the implementation of monetary and macro-prudential policy mix, supported also by the strengthened coordination of government policy, will be able to maintain the macroeconomic stability and bring inflation to the target, which are 5% ± 1% in 2011 and 4.5% ± 1% in 2012.

The Board of Governors considered that the global economic recovery in the future is better as seen from the upward adjustment of global economic growth projections by various international agencies. This improvement of global optimism will have an impact on world trade volume which has now also increased. This will have positive influence on the demand for export products to help encouraging domestic economic growth. However, the process of global economic recovery is still faced with the uncertainties related to the risk of debt crisis that hit several countries in Europe and the potential disruption of production after the earthquake in Japan. In addition, the rising prices of oil and global food commodity are predicted to continue which cause inflationary pressures in many developed countries and emerging economies, including Indonesia.
On the domestic side, the Board of Governors observed that Indonesia’s economic growth is forecasted to increase by 6.0 to 6.5% in 2011 and 6.1 to 6.6% in 2012. This economic recovery is underpinned by a more balanced source of growth in line with the improving investment performance and the export performance that remains solid. In the second quarter of 2011, economic growth is forecasted to grow quite high at 6.4%. The role of investment to increase the capacity of the economy, especially through FDI, is expected to rise in line with the demand that remains strong, both from domestic and external, and also with the improvement in sovereign credit rating. By sector, all sectors of the economy are predicted to grow high, with the highest growth in the sector of transport & communication, trade, hotels & restaurants, and construction.

The performance of Indonesia’s balance of payments recorded a surplus which is estimated to be still high enough in 2011. This surplus is derived either from the current account or from the capital and financial transactions. Export is forecasted to grow quite high. Capital inflows, in the form of portfolio, are predicted to remain large, while the foreign direct investment (FDI) is expected to increase. With such development until the end of March 2011, foreign reserves stood at 105.7 billion U.S. dollars, equivalent to 6.3 months of imports and foreign debt payments.

The strengthening trend in rupiah continued in March 2011. In addition to being in line with the performance of BOP, which recorded a grand surplus and foreign investors’ positive perception toward the strength of Indonesia’s economic fundamentals, the strengthening of rupiah is also a part of Bank Indonesia’s policy response to control inflationary pressures, particularly from the rising prices of international commodity (imported inflation). Until the end of March 2011 the rupiah was strengthened by 3.47% (ptp) to Rp8.708 per U.S. dollar. This appreciation to Rupiah has not so far affected the competitiveness of Indonesia in terms of the exchange rate, among others, reflected in the performance of Indonesia’s non-oil exports which continue to show a relatively high improvement.

In regard to price, although the inflation has shown a declining trend, the risk of future inflation pressures is expected to remain quite high. CPI inflation in March 2011 reached 6.65% (yoy) or deflation of 0.32% (mtm) in line with inflation correction in alimentation products. Although it is still relatively high, the inflationary pressure from the volatile foods group showed a declining trend in line with the Government measures to strengthen the national food. Meanwhile the moderate inflation of administered prices is associated with the minimum price adjustment policies by the Government. However, the core inflation showed an increasing trend, which was recorded at 4.45% (yoy) or 0.25% (mtm) in March 2011, as the propagated impacts of the high prices of food and the rising inflation expectations. Looking ahead, the risk
of inflationary pressures is expected to remain relatively high, influenced by the rising prices of international commodity, the high domestic demand, and the high inflation expectations. Bank Indonesia will continue to be alert to the risk of inflationary pressures and strengthen the mixture of monetary and macro-prudential policy to control the inflation targets.

The stability of financial system is maintained along with the continuing improvement of the intermediation function of banks and the banking liquidity which is in control. The banking industry is under a stable condition characterized by the sustained capital and liquidity as reflected in the high capital adequacy ratio (CAR) at the level of 18% and the ratio of nonperforming loans (NPL) which is maintained fewer than 5% gross. The banking intermediation is also getting better reflected in the rising credit growth, which in March 2011 reached 25.1% (yoy), supported by the growth in all types of loans including loans to Small Medium Enterprises (SMEs).
ANALYSIS OF THE IMPACT OF MACROECONOMIC POLICIES ON TEXTILE INDUSTRY AND ITS PRODUCTS IN INDONESIA

Iwan Hermawan, SP. MSi ¹

Abstract

Textile and textile’s product play an important role in the Indonesian economy. During the last five years, however, the share of these industries and commodities to gross domestic product tend to decrease. The objectives of this study are to analyze factors affecting Indonesian textile and textile’s product, and the prospect of Indonesian textile and textile’s product in the future. Results of the study show that domestic textile production was affected by world cotton price and wage rate, while the domestic garment production was affected by wage rate in the garment sector. Indonesia’s textile export to world market was influenced by domestic textile price, and Indonesia’s export garment was influenced by exchange rate (Rp/US$). Indonesian textile demand was affected by wage rate while domestic garment demand was affected by income per capita of Indonesia. In general, the prospect of Indonesian textile and textile’s product seems not too good. In fact, Indonesian textile and textile’s product had depended on high import cotton, investment, and exchange rate.

JEL Classification Number: C53, E60, F43, and F4.
Keyword: export, open economy, forecasting, simulation, textile and textile’s product.

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I. INTRODUCTION

The industry of textiles and products of textile (TPT) offers an important opportunity for a country to start the industrialization of its economy. This industry plays an important role in increasing export orientation in Asian countries, as in Hong Kong, Singapore, Taiwan, South Korea, Malaysia, China, Indonesia, Thailand, and Vietnam. In addition, the number of population of the Association of Southeast Asian Nations (ASEAN) country has reached approximately 597 million people and the implementation of the ASEAN Single Window (ASW) with 0 percent import duty (with the exception of Laos, Cambodia, and Myanmar which the implementation starts in 2012) provide a grand opportunity for the textile market (Sunarno, 2008).

Textiles and clothing sector is a key sector in Pakistan, Vietnam, Thailand, Sri Lanka, and Indonesia. In 2010 textile export growth in Vietnam reached US$ 11.2 billion. In Indonesia, the performance of textile products also contributes to economic growth in Indonesia. Textile industry has a 2.18 percent contribution to Gross Domestic Product (GDP) and 8.01 percent to manufacturing industry in 2010 (CBS, 2008). Even the non-oil export commodities which provide the largest contribution for more than 20 years are the textile products. This increase is not independent from the government policy in the early development of this industry.

Textile industry is also the largest contributor to the foreign exchange earnings of Indonesia. In 2009, the textile industry contributed 12.72 percent in foreign exchange earnings on exports of industrial products, excluding oil and gas, and 9.58 percent to total non-oil exports, although 85 percent of cotton, as the raw materials, is imported. That amount increased sharply from only US$ 559 million in 1985 (CBS, 2010). Besides having a large contribution in the GDP and foreign exchange, the industry also employs many workers, both who work directly or indirectly.

The importance of textiles and clothing can be seen from its role as one of the basic human needs, other than food and shelter. Therefore, the consumption of clothing will tend to increase aligned with population growth rate (Figure 1). The potential market for Indonesian textile commodities is relatively large because the needs of the urban fabric of society are not only the dress, but also the needs of non-apparel. In 2005 the Indonesian textile consumption

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6 Exports of industrial products of apparel and other textiles
decreased significantly compared to 2004. This is because on January 1, 2005, the quota system was terminated and adapted to the provisions of the General Agreement on Tariffs and Trade (GATT). This agreement was commenced from the Uruguay Round at April 15, 1994 in Marrakesh that issued the Agreement on Textile and Clothing (ATC) to set the import quota system.

On the other hand the changes in quota system would have positive impact for the textile industry development through fairer trade and mark a new era of world textile trade. The discriminative textile quota system was abolished and the textile products market share is getting larger through international competition and opportunities for the development of textile industry will be even greater. Indonesia is one among the biggest textile producers in the world. In 2000 the Indonesian textile exports reached US$ 8.2 billion (Rp 74.9 trillion) and was ranked 10th among the world textile producers. In 2003, Indonesian textile exports only scored US$ 7.03 billion, which drops the ranking to 17th place. But in 2004, this sector could increase foreign exchange earnings up to US$ 7.6 billion. According Thoborn (2010)\(^8\) in the year 2007 the total value of Indonesian textile exports amounted to US$ 9.73 billion, which was ranked 12\(^{nd}\) for the textile exports and 8\(^{th}\) for the garment exports.

The above figures indicate that the Indonesian textile industry has the potential and good growth opportunities. This is supported by the ability of the textile industry in contributing


to GDP, foreign exchange earnings, and at the same time to employment. Besides the textile industry has a big opportunity, where the demand for textile products will increase along with population growth. Nevertheless, the potential and opportunities for the development of the textile industry is not without obstacles. Constraints faced by the textile industry might disrupt or reduce its contribution to the Indonesian economic development.

Globalization, which is marked by the end of the quota system in 2005, has encouraged more open world trade in textiles and clothing and changed the market map from the side of importer management supply. These changes in world textile trade raise the opportunity and at the same time the threat to the Indonesian textile industry. Opportunity that is brought is that the market share of countries that had been protected by the quota system will be opened. While the threat will be the intense competition among countries in the world textile producers, such as China, India, United States and the European Union. The issues of non-tariff barriers, such as transshipment and dumping influence the flow of textiles and clothing trade penetration from developing countries to developed countries.

While competition in the world market is increasing, the conditions in the domestic textile industry are relatively poor. One of the circumstances that aggravate the prospects of textile industry development in Indonesia is the non-conducive investment climate, while this industry requires large investments to revitalize their deteriorating machines and technology. This non-conducive investment situation is caused by, among others, the lack of legal certainty, wide spreading corruption, cumbersome bureaucratic on labor issues, and taxation.

In 1997, the monetary crisis that hit East Asian countries, including Indonesia, caused the rupiah to depreciate. This should have made Indonesia’s textile products to be more competitive for consumers abroad, because the price of Indonesian textile products became cheaper. But in reality the value of textile exports decreased to US$ 1.3 billion in 1997 (CIC, 2001).

With all various problems mentioned above, would the textile industry be still able to survive or grow? It is therefore important to analyze the factors that influence the prospect of Indonesian textile industry in the future. The purpose of this study is to: (1) analyze the factors that influence the development of Indonesian textile industry, and (2) analyze the prospects for the development of Indonesian textile industry in the future. The results are expected to provide inputs for policy formulation that is will be supportive for the development of Indonesian textile industry.

The next section of this paper explains the theory and empirical literatures on textile industry, while the third explain the methodology applied. The result and analysis will be explained on fourth section and conclusion will be the last section.
II. THEORY

2.1. Trade Theory

Basically some of the factors that drive the emergence of a country’s international trade with the others countries come from the desire to expand the marketing of export commodities, to increase foreign exchange for development activities, differences in supply and demand between countries, as well as the differences in the relative cost of producing certain commodities (Gonarsyah, 1987).

In Figure 2 it is explained how trade can occur between two countries (Indonesia and China) and between the two commodities (garments and rice). Trade occurs because of differences in slope that indicates the relative price ratio between rice and garments. The assumptions that are used include, i.e. there are only two countries that conduct the trading, the presence of constant opportunity costs, and that each country is trying to achieve the highest level of welfare (the tangent point between the indifference curves and barter lines).

Before the trade takes place (autarky), the domestic exchange ratio is different in the two countries. It also shows the differences in comparative advantage, where the garment is relatively cheaper in Indonesia than in China. When the trading started between the two countries, the ratio of international exchange (terms of trade) underlies between the two domestic ratios, for

![Figure 2. Trading Equilibrium Trade](image_url)

Description: SB and SL is the barter line; point T and M is the point where price ratio is equal to the marginal rate of substitution, and i1-i4 is the indifference curve.
example 1 garment: 1 rice, and 3 garments: 3 rice. The international exchange rate will be balanced depends on the willingness of each country to offer its export and import commodities in the relative price of purchase.

At the final equilibrium position, Indonesia will produce at point S and consume at point T, in which Indonesia produces garments of OS (100 million tons), domestic consumption of OD (55 million tons), and exports amounted to SD (45 million tons) to be exchanged for rice imports at DT (90 million tons). TRS triangle is a trading triangle. TR represents the export of garments, RS represents the import of rice, and the TS slope represents the relative price of the garment. China will also profit the trade from importing garments and exporting rice, where the gain in total trade can be seen in Table 1. So without trade, China’s rice consumption only amounted to 120 million tons and garment’s amounted to 40 million tons. After making the trade with Indonesia, China’s rice exports increased by NB (90 million tons) and Chinese garment imports increased by NM (45 million tons).

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Rice (million tons)</th>
<th>Garment (million tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production (1)</td>
<td>Export (2)</td>
</tr>
<tr>
<td>China</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Worldwide</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>China +30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia +15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worldwide +20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


### 2.2. Construction of Economic Model of Indonesian Textile and Textile Products

Based on the corporation theory, input demand is derived from the production function of each company with the assumption that producers maximize profits within the constraints
of technology and market (output and input price) (Varian, 1978 in Sinaga, 1989). Another assumption is that each company faces a perfectly competitive market, both in input and output markets, so that each company is a price taker.

The derivation of input demand and output supply will require the terms First Order Necessary Condition (FONC) and Second Order sufficient Condition (SOSC) in maximizing the profit (Henderson and Quandt, 1980). It is assumed that the production function can be derived (twice differentiable), demand for the company against certain input condition requires the input productivity (marginal product) that worth the price. Textile commodities are a derived demand from commodity garments. Therefore variables contained in the domestic textile demand equation look different from the usual demand for final goods.

In this study, it also assumed that there is only one type of textile and garment traded. Therefore, textiles and garments are considered as a same commodity which is then converted in units of the same weight (tons). This conversion factor is using the general calculation which is applied by the API. Meanwhile, the domestic composite price variable for textile and garment industries is based on data published by API and the foreign variable is using the proxy of export prices of textile and garment in the world.

In addition, Indonesia is categorized as a small open economy. This classification is based on economic behavior, in which Indonesia cannot influence the world prices or world prices variable as exogenous variables (Krantz, 2006). According to Houck, 1986 that small importer countries face a flat excess supply and are unable to influence the world prices. Therefore the assumption used is that a small country behaves as a price taker, both in the input and output markets. Additionally, transportation costs are zero and there are no trading barriers. This condition is constructed in the model by positioning of textile and garment world prices variable as exogenous variable in the equation of production, exports, and import of domestic textile and garment.

Economic relations between variables in the model are formulated on the basis of microeconomic theory, macroeconomic theory, international trade theory, and research results related. Estimation parameters sign becomes another form of the hypothesis which is later followed as the basis to determine the method of analysis and appropriate data processing. The connection between Indonesia and the world’s textile industry is the reason why this model is constructed with a dynamic model in the form of simultaneous equations. The dynamic nature of the aspects of supply, demand, domestic as well as world prices is also accommodated with the previous year’s variables into the model. Diagram 1 presents a simple relationship between endogenous and exogenous variables in blocks of textile and garment market in Indonesia and the world. The equations are divided into four blocks, namely (1) Indonesian
textile market block, (2) Indonesian garment markets block, (3) world textile market block, and (4) world garment market block.

Based on the relationship between variables in the block, the compiled equations consist of endogenous and exogenous variables. Determination of these variables is based on theoretical framework, empirical studies, and also the conditions in the field. The selected variables are variables that are considered influential and mainly adapted to the availability of data. Textile industry is composed of the subsectors of fibers, yarns, fabrics, apparel, and other textiles. Not all these sub-sectors would be made explicit in economic models. Sub-sectors of fibers, yarns, and fabrics will be included in the textile group, while apparel and other textiles products belong to the garment group. This division is due to data availability. Operational model developed in this study attempted to capture all economic phenomena in the textile industry, both in Indonesia and the world market. This operational model comprises 24 behavior equations and 6 identity equations, however, only 12 behavioral equations and 6 identity equations would be further discussed as they are related directly to the textile industry in the country. The behavior of textile and garment exports of Germany, United States, China Italy, Turkey, and Japan would not be explained. The equations are presented as follows:
1. Domestic textile production

\[ PT_{D_t} = a_0 + a_1 HTDR_{t-1} + a_2 HCWR_{t-1} + a_3 (IRR_{t-1} - IRR_{t-1}) + \\
    a_4 UTKTR_{t-1} + a_5 BBMR_{t-1} + a_6 T + a_7 PT_{D_{t-1}} + U_1 \]  

(1)

The estimation parameter sign expected in the equation is:

\[ a_1, a_6 > 0; \ a_2, a_3, a_4, a_5 < 0 \text{ and } 0 < a_7 < 1. \]

2. Indonesian textile export

\[ XT_{I_t} = b_0 + b_1 HTWR_t + b_2 (HTDR_t - HTDR_{t-1}) + b_3 PT_{D_{t-1}} + \\
    b_4 ERIR_{t-1} + b_5 DKG + b_6 T + b_7 XT_{I_{t-1}} + U_2 \]  

(2)

The estimation parameter sign expected in the equation is:

\[ b_1, b_3, b_4 > 0; \ b_2 < 0 \text{ and } 0 < b_5 < 1. \]

3. Domestic textile supply

\[ STD_t = PT_{D_t} + MT_{I_t} - XT_{I_t} \]  

(3)

4. Domestic textile demand

\[ DTD_t = c_0 + c_1 (HTWR_{t-1} / HTDR_t) + c_2 HGDR_{t-1} + c_3 UTKTR_{t-1} + \\
    c_4 BBM_{t-1} + c_5 (IRR_{t-1} - IRR_{t-1}) + c_6 T + c_7 DTD_{t-1} + U_3 \]  

(4)

The estimation parameter sign expected in the equation is:

\[ c_1, c_2, c_3, c_4, c_5 < 0; \ c_6 > 0 \text{ and } 0 < c_7 < 1. \]

5. Indonesian textile import

\[ MT_{I_t} = d_0 + d_1 HMTIR_{t-1} + d_2 (HTWR_t / HCWR_t) + d_3 TFTP_{t-1} + d_4 ERIR_{t-1} + \\
    d_5 (GDPIR_t / GDPIR_{t-1}) + d_6 POPI_{t-1} + d_7 T + d_8 MT_{I_{t-1}} + U_4 \]  

(5)

The estimation parameter sign expected in the equation is:

\[ d_1, d_2, d_3, d_4, d_7 < 0; \ d_5, d_6 > 0, \text{ and } 0 < d_8 < 1. \]
6. Domestic textile price

\[ HTDR_t = e_0 + e_1 STD_{t-1} + e_2 (HGDR_t - HGDR_{t-1}) + e_3 (HTWR_t - HCWR_{t-1}) + e_4 HTDR_{t-1} + U_5 \]  

The estimation parameter sign expected in the equation is:

\( e_1 < 0; e_2, e_3 > 0 \) and \( 0 < e_4 < 1 \).

7. World textile price

\[ HTWR_t = f_0 + f_1 XTW_t + f_2 MTW_{t-1} + f_3 HTWR_{t-1} + U_6 \]

The estimation parameter sign expected in the equation is:

\( f_1 < 0; f_2 > 0 \) and \( 0 < f_3 < 1 \).

8. World textile export

\[ XTW_t = XTI_t + XTG_t + XTA_t + XTC_t + XTR_t \]

9. World textile import

\[ MTW_t = MTI_t + MTL_t + MTA_t + MTC_t + MTR_t \]

10. Domestic garment production

\[ PGD_t = g_0 + g_1 (HGWR_t - HGDR_{t-1}) + g_2 (HTDR_t - HTDR_{t-1}) + g_3 HCWR_{t-1} + g_4 (IRR_t - IRR_{t-1}) + g_5 UTKGR_{t-1} + g_6 BBMR_t + g_7 T + g_8 PGD_{t-1} + U_7 \]

The estimation parameter sign expected in the equation is:

\( g_1, g_7 > 0; g_2, g_3, g_4, g_5, g_6 < 0 \) and \( 0 < g_8 < 1 \).

11. Indonesian garment export

\[ XGI_t = h_0 + h_1 HGWR_t + h_2 (HTWR_t - HGDR_{t-1}) + h_3 PGD_t + h_4 ERIR_{t-1} + h_5 DKG + h_6 T + h_7 XGI_{t-1} + U_8 \]
The estimation parameter sign expected in the equation is:

\[ h_2, h_5 < 0, \ h_1, h_3, h_4, h_6 > 0 \text{ and } 0 < h_7 < 1. \]

12. Domestic garment supply

\[ \text{SGD}_i = \text{PGD}_i + \text{MGI}_t - \text{XGI}_t \] .... (12)

13. Domestic garment supply

\[ \text{DGD}_t = i_0 + i_1(\text{HGWR}_t/\text{HTWR}_{t-1}) + i_2(\text{HGDR}_t*\text{ERIR}_t) + i_3(\text{GDPIR}_t/\text{POPI}_t) + i_4(\text{MGI}_t-\text{MGB}_{t-1}) + i_5\text{DGD}_{t-1} + U_9 \] .... (13)

The estimation parameter sign expected in the equation is:

\[ i_1, i_2, i_4 < 0; \ i_3 > 0 \text{ and } 0 < i_5 < 1. \]

14. Indonesian garment import

\[ \text{MGI}_t = j_0 + j_1\text{HMGIR}_t + j_2(\text{HGWR}_t-\text{HGWR}_{t-1}) + j_3\text{TGF}_t + j_4\text{PGD}_{t-1} + j_5\text{ERIR}_t + j_6(\text{GDPIR}_t/\text{POPI}_t) + j_7\text{MGI}_{t-1} + U_{10} \] .... (14)

The estimation parameter sign expected in the equation is:

\[ j_1, j_2, j_3, j_4, j_5 < 0; \ j_6 > 0 \text{ and } 0 < j_7 < 1. \]

15. Domestic garment price

\[ \text{HGDR}_t = k_0 + k_1(\text{DGD}_t/\text{DGD}_{t-1}) + k_2(\text{HTWR}_t-\text{HTWR}_{t-1}) + k_3(\text{HTWR}_{t-1}/\text{HTWR}_t) + k_4\text{T} \]

\[ k_5\text{HGDR}_{t-1} + U_{11} \] .... (15)

The estimation parameter sign expected in the equation is:

\[ k_1, k_2, k_3, k_4 > 0; \ k_5 < 0 \text{ and } 0 < k_6 < 1. \]

16. World garment price

\[ \text{HGWR}_t = l_0 + l_1\text{XGW}_t + l_2\text{MGW}_{t-1} + l_3\text{HGWR}_{t-1} + U_{12} \] .... (16)
The estimation parameter sign expected in the equation is:

\[ l_1 < 0; l_2 > 0 \text{ and } 0 < l_3 < 1. \]

17. World garment export

\[ XGW_t = XGI_t + XGG_t + XGC_t + XGT_t + XGR_t \]

(17)

18. World garment import

\[ MGW_t = MGI_t + MGG_t + MGA_t + MGJ_t + MGR_t \]

(18)

2.3. Empirical Review on Textile and Textile Products

2.3.1. Empirical Review on Textile and Textile Products in Indonesia

The study by Pracoyo (1995) is related to the export of textile industries which used the time series data of 1983-1992 and estimation methods Two Stage Least Squares (2SLS). Pracoyo adopted the model of export supply and demand which had been carried out by Muscatelli, Srinivasan, and Vines (1992). The result showed that Indonesian textile export supply is influenced by the textile price, raw material costs, wages, rates, and technology. While the textile export demand side is influenced by the textile price, world textile prices, the price of substitute goods (the world price of wool), other countries’ revenues, and consumer tastes. It is also concluded that (1) tariff reduction will encourage a more competitive world trade. Tariff reduction by 30 percent would encourage a more competitive world trade, (2) granting wage by 1 percent would reduce the quantity supplied by 4.5 per cent. This occurs because wages belongs to the component cost in production, and (3) changes in technology, which is demonstrated by the trend variable, encourage more efficient textile production.

The research using Ordinary Least Squares (OLS) estimation methods was conducted by Wintala (1999). The conclusion that can be drawn from his analysis of the factors that influence the Indonesian textile exports to the United States, Britain, and Japan in 1978-1997, is that the trend of Indonesian textile exports to the United States, Britain, and Japan is positive and statistically significant. Devaluation of the rupiah, the rising foreign exchange reserves, population increase, and clothing price index tend to increase the export volume of Indonesian textiles.

Istojo (2002) analyzed the structure of the Indonesian textile industry on the World Trade Organization (WTO) in 2005. The method used is the description of the industry characteristics, the five forces model, driving forces, and key success factors. The result is that that the textile
industry is a highly dependent to suppliers and buyers as well as intense competition among companies in the Indonesian textile industry. Implementation of the WTO in 2005 intensifies the competition and struggle for markets at home and abroad. The implementation of the WTO will also alter the structure of the textile industry into mass customization which tend to the non-price factors and is fully supported by the principle of quick response and just in time stock. It is also noticed that textile companies must be able to do a lot of manufacturing innovation that will increase product differentiation.

Agustineu (2004) studied the factors that affect the output of textile industry in West Java using the Cobb Douglas model, in year 1980-2001. The result is that the capital, raw materials, and fuel give a positive influence to the increase of the output of textile industry in West Java. Labor factor causes the opposite effect with the factors aforementioned. The textile industry in West Java is in the Increasing returns to scale condition.

2.3.2. Study Review on World Textile and Textile Products

Mlachila and Yongzheng (2004) used the General Trade Analysis Project (GTAP) to analyze the end of the textile quotas with a case study in Bangladesh. There are three factors that affect the performance of textile and apparel exports of Bangladesh in the 1990s, which are low wages, net flows of foreign direct investment (FDI), and quotas imposed in the competitor countries. Bangladesh faced serious problems with competitiveness after quota system ended, because of the weak infrastructure and a variety of macro-climate that was not supportive. The simulation results showed that Bangladesh exports would decline after the abolition of quotas and this would affect the Balance of Payment (BOP).

WTO (2004) utilized the GTAP to describe the condition of the global textile industry after the end of the ATC. China and India are two countries that will dominate the textile market of the European Union, United States, and Canada after the quota system ended. Even China is expected to take up to 50% share of world textile market. In addition, vertical specialization in the textile supply chain is very important, and the countries with a geographical proximity will benefit much from bilateral agreements and lower rate. The important findings for Indonesian textile industry are the change of textile market share in EU and US markets. In the EU market Indonesia will gain an increase of market share by 1 percent (from 4 percent to 5 percent) for the garment market after quotas expire. As for the textile markets, Indonesia will experience a stagnancy (from 3 percent to 3 percent). In contrary in the U.S. market, textile Indonesia will be stagnant (from 3 percent to 3 percent). The decline occurred for garment commodity in the U.S. market (from 4 percent to 2 percent).
The various research studies on the textile industry, in general give an overview of the textile export growth and the factors that influence it, both at national and international levels. Also, many studies make predictions on the development of post-quota textile industry in 2005. However, there are still parts that have not been elaborated in depth by previous researchers. The linkage between the Indonesian market and world markets plays an important role in reviewing the development of Indonesian textile industry. Aggregate and descriptive research of textile industry tends to lead to a non-specific conclusion, while the micro-scale research will also result in conclusions that cannot be generalized. Therefore, on this occasion the development of the textile industry will analyzed holistically, both the textile and garment industry, by linking the textile industry simultaneously through economic variables, including monetary and fiscal policy.

III. METHODOLOGY

The main analytical tool used is the time series econometric, which is useful to analyze the factors through sign and size of estimation parameter of each behavior equation and prospects for the development of Indonesian textile industry through forecasting simulation. Besides, all structural equation have undergone a model specification by trial and error so that in the end it will generate the equations that are based on the necessity and sufficiency terms in arranging simultaneous equations without neglecting the basic assumptions of regression equation (multicollinearity, homoscedasticity, and autocorrelation).

3.1. Analysis Procedure

According to the order condition, equation can be identified if the number of variables included in the equation is greater than or equal to the sum of all the endogenous variables minus one. Formula identification of structural models according to the order condition (Koutsoyiannis, 1978) is as follows:

\[(K - M) > (G - 1)\]  \(\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad}\]
If an equation in the model shows the condition \((K - M) > (G - 1)\) then the equation is **over identified**, if \((K - M) = (G - 1)\) then the equation is **exactly identified**, and if \((K - M) < (G - 1)\) then the equation is **under identified**. There are 30 equations in structural model of this study, consisting of 24 behavioral equations and 6 identity equations. There are 24 endogenous variables \((G)\) and 80 predetermined variables. The total number of variables included in the model \((K)\) is 104. According to the formula of model identification with the criteria order condition, then each equation is **over-identified**.

If the equation in the structural model is all over identified then this equation can be predicted by using the Limited Information Maximum Likelihood (LIML), Full Information Maximum Likelihood (FIML), Two Stage Least Squares (2SLS) or Three Stage Least Squares (3SLS). The method used in this study to predict the structural estimation parameters is 2SLS. 2SLS method is established with the assumption that (1) the requirement must meet the assumption of zero stochastic disturbance, constant variance and covariance equal to zero, (2) specification of the structural model is exactly precise as far as the predetermined variables, (3) the number of observation samples is greater than the amount of predetermined variables in the model, and (4) explanatory variables do not experience a perfect collinearity. By considering these assumptions, the DW (Durbin Watson) statistic is not valid to predict the structural equations of the simultaneous equations model, especially in the presence of time-different endogenous variables.

The data processing to estimate the economic model is done by using the computer software program SAS, version 6.12. To test the explanatory variables, the F statistical test is simultaneously conducted, while to test the individual explanatory variables, the t statistical test is used.

**Validation of an economic model aims at analyzing on how far a model can represent the reality.** The statistical criteria used for the validation of economic model estimation are the Root Means Square Error (RMSE), Root Means Square Error Percent (RMSPE), and Theil's Inequality Coefficient (U-Theil).

**RMSPE statistic** is used to measure how far the values of the endogenous variables from the estimation deviate from the actual flow values in the relative size (percent); while value-Theil U statistic is to determine the ability of the model in analyzing the forecasting simulation. Theil U-value ranges between 1 and 0. If the U-Theil = 0 then the estimation model is perfect, if the U-Theil = 1 then the estimation model is naive. To view the closeness of the direction (slope) between the actual and simulated results, we observe the coefficient
of determination (R<sup>2</sup>). Basically, the smaller the value of RMSPE and U-Theil and the greater the value of the coefficient of determination, the better the estimation model.

The policies that are simulated, for the forecasting (ex-ante) year 2007-2012, are the decline in interest rates in Indonesia, the adjustment of the exchange rate of Rupiah/US$, the increase in textile industry production cost through wages and fuel prices, the increase of Indonesia’s GDP, the increase of Indonesia’s population, the increase of US GDP, the increase of China’s GDP, and the elimination of textile tariffs, along with its combinations.

### 3.2. Source and Type of Data

The type of data used in the econometric model is secondary time series data of 1980-2006. The data is extracted from official publications, such as the Indonesian Textile Association (Asosiasi Pertekstilan Indonesia/API), the Central Statistics Agency (Bapan Pusat Statistik/BPS), United Nations Conference on Trade and Development (UNCTAD), United Nation (UN), International Monetary Fund (IMF), WTO, Ministry of Commerce, Ministry of Industry, Jakarta daily publications, and internet.

All the data in rupiah unit are deflated using the Consumer Price Index (CPI) of Indonesia in 2000 (2000=100) and the variables in US$ unit are deflated using CPI proxy United States in 2000 (2000=100). This is done to eliminate the effects of inflation.

### IV. RESULT AND ANALYSIS

#### 4.1. The Economic Model Structure of Indonesian Textile and Textile Products

**a. Indonesian Textile Productions**

The performance of Indonesian textile production in the level of 98 can be explained by the lag of Indonesian textile prices, the lag of world cotton prices, the interest rates, the lag of textile workers wage, the lag of fuel prices, the time trend, and the lag Indonesian textile production. All estimation parameters are in line with expectations and all variables statistically give a significant effect.

The lagging estimation parameter coefficient of Indonesian textile prices is positive at the level of 0.514. This means if there is a price lag increase of Indonesian textiles at 10 US$ per ton, the Indonesian textile production will rise by 5140 thousand tons, ceteris paribus. The improvement Indonesia’s textile production that is in line with the increase of textile prices in
Indonesia indicates that the price of Indonesian textiles is an economic signal for textile manufacturers in producing textiles in Indonesian market.

The main raw materials of textiles are textile fibers which have an irreplaceable advantage compared to the non-cotton materials, one of which is easy to absorb sweat and its hygroscopic characteristic. Therefore, the world cotton price changes affect the dynamic of Indonesian textiles production. According to Istojo (2002) Indonesian textile industry is very dependent on suppliers and buyers. More than 85 percent of cotton for the Indonesian textile industry is imported from Australia, United States, China, India, Pakistan, Tanzania, and others. This is because cotton has not been maximally cultivated in the country. In this study, Indonesian textile production is also influenced significantly by the lag of the world cotton price in the opposite direction. If the lagging world price of cotton increase by 10 US. $ Per ton, it will lower the Indonesian textile production by 354,812 tons, ceteris paribus. In the short term and long term, Indonesian textile production is very responsive to lag of world cotton prices.

Bank interest rate bank is proxied with bank interest rate for investment activities. Interest rates contributed negatively to Indonesian textile production. If the bank raised interest rates through monetary policy by 1 percent, ceteris paribus, then it would lower the Indonesian textile production by 2,410 thousand tons. This condition reduces incentives for manufacturers, thereby reducing the production of textiles in Indonesia up to 0.053 percent and 0.772 percent, respectively in short and long term.

Textile industry employs many workers that the wage labor became one of the important components of production costs in the sustainability of the production process. Wage labor in the textile sector has a significant effect on Indonesian textile production in a negative direction. If the amount of wage labor in the textile sector is increased by Rp. 1,000,000 per capita per year, it will decrease the production of textiles to 0.110 thousand tons of Indonesia, ceteris paribus. The response of Indonesian textile production to wage labor is inelastic in the short term and elastic in the long term. As examined by Pracoyo (1995) that the wage labor is statistically significant in affecting Indonesian textile production.

In addition to labor costs, fuel prices (especially diesel and fuel oil) also contribute to the costs of production in the textile sector. A fuel price is negatively related to the production of textiles of Indonesia and its effect is statistically significant. If the fuel price increases by Rp.10 per liter, it will lower the Indonesian textile production as much as 1,444 thousand tons, ceteris paribus. In the short and long term, the Indonesian textile production is less responsive to fuel prices.
Time showed an increasing tendency of Indonesian textile production amounting to 51,830 thousand tons. It is strongly related to the garment industry which is in desperate need of the textile industry output as raw material. Indonesian textile production lag can also become basic information for manufacturers to produce in the next year. If the lag of textile production increases by 1,000 tons, then in the following year the product will increase by 0.720 thousand tons, ceteris paribus.

b. Indonesian Textile Export

Indonesian textile exports equation has a high determination coefficient (0.961) which indicates the high ability of explanatory variables in explaining the behavior of Indonesian textile exports. All explanatory variables have estimation parameter sign according to expectations. However, not all variables have a significant effect on the Indonesian textile exports. The variables with significant effect are the change in the price of Indonesian textiles, world textile trade integration dummy, and lag of textile export.

The increasing Indonesian textile price will be an incentive for manufacturers to start producing. If the change in Indonesian textiles prices rises by US$ 10 per ton, it will lower the Indonesian textile exports up to 5854 thousand tons, ceteris paribus. In the short term, the response of Indonesian textile exports to changes in the price of Indonesian textiles is inelastic and the elastic in the long term.

The world textile trade had a significant change from the 1950s until 2005. The integration phase of textile trade in accordance with the GATT began in 1995 until 2005. The process reduced the number and types of textile import quotas from importing countries, such as the United States, Canada, the European Union, Finland, Norway and Turkey. These conditions caused an impact on Indonesian textile exports. In this study the textile trade integration dummy significantly affect Indonesian textile exports. The process of integration of textile trade for 10 years cut the Indonesian textile exports up to 134,367 thousand tons.

The lag of Indonesian textile exports also significantly influence Indonesian textile exports in the following year. This shows that Indonesian textile exports may not be quick enough to adjust back to equilibrium level, or in other words, Indonesian textile exports is relatively unstable.

c. Indonesian Textile Supply

The Indonesian textile total supply is the sum of textile production, textile imports, and textile exports of Indonesia. Based on this identity relationship, any change in the textile
production, textile imports, and textile exports caused by the government intervention, among others, through the instruments of monetary and fiscal policies, will affect the amount of textiles that are available in Indonesia market. The magnitude of change in Indonesian textiles supply depends on the elasticity of the textile production, textile imports, and also textile exports of Indonesia, both directly and indirectly.

d. Indonesian Textile Price

The value of determination coefficient of the Indonesian textiles price equation is 0.833. This indicates the high ability of explanatory variables in explaining the price behavior of Indonesian textiles. The estimation parameter sign in the structural equation has also been in line with the expectations, and the variables which significantly affected the price of Indonesian textiles are the changes in Indonesian garment prices, and the lag of Indonesian textile price.

The changes in the price of Indonesian garment significantly affect the price of Indonesian textiles in a positive manner. If changes in Indonesia’s garment prices rise by US$ 100 per ton, it will stimulate the Indonesian textile price to increase by US$ 0.819 per ton, ceteris paribus. The response in the short and long term is the inelastic; this shows that Indonesian textile prices are less responsive toward the price changes in Indonesia’s garment.

In addition to changes in Indonesia’s garment prices, the lag of Indonesian textiles price is also very significant. This indicates that the price of Indonesian textiles requires a slower adjustment to reach the equilibrium level, or in other words the price of Indonesian textiles is relatively unstable. If the lag of Indonesian textile prices increases by US$ 10 per ton, it will increase the price of Indonesian textiles next year amounting to US$ 6.889 per ton, ceteris paribus.

e. Indonesian Textile Demand

Indonesian textile demand equation has a quite high determination coefficient at 0.819. This situation illustrates the high ability of explanatory variables in explaining the behavior of demand for Indonesian textiles. Demand for Indonesian textiles is explained by changes in textile price of Indonesia, lag of Indonesia’s garment prices, lag of wage labor, changes in interest rates, time trends, and the lag of demand for Indonesian textiles. All estimation parameter sign meet the expectations. The lag of Indonesia’s garment prices, lag of wage labor in the textile industry, and lag of demand for Indonesian textile significantly affect the demand for Indonesian textiles.
The lag of Indonesia’s garment prices has the opposite relationship with the demand for Indonesian textiles. If the lag garment prices rises by US$ 10 per ton, the Indonesian textile demand would decrease by 0.270 thousand tons, ceteris paribus. In addition, Indonesian textile demand is less responsive to the lag of price changes of Indonesian garment, either in the short and long term. The demand for Indonesian textiles is a reflection of demand for textiles by textile industry itself and in the end the output of textile industry will be used as the input by the garment industry.

The lag of wage labor in the textile sector contributes in affecting the change of demand for Indonesian textiles. If the lag of wage labor rises by 1 percent, it will lower demand for Indonesian textiles by 0.715 percent in the short term and 1.856 percent in the long term. Textile demand is a derived demand for the garment industry. The information about the lag of demand for Indonesian textiles plays an important role to estimate the demand for Indonesian textiles in the following year. If the lag of demand for Indonesian textiles increases by 1000 tons, there will be a tendency to increase the demand for Indonesian textiles in the following year as much as 0.615 thousand tons, ceteris paribus.

f. The Indonesian Textile Import

Based on the estimation result, only the lag of Indonesian textile imports significantly influence Indonesian textile imports for the following year. This shows that Indonesian textile imports require a relatively slower time to adjust back to equilibrium levels.

g. Indonesian Garment Production

The performance of Indonesian garment production can be explained as much as 0.939 by its explanatory variables. The variable estimation parameters sign in the structural equation have also been in line with expectations. Variables that are significantly influential are the lag of garment labor wages, time trends, and garment production lag.

Similar to the textile industry, garment industry also employs many workers. There are several parts in the garment production process, such as sewing, which cannot be entirely replaced by machine. The high employment of labor will affect the cost of production. Lag of garment workers wage in this study is very different statistically. If there is an increase of garment workers’ lag by Rp. 1 million per capita per year, it will reduce the Indonesia’s garment production as much as 0.055 thousand tons, ceteris paribus. In the short term, the Indonesian garment production is less responsive, compared to the long term.
Besides the garment workers’ wages’ lag, the time trend is also very real influential on Indonesian garment production. Garment is a product which is strongly associated with fashion trends and dynamically changes according to the development of time. Based on time trends, Indonesia’s garment production increased by 26,869 thousand tons. Also the garment production lag becomes information to produce the garment the following year. If the lag of Indonesian garment production increases by 1,000 tons, the Indonesian garment production the following year will increase by 0.453 thousand tons, ceteris paribus.

**h. Indonesian Garment Export**

The performance of Indonesian garment exports at 0.952 can be explained by its explanatory variables. The variable estimation parameter sign in the structural equation has also been in line with expectations. Indonesia’s garment exports is explained by the ratio of the world garment price lag with the world textile prices, the price of Indonesian garment products, ratio of Indonesian garment production with Indonesian garment production lag, lag of rupiah exchange rate against the US$, the world textile trade integration dummy, and lag of Indonesian garment exports. From these six variables, only the lag of exchange rate of rupiah against the US dollar and the lag of Indonesian garment exports give a significant effect.

Exportation of garments is associated with the exchange rate of rupiah against the US$. The depreciated rupiah will increase the competitiveness of Indonesian garment products. The lag of rupiah exchange rate against the US$ significantly change the short-term elasticity by 0.310 and the long-term by 1.353. This means that if the lag of the rupiah exchange rate against US$ is depreciated by 10 percent, the Indonesian garment exports will increase by 3.10 percent in short term and 13.530 percent in long-term or elastic, ceteris paribus.

The coefficient of lag of Indonesia’s garment exports has a positive estimation parameter outcome at 0.771. This means that if the lag Indonesia’s garment exports increases by 1000 tons, then Indonesia’s garment exports the following year will increase by 0.771 thousand tons, ceteris paribus.

**i. Indonesian Garment Supply**

The total supply of Indonesian garment products is the identity equations from Indonesian garment production, imports, and exports. The magnitude of changes in Indonesian garment supply depends on the elasticity of the Indonesia garment production, imports and also exports, either directly or indirectly.
**j. Indonesian Garment Price**

Indonesian garment price equation has a high determination coefficient value at 0.889. This demonstrates the high capability of explanatory variables in explaining the behavior of Indonesia's garment prices. The variable estimation parameter sign has also been in line with the expectations. Indonesia's garment prices can be simultaneously explained by the ratio of demand for Indonesian garment with Indonesian garment production lag, lag of world garment prices, world textile price changes, and lag of the Indonesian garment price.

The only variable that is significantly influential is the lag of Indonesian garment price. The information of price lag becomes important to set prices in the following year. Lag of Indonesian garment prices brings a highly significant effect whose coefficient is positive at 0.861. This means that if the lag of Indonesia's garment prices rises by 1,000 tons, then Indonesia's garment prices will increase by 0.8261 thousand tons at the following year, ceteris paribus.

**k. Indonesian Garment Demand**

The performance of Indonesian garment demand is explained simultaneously by the world garment price, the textile price changes in Indonesia, Indonesia's GDP per capita, the changes in secondhand garments imports of Indonesia, the world textile trade integration dummy, and the lag of demand for Indonesian garment. There are three of these five variables that significantly influence the change in demand for Indonesian garment.

Price is an important factor affecting the dynamics of the demand, which is aligned with the results of this research. Indonesia's garment prices bring statistically significant effect in a negative manner. Meanwhile, based on its elasticity, the short-term elasticity would be at 0.387 percent and at 0.553 percent for the long term. This can be interpreted in particular, that any increase in the price of Indonesian garment products as much as US$ 10 per ton, it will lower the demand for Indonesian garment by 3,870 thousand tons in the short term and by 5,530 thousand tons in the long run, ceteris paribus.

GDP per capita of Indonesia give a noteworthy effect in a unidirectional relationship with changes in demand for Indonesian garment. If Indonesia's GDP per capita increased by Rp. 1 billion, it will stimulate an increase of demand for Indonesian garment products by 0.011 thousand tons, ceteris paribus. The response of Indonesian garment demand to Indonesia's GDP per capita is inelastic, both in the short and long term.
The textile import quota policies are considered discriminative. Traditional markets, such as those in the United States, Canada, the European Union, Finland, Norway and Turkey limit the amount of imports coming from Indonesia. Based on the results of the study, it is noted that when the world textile trade integration is applied, it will increase the demand for Indonesian garment products by 66,548 thousand tons, ceteris paribus. Also the lag of demand for Indonesian garment also significantly affects the demand for Indonesian garment the following year. If the lag of demand for Indonesian garment products increases by 1,000 tons, it will raise the demand for Indonesian garment the following year by 0.300 thousand tons, ceteris paribus.

I. Indonesian Import Garment

Indonesian garment imports are described by the Indonesian garment import prices (in rupiah), the changes in world garment prices, the lag of garment import tariffs, the lag of Indonesian garment production, the lag of Indonesian total population, Indonesia’s GDP ratio to the lag of Indonesia’s GDP, and the lag of Indonesian garment imports. Among these variables, the ones with significant effect are the change of world garment prices, the lag of garment import tariffs, the lag of Indonesian garment production, and the lag of Indonesian garment imports.

The coefficient of estimation parameter in the world garment price change is at 0.006 toward the opposite direction. This means that with an increase of the world garment prices by U.S. $ 10 per ton, the Indonesian garment imports will decrease by 0.064 thousand tons, ceteris paribus. Meanwhile the response of Indonesian garment imports, both in the short and long term, is inelastic.

The lag of garment import tariffs is affecting Indonesian garment imports toward the opposite direction. This means an increase of lag garment import tariff by 1 percent, will lower the Indonesian garment imports by 2,119 thousand tons, ceteris paribus. In both the short and long term, the Indonesian garment imports are elastic to the lag of garment import tariffs.

The Indonesian garment imports are also influenced by the lag of Indonesian garment production. Shall the lag of Indonesian garment production increase by 1000 tons, the Indonesian garment imports will decrease by 0.221 thousand tons, ceteris paribus. The response of Indonesian garment import to the lag of Indonesian garment production is elastic, both in the short and long term.

The other variable that is also statistically significant is the lag of Indonesian garment imports. The coefficient of lag of Indonesia’s garment imports is positive at 0.615. This means
that if the lag of Indonesian garment imports increase by 1000 tons, the Indonesian garment imports the following year will increase by 0.615 thousand tons, ceteris paribus.

4.2. Economic Model Validation of Indonesian Textile and Textile Products

From the 30 equations that form the model, 27 equations have the RMSPE value below 50 percent, and 1 equation has RMSPE value between 50 to 100 percent, and 2 RMSPE equations have a value above 100 percent. This means that the predicted value can well follow the historical trend data. Meanwhile based on the U-Theil, 29 equations have a U-Theil value below 0.20, and there is an equation which has a U-Theil value above 0.20. This means that the simulation model follow the actual data quite well. Based on all the above criteria, then the constructed economic model has a sufficient and valid forecasting ability to perform simulations of macroeconomic policy alternatives via forecasting simulation (ex-ante).

Table 2.
The Impact of Macroeconomic Policies toward the Change of Endogenous Variable
Average Value Year 2007-2012

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>The Change by Simulation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Indonesian Textile Production (PTD.)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Indonesian Garment Production (PGD.)</td>
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</tr>
<tr>
<td>Indonesian Textile Demand (DTD.)</td>
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</tr>
<tr>
<td>Indonesian Garment Demand (DGD.)</td>
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</tr>
<tr>
<td>Indonesian Textile Supply (STD.)</td>
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<tr>
<td>Indonesian Garment Supply (SGD.)</td>
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</tr>
<tr>
<td>Indonesian Textiles Price (HTDR)</td>
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</tr>
<tr>
<td>Indonesian Garment Price (HGDR)</td>
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</tr>
<tr>
<td>Indonesian Textile Exports (XTI)</td>
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<tr>
<td>Indonesian Textile Imports (MTI)</td>
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</tr>
<tr>
<td>World Textile Price (HTWR)</td>
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<tr>
<td>World Garment Price (HGWR)</td>
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<tr>
<td>Indonesian Garment Imports (MGI)</td>
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<tr>
<td>World Textile Imports (MTW)</td>
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<tr>
<td>World Garment Exports (XGW)</td>
<td>0.0000</td>
</tr>
<tr>
<td>World Garment Imports (MGW)</td>
<td>0.0000</td>
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</tbody>
</table>

Description:
Simulation 1: The bank interest rate falls by 5 percent.
Simulation 2: Adjustment of rupiah exchange rate = Rp. 9 000/US $.
Simulation 3: Wages of textile and garments labor rise respectively by 14.5 percent and 15 percent.
Simulation 4: Liberalization of trade.
Simulation 5: Combination 4, Indonesia's GDP increases by 8 percent, and Indonesia's population increases by 1.1 percent.
Simulation 6: Combination 3, 5, Indonesia’s GDP increases by 8 percent, Indonesia’s population increases by 1.1 percent, GDP of USA increases by 3.1 percent, and China’s GDP increases by 8.5 percent.
4.3. Simulation Result

Table 2 presents the results of simulation of macroeconomic policies on the development of textile industry in Indonesia.

**a. Reduction of Bank Interest Rate**

The policy to lower the bank interest rates by 5 percent is one of the monetary policies that can increase the production of Indonesian textiles. The textile industry is a capital-intensive industry compared with the garment industry. However, a mere 5 percent of bank interest rate cut is not used by textile manufacturers in Indonesia to increase textile production. This does not bring any change to the Indonesian textile exports. Meanwhile, an Indonesian textile import has declined by 0.002 percent. In total the Indonesian textiles supply increased by 0.057 percent. While the decline in Indonesian textile supply does not change the price volatility of Indonesian textiles therefore Indonesian textile demand was also unchanged.

The Indonesia’s garment prices that did not change, as the output price for the garment industry, contribute in reducing the Indonesian garment production by 0.005 percent. A decline in garment production will then encourage the reduction in Indonesia’s garment exports by to 0.003 percent. On the other hand garment imports increase by 0.079 percent. In total, the Indonesian garment supply slightly increases by 0.0002 percent. A decrease in bank rate by 5 percent will less likely motivate the people to save. This makes the demand of garments increase by 0.0002 percent.

**b. Adjustment of Exchange Rate at Rp. 9,000 to US$**

The exchange rate that relatively does not fluctuate will assist manufacturers in calculating and determining the production costs and business risks. Therefore monetary policy is able to improve the exports of Indonesian textile and garment, respectively by 6.059 percent and 21.676 percent. At the same time this will also increase textile imports by 0.167 percent and reduce garments imports by 5.175 percent. The total supply of Indonesian textiles and garments decreased, respectively by 11.924 percent and 63.908 percent.

This declining supply of Indonesian textile will cause textile price to increase by 0.534 percent, so the demand for Indonesian textiles will decline by 0.282 percent. Indonesian textile price increases in turn will make the Indonesian garment production decreasing by 0.002 percent.
The exchange rate adjustment policies also increase the Indonesian garment exports by to 21,676 percent. Indonesian garment prices decline by 0.722 percent will stimulate even more the increase in exportation, reduce the Indonesian garment products by to 5.175 percent, and increase demand for Indonesian garment by 0.129 percent. Additionally the other impact is the decline in Indonesia’s garment production by 0.002 percent. In total, Indonesian garment supply decrease by 63.908 percent.

c. Increase of Labor Wage in Textile and Garment Industry

Textile and garment industry employs many workers, especially the female ones. The policy to increase labor wages in both sectors respectively 14.5 percent and 15 percent will push down the textile and garment production. Indonesian textile production decreases by 25.411 percent. Indonesian textile exports will be suppressed by 8.965 percent and Indonesian textile imports will increase by 0.552 percent. In total, Indonesian textile supply decreases by 34.307 percent.

The decline of Indonesian textile supply will raise the Indonesian textiles price by 1.804 percent. The following impact is the decline of demand for Indonesian textiles by 73.455 percent. The increase of Indonesian textile price will lower the Indonesian garment production by 12.630 percent. Indonesia’s garment exports at the following step will also experience a decline by 4.798 percent. Indonesian garment imports will increase by 125.151 percent, so that in total; Indonesian garment supply will decline by 18.735 percent.

Besides Indonesian garment prices rises by 1.283 percent, as an indirect result of the increase of wage labor. Ultimately this will create the demand for Indonesian garments to decline by 0.237 percent.

d. Liberalization of Textile and Textile Products Trade

Liberalization of trade with the tariff reduction to zero percent as a form of the trading policy, eventually gives an impact to the increase of Indonesian textile imports by 13,735 percent. The decline of domestic textile production amounted to 0.290 percent will further increase the imports. The increase of Indonesian textile imports will increase the Indonesian textile supply by 12.433 percent. It turns out that the increase in the textile supply push down the Indonesian textile price by 0.601 percent, in which the demand for Indonesian textiles increases by 0.376 percent. The Indonesian textile prices, which also fall, are responded by Indonesian textile exports which increase by 0.148 percent.
Garment import tariff reduction to zero percent will increase Indonesian garment imports by 179.891 percent, so that in total the Indonesian garment supply increases by 21.950 percent. On the other hand, an Indonesian garment price, which increases by 0.481 percent, causes the demand Indonesian garment to decrease by 0.092 percent. The increasing price of Indonesian garment is an incentive for Indonesian garment manufacturers to increase production, amounting to 0.001 percent. In addition, the rising Indonesian garment prices also encourage the increase of exports by 0.024 percent of future.

**e. The Increase of Labor Wage in Textile and Garment Sector, the Increase of GDP of Indonesia and the Increase of Total Population of Indonesia**

The combination of the increased labor wage policy in the textile and garment sector, the increase of Indonesian GDP by 8 percent, and the demographic policies through the increased population by 1.1 percent, makes the Indonesian textile production declines by 25.411 percent, which subsequently encourages the decline in Indonesian textile exports by 8.965 percent. In addition, Indonesian textile imports increase by 0.763 percent. In total the Indonesian textile supply decreases by 34.115 percent. The decline of textile supply will increase the price of Indonesian textiles by 1.737 percent. In turn, these circumstances cause the demand for Indonesian textiles to decline by 73.456 percent.

The growth of Indonesian GDP and population naturally encourage the increase of demand for Indonesian garment by 3.268 percent. This situation put Indonesian garment prices to improve by 1.443 percent. And also, due to the dominating labor wage in the garment sector in the production costs, the garment industry output price will also increase.

The increase of the Indonesian textile prices as the garment industry input prices can reduce the production of Indonesian garment products by 12.630 percent. Meanwhile, Indonesian garment exports show a decline of 4.801 percent. This is because the increasing domestic garment prices turn out to be appealing for Indonesian garment manufacturer to work on the Indonesian market. Additionally, Indonesian garment imports rise by 126.832 percent. In total Indonesian garment supply decreases by 18.522 percent.

**f. The Increase of Fuel Price, the Liberalization of Textile and Textile Products, the Increase of GDP of Indonesia, USA and China, and the Increase of Indonesian Population**

The fuel price increase policy by 8.5 percent, the trading liberalization, the Indonesian
GDP increase by 8 percent, the increase in Indonesian population by 1.1 percent, the increase of GDP of the USA and China by respectively 3.1 percent and 8.5 percent are able to raise the Indonesian textile production, correspondingly 12.827 percent and 1.585 percent. Therefore, Indonesian textile exports will also increase by 4.926 percent as well as the Indonesian textile imports by 13.524 percent. So in total the Indonesian textile supplier will increase by 29.746 percent. This situation causes the Indonesian textile price to decrease by 1.536 percent, so that the demand for domestic textiles increases by 0.847 percent.

The increase in GDP and population of Indonesia will drive the increase of demand for Indonesian garments by 3.465 percent, so the Indonesian garment prices shall increase by 0.321 percent. Indonesian garment exportation still shows an increase of 1.562 percent as well as the importation of Indonesian garments at 172.297 percent. In total, the Indonesian garment supply increases by 22.412 percent.

The increase of GDP of the United States and China would increase the textile imports of USA by 1.341 percent and of China by 5746 percent. Therefore, the total world textile imports will increase by 2.106 percent, which in turns the world textile prices will increase by 2.262 percent. This price increase will have an impact to the Indonesian garment price increase. As for garment products, the increase in GDP of the United States will encourage the increase of world total garment imports by 0.057 percent. At the end of the increasing world garment imports have not been able to increase the world garment prices. This is because the world total exports increase higher than the imports. The world garment price reduction by 18.690 percent will have an impact on Indonesian textile price declines and the increase of Indonesian garment prices.

4.4. Discussion

The increase in production of textile and garment industry is generally associated with the increase in employment. While exports of textile and garment industries are associated with the acquisition of foreign exchange needed to support the Indonesia’s economic development. Policies that can reduce the production as well as the exports in textile and garment industry are the policy of the labor wages increase in textile and garment sectors respectively by 14.5 percent and 15 percent (simulation 3), the trading liberalization, and the increase in Indonesia’s GDP and population (simulation 5). One of the production cost components that plays a major role in the sustainability of the textile and garment production is the labor. Labors that are required, particularly in the garment industry, are that workers with certain skills without having to possess a high level of education. Therefore, the increase of
employment in the textile industry can ultimately reduce the number of unemployed in the community that in fact occurs as a result of the certain limitations to pursue higher education. The policies to increase the labor costs which is conducted by the government regulation, such as the increase of regional minimum wage, will eventually stimulate a reduction in production and exports, and a rationalization of manpower. Liberalization of trade in textiles and garments which is marked by the elimination of tariffs to zero percent actually tends to increase the volume of Indonesian textile and garment imports. However on the other side, the Indonesian textile exports still show an increase, but not with the Indonesian garment exports. This happens due to the increasing competition among the world’s textile producers, such as China South Asian countries.

The policies that are only capable to increase production and export in one sector are the policy of interest rates increase (simulation 1). This policy reduces the production and export of Indonesian garment and makes the textile production and export stagnant. Textile industry is one of the high-risk industries, so that the banks are less interested in providing investment credit. In general, banks only provide short-term loan or credit (90 percent) and medium term (10 percent) to the textile industry, while the restructuring of the textile industry machinery requires a long-term loan between 10 to 15 years. The textile industry is more capital intensive than the garment industry, so that the restructuring problem is more frequent in the textile industry. The outdated machinery and technologies may affect the productivity of the textile industry.

The policies that are still capable to increase the production and exports in both sectors are shown in the simulation 2, which is the monetary policy through the adjustment of the Rupiah against US$, and simulation 6, which is a combination of wage policy, liberalization, and increase of GDP of Indonesia and some developed countries. Since Indonesia adopts the floating exchange rate regime, the rupiah exchange rate value fluctuates over time. Nevertheless, the Bank Indonesia still can intervene to stabilize it using the monetary policy instrument. A stable rupiah will help exporters and importers in calculating and predicting the costs and as well as future profits.

V. CONCLUSION

The factors that influence the development of Indonesian textile and textile products industry is as follows:
1. Indonesian textile production is influenced in a negative manner by the lag of world cotton price and the lag change in labor of the textile sector. Indonesian garment production is
influenced by the lag of labor wage in the garment sector.

2. Indonesian textile exports to the world markets are elastic in the long run towards the changes of Indonesian textile prices. Meanwhile, Indonesian garment exports in the world markets are affected by the lag of exchange rate against US$.

3. The demand for Indonesian textiles has an elastic response to the lag of labor wage of the textile sector, and the demand for Indonesian garment is influenced in a positive direction by the income per capita of Indonesian population of Indonesia.

Based on the conducted policy simulations, it can be concluded that:

1. The policies that can increase the production and exports in textile and garment industry are (1) the single policy through the adjustment of the rupiah exchange rate against US$ and (2) the combination of policies to raise the wages, trade liberalization policies, and the increase of GDP of Indonesian some other developed countries as a potential form of the world textile market.

2. The policies that reduce the production and export in the textile and garment industry are (1) the single policy through the increase of labor wage in the textile and garment industry and (2) the combination of the increase of the labor wage in the textile and garment industry, the increase in GDP of Indonesia, and the demographic policies through Indonesia's population growth.

Overall from the estimation result, of this parameter coefficient and the policy simulations, shows an increase in the interest rates for investment activities, fuel, and also the labor wage in the textile and garment sector, which at the same time can reduce the domestic production of textiles and garments in the future. World cotton prices also affect the decline in Indonesian textile and garment exports. Meanwhile the exchange rate adjustment will encourage an increase of Indonesian textiles and garments exports in the period of 2007 to 2012.

This conclusion provides some implications as follows:

1. The increasing production of the Indonesian textile industry may encourage further employment. Therefore economic incentives are necessary, among which is the reduction of banking interest rates for investment.

2. The increasing Indonesian textile exports may improve the revenue of the country. The increasing exports of textiles and clothing can be triggered by the exchange rate adjustments at Rp 9000/US$. The relatively stable exchange rate of Rp/US$ would help textile manufacturers in calculating the cost of raw materials and profits.

3. The development of cotton plantation, as one of the main raw material, needs to be realized. A very high dependence on cotton imports can threaten the Indonesian textile competitiveness in the world markets.
REFERENCES


### Table 1.
Notes of the Endogenous and Exogenous Variables employed in the model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
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<tbody>
<tr>
<td>PTD&lt;sub&gt;t&lt;/sub&gt;</td>
<td>The domestic textile production at the year t (1,000 ton)</td>
</tr>
<tr>
<td>PTD&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>The domestic textile production at the year t-1 (1,000 ton)</td>
</tr>
<tr>
<td>PGD&lt;sub&gt;t&lt;/sub&gt;</td>
<td>The domestic garment production at the year t (1,000 ton)</td>
</tr>
<tr>
<td>PGD&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>The domestic garment production at the year t-1 (1,000 ton)</td>
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<td>HTDR&lt;sub&gt;t&lt;/sub&gt;</td>
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<tr>
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</tr>
<tr>
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<td>Real price of the world textile at the year t-1 (USD/ton)</td>
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<td>HGDR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>Real price of domestic garment at the year t (USD/ton)</td>
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<td>Real price of domestic garment at the year t-1 (USD/ton)</td>
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<td>Integration dummy of world textile trading</td>
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THE IMPACT OF EXCHANGE RATE DEPRECIATION AND
THE MONEY SUPPLY GROWTH ON INFLATION:
THE IMPLEMENTATION OF THE THRESHOLD MODEL

Rizki E. Wimanda

Abstract

This paper investigates the impact of exchange rate depreciation and money growth to the CPI inflation in Indonesia. Using monthly data from 1980:1 to 2008:12, our econometric evidence shows that there are indeed threshold effects of money growth on inflation, but no threshold effect of exchange rate depreciation on inflation. However the threshold value for exchange rate depreciation is found at 8.4%, and there is no significant difference between the coefficient both below and above the threshold value. Meanwhile, two threshold values are found for money growth, i.e. 7.1% and 9.8%, and they are statistically different. The impact on inflation is high when money grows by up to 7.1%, it is moderate when money grows by 7.1% to 9.8%, and it is low when money grows by above 9.8%.

JEL Classification: C22; E31; E51.
Keywords: Inflation, Threshold Effect; Indonesia

1 Extracted from Wimanda (2010), Doctoral Thesis, Chapter 4, “Threshold Effects of Exchange Rate and Money Growth on Inflation”.
2 Researcher in Economy at Bank Indonesia, email: rizki@bi.go.id.
I. INTRODUCTION

Concerns about inflation have been very intense since Indonesia adopted the inflation targeting in 2000. One of the important topics of the study is to examine the factors that cause inflation.

Wimanda (2010) found that inflation in Indonesia is significantly influenced by inflation expectations (backward-looking and forward-looking), output gap, exchange rate depreciation, and growth in money supply. Analysis of monthly samples from early 1980 until the end of 2008 shows that the formation of inflation expectations in Indonesia is still dominated by the backward-looking inflation expectations with a share of 0.7, while the portion of forward-looking inflation expectations is around 0.2. In his analysis, Wimanda also found that the impact of exchange rate is greater than the impact from the growth in money supply (M1). The analysis assumes that the impact of these two variables is linear, meaning that their impact is constant for each level of exchange rate depreciation and money supply growth.

By using the threshold model, this paper will test whether the impact of exchange rate and money supply growth on inflation is linear or not. And then to test whether there is a threshold value, how much the threshold value that can be identified, and the extent of the impact.

The systematic of this paper is as follows. Literature study will be discussed in the second chapter. Methodology and data will be discussed at the third part of this paper, while the estimation results and conclusions will be presented at the fourth and fifth chapter.

II. THEORY

2.1. Pass-through of Exchange Rate

One of the central issues in international economics is the pass-through of exchange rate which is defined as an impact of 1 percent of depreciation on the domestic inflation. In general, to test the exchange rate pass-through, we estimate at the following equation:

\[ \pi_t = \alpha + \gamma e_t + \delta x_t + \varepsilon_t \]  

where \( \pi_t \) is the domestic inflation, \( e_t \) is the depreciation of the exchange rate (nominal), and \( x_t \) is the other control variables (in growth).

In general, the study of exchange rate pass-through can be divided into 3 groups.

---

The first group is the study of the impact of exchange rate on the import prices of certain industries, like as conducted by Bernhofen and Xu (1999) and Goldberg (1995). The second group is the study the impact of exchange rate on import prices in the aggregate, for example Hooper and Mann (1989) and Campa and Goldberg (2005). And the third group is the study of the impact of exchange rate on the CPI or WPI, for example, Papell (1994) and McCarthy (2000).

Although the literature on exchange rate pass-through is very plentiful, but empirical studies mostly focus on developed countries. A survey carried out by Menon (1995) showed that 48 studies on exchange rate pass-through specifically cover the United States and Japan. Similarly, Goldberg and Knetter (1997) mentioned that the study of exchange rate pass-through during the 1980s is dominated by the USA.

For OECD countries, the study of the impact of exchange rate pass-through on their import prices was conducted by Campa and Goldberg (2005). They found that exchange rate pass-through is partial, where import prices reflect 60 percent of exchange rate movements in the short term and nearly 80 percent in the long term. They also found that countries which have a low exchange rate volatility and low inflation have a low impact of exchange rates pass-through.

Using 71 countries data from 1979 to 2000, Choudhri and Hakura (2006) showed that there was a strong positive relationship between the exchange rate pass-through with the inflation average. Countries with low inflation tend to have a low exchange rates pass-through, and vice versa.

The relationship of exchange rate and inflation in Malaysia, Philippines, and Singapore was examined by Alba and Papper (1998) during the Q1 of 1979 Q1 until the Q2 of 1995. They found that the exchange rate pass-through for the Philippines is higher compared to Malaysia, while the exchange rate pass-through to Singapore was oppositely negative.

To support the argument of “fear of floating”, Calvo and Reinhart (2000) also examined a number of developed and developing countries, including Malaysia and Indonesia. By using the monthly data from August 1997 through November 1999, they found the pass-through rate in Indonesia was 0.062.

2.2. Relationship between Money and Inflation

The quantity theory and the exchange equation provide a useful framework to analyze empirically the relevance of money in the economy. The relationship of money and inflation can
be derived from the money demand equation. The public wants to hold money to buy goods and services. If the price of goods and services rises, people tend to hold more money. The most important factor in the demand for money is the income. When incomes rise, people will tend to shop more. Higher expenditures are associated with more cash on hand. Thus, this relationship can be written as:

\[
\frac{M}{P} = kY, \tag{2}
\]

where \( M \) is the nominal money, \( P \) is the price level based on the CPI or GDP deflator, \( Y \) is the income and \( k \) is the proportion factor. Equation (2) can be rewritten as

\[
P = \frac{1}{k} \frac{M}{Y} \tag{3}
\]

By assuming that the causality from \( M \) to \( P \) exists, equation (3) states that the quantity of money determines the price level, although money is not the only factor. For example, when income and other factors which are reflected by \( k \) do not change, and when the quantity of money increases, the price level will increase.

Milton Friedman (1968) argues that inflation is a monetary phenomenon. Studies conducted by Lucas (1980), Dwyer and Hafer (1988), Friedman (1992), Barro (1993), McCandless and Weber (1995), Dewald (1998), Rolnick and Weber (1997) and others concluded that the changes in the quantity of money and price changes have a close relationship.

Dwyer and Hafer (1999) showed that the price level has a positive and proportional relationship to the quantity of money in America, Britain, Japan, Brazil, and Chile during the 20th century. They also showed that in the shorter term, 5 years, the relationship of money growth and inflation remains in force.

Empirical study of the relationship between money growth (M1 and M2) and the inflation in 160 countries was carried out by De Grauwe and Polan (2005). They showed that during the past 30 years, the relationship of money supply growth and inflation is still valid. However, after dividing the sample based on the rate of inflation, they showed that countries with low inflation (below 10%), the relationship between both variables weakened. Conversely, the relationship was strong in the countries with high inflation rates. However, this study did not specify at what level of money supply will give a different effect on inflation.
2.3. Threshold Model Application

Threshold model is a special case of complex statistical frameworks, such as mixture models, switching models, Markov-switching model, and smooth transition threshold model (Hansen, 1997).

Threshold model can be applied in many cases. For example, Galbraith (1996) conducted a study on the relationship between money and output. By using the data of US and Canada, he found that money has a strong influence on the output when the value of money growth is below certain threshold. This result is consistent with the proposition that the monetary policy has little impact or no impact at all on when the money growth is very high.

Khan and Senhadji (2001) investigated the relationship between the inflation and economic growth in 140 countries during the period of 1960 until 1998. They argue that inflation has a negative impact on the economy when inflation is above certain threshold values. In contrast, inflation has a positive impact on the economy when inflation is below the threshold value. They found that the threshold value for developed countries is 1-3 percent, and about 11-12 percent of threshold value for developing countries.

Threshold model is also used by Papageorgiou (2002) to evaluate the level of openness of the economy. Foster (2006) examined the relationship of export and economic growth for African countries. The evaluation of the fiscal deficit was also performed using the threshold models, for example for the case of USA (see Arestis, Cipollini and Fattouh, 2004) and Spain (see Bajo-Rubio, Diaz-Roldan and Esteve, 2004).

Meanwhile, the study of the threshold of exchange to the inflation and the threshold of money supply to inflation, to our knowledge, does not yet exist. Therefore, this study is conducted with the intention to complete the literature gap.

III. METHODOLOGY

3.1. Empirical Model and the Estimation Technique

This study is using the threshold model to answer the questions above. Threshold model is a special case of a complex statistical framework, such as mixture models, switching models, Markov-switching models, and smooth transition threshold models. In general, the threshold model can be written as follows:

\[ y_t = \beta' x_t + \delta_1 z_t I (th_t \leq \lambda) + \delta_2 z_t I (th_t > \lambda) + \mu_t \] (4)
where is the dependent variable, is the explanatory variable to be tested, is the vector of other explanatory variables, is the indicator function, is a threshold variable, and is the value of the threshold. In the equation above, the observations are divided into two regimes; depend on whether the threshold variable is smaller or larger than the value of.

To estimate the model, the threshold value and the value of slope parameter are estimated simultaneously. Hansen (1997) recommended seeking estimates of by finding the minimum value of sum of squared errors. To ensure that the number of observations in each regime is sufficient, the models are estimated for all the threshold value from the variable threshold between the 10th and 90th percentile.

Having found the threshold value, we need to test whether the value is statistically significant or not. In this case, whether the null hypothesis is to be rejected or accepted. One thing that may complicate is the non-identified threshold value in the null hypothesis. This implies that the classical test does not have a standard distribution, so that critical values cannot be obtained from the standard distribution tables.

This study follows Hansen (1997, 2000) in the search for multiple regimes in the data by using the exchange rate depreciation and the growth of M1 as the threshold variable. This method, which is based on the asymptotic distribution, will test the significance of regimes selected by the data.

In this study, we do not evaluate long-term relationship of the value of the exchange rate and the money supply to the price level, but we are more interested to see the short-term relationship of the exchange rate depreciation and the money supply growth to inflation. To examine the existence of a threshold effect of exchange rate depreciation on inflation, this hybrid model of Phillips curve will be estimated as follows:

\[
\pi_t = c + \alpha_1 \pi_{t-1} + \alpha_2 \pi_{t+1}^e + \beta \text{gap}_t + \gamma_1 (1 - d_t) [I(\text{er}_t > \text{er}^*)] + \gamma_2 d_t [I(\text{er}_t \leq \text{er}^*)] + \theta m_t + \delta_1 \text{crisis} + \delta_2 \text{fuel} + \delta_3 \text{fitri} + \varepsilon_t
\]

where,

\[
d_t = \begin{cases} 
1 & \text{if } \text{er}_t \leq \text{er}^* \\
0 & \text{if } \text{er}_t > \text{er}^* 
\end{cases}
\]

is inflation, \(\pi_{t-1}\) is the backward-looking inflation expectations, \(\pi_{t+1}^e\) is the forward-looking inflation expectations, \(\text{gap}_t\) is the output gap, \(\text{er}_t\) is the depreciation of the exchange rate\(^4\), \(\text{er}^*\)

\(^4\) The exchange rate is defined as the domestic currency per foreign currency. In this case we use Rp/USD. Thus, a negative \(\text{er}\) value means depreciation, while a positive \(\text{er}\) value indicates an appreciation.
is the threshold value of the exchange rate, $m_t$ is the growth of money supply (M1), $\text{crisis}$ is the dummy variable to capture the financial crisis 1997-1998, $\text{fuel}$ is a dummy variable to capture the fuel price surge in January 2005 and October 2005, and $\text{fitri}$ is the dummy variable to capture the phenomenon of Idul Fitri.

We use instrumental variables (IV) estimators, which is the two-stage least squares (TSLS). This estimation method can overcome the endogeneity problems given that within the model used there is then inflation value in the future.

Model estimation is done by conditional least squares method which can be explained as follows:

For each threshold value $er_t^*$, the model is estimated through TSLS, to obtain the sum of squared residuals (SSR). The least squares estimation of $er_t^*$ is obtained by choosing the threshold value $er_t^*$ which has the minimum value of SSR. If we put all the threshold value observations into the vector, the compact notation of equation (2) then is as follows:

$$y = x\beta_{er} + \varepsilon, \quad er = e_{\text{r}}, \ldots, e\bar{r},$$

(6)

where $\beta_{er} = (c, \alpha_1, \alpha_2, \beta, \gamma_1, \gamma_2, \theta, \delta_1, \delta_2, \delta_3)'$ is the vector of parameters, $y$ is the dependent variable, and $x$ is the matrix of the explanatory variables. It is noteworthy that the coefficient vector $\beta$ is indexed with $er$ to show its dependence to the threshold value, which ranged from $e_{\text{r}}$ to $e\bar{r}$. We define $S_1(er)$ as SSR with the threshold value of exchange rate depreciation on $er$. The threshold estimation value $er^*$ which is obtained is the threshold value with the minimum $S_1(er)$ value, namely:

$$er^* = \text{argmin} \left[ S_1(er), \quad er = e_{\text{r}}, \ldots, e\bar{r} \right]$$

(7)

Once the threshold value is obtained, we need to examine whether the threshold effect is statistically significant or not. In equation (2), to test the existence of the threshold effect, we need to test the null hypothesis, which is $H_0: \gamma_1 = \gamma_2$. Hansen (1997, 2000) suggested the bootstrap method to simulate the asymptotic distribution of the likelihood ratio test from the $H_0$ as the following:
\[ LR_0 = n \left( \frac{S_0 - S_1}{S_1} \right) , \] (8)

where \( S_0 \) and \( S_1 \) is the SSR for \( H_0 : \gamma_1 = \gamma_2 \) and \( H_1 : \gamma_1 = \gamma_2 \). In other words, \( S_0 \) and \( S_1 \) is the SSR from the equation (2) without and with the threshold effects. Asymptotic distribution of \( LR_0 \) is non-standard and dominate the distribution of \( \chi^2 \). The distribution of generally depends on the moments of sample, so that the critical values cannot be tabulated.

Given that \( \gamma \) has not been identified, the asymptotic distribution of \( LR_0 \) is not \( \chi^2 \). Hansen (1997) showed that this can be approximated by using the following bootstrap procedure:

1. Set \( \mu_t^* , t = 1, ..., n \) as random number, drawn from a normal distribution whose mean is zero and whose variance is one i.e. \( N(0,1) \).
2. Set \( y_t^* = \mu_t^* \).
3. By using the observation of \( x_t , t = 1, ..., n \), regress \( y_t^* \) at \( x_t \) and find the residual variance \( \sigma_n^{*2} \) from the linear model, where
   \[ \sigma_n^{*2} = \frac{1}{n} \sum_{t=1}^{n} (y_t^* - x_t \bar{\beta})^2 \]
4. By using the observation of \( x_t , t = 1, ..., n \), regress \( y_t^* \) at \( x_t(\gamma) \) and find the residual variance \( \sigma_n^{*2}(\gamma) \) from the threshold model, where
   \[ \sigma_n^{*2}(\gamma) = \frac{1}{n} \sum_{t=1}^{n} (y_t^* - x_t \bar{\beta}_\gamma)^2 \]
   and \( \gamma \) are the threshold value.
5. Calculate \( F_n^*(\gamma) = n \left( \frac{\sigma_n^{*2} - \sigma_n^{*2}(\gamma)}{\sigma_n^{*2}(\gamma)} \right) \).
6. Repeat step number 4 and 5 for the other \( \gamma \).
7. Find \( F_n^* = \sup_{\gamma \in \Gamma} F_n^*(\gamma) \).
8. Repeat step 1 to 7 over and over again.

Hansen (1997) also showed that the repetitive sampling from \( F_n^* \) can be used as an approximation to the asymptotic distribution from \( F_n \). The \( p \)-value of this test is to calculate the percentage of bootstrap samples whose the value of \( F_n^* \) exceed \( LR_0 \) (see equation (5)).
This study follows Hansen (2000) in forming the confidence region for \( er^* \). The confidence intervals for the threshold parameter inversion are built by inverting the asymptotic distribution of the likelihood ratio statistics. In this case, we tested null hypothesis \( H_0: \, \, er^* = er \) by calculating the likelihood test as follows:

\[
LR(er) = n \left( \frac{S_1(er) - S_1(er^*)}{S_1(er^*)} \right),
\]

where \( S_1(er) \) and \( S_1(er^*) \) is the SSR from equation (2) with threshold \( er \) and \( er^* \). Define \( c_{\xi}(\beta) \) as the \( \beta \)-level critical value for \( \xi \) from Table 1 in Hansen (2000). Thus that defines

\[
\hat{\Gamma} = [er : LR(er) < c_{\xi}(\beta)]
\]

Hansen (2000) shows that is asymptotically valid for \( \beta \)-level confidence at \( er \). To get a confidence interval, we plot the likelihood ratio \( LR(er) \) with the threshold value \( (er) \), pull a straight line on \( c_{\xi}(\beta) \), and mark the threshold value with the likelihood ratio whose value is under the critical value. It should be noted that the \( LR(er) \) will be equal to zero when \( er = er^* \).

To test the existence of threshold effect of the money growth toward inflation, we use the same model, but we replace the exchange rate depreciation with the growth of money supply as the threshold variable. The model will be next estimated as follows:

\[
\pi_t = c + \alpha_{1}\pi_{t-1} + \alpha_{2}\pi_{t-1}^{*} + \beta\text{gap}_t + \gamma er_t + \theta_1(1 - d_t) \left( (m_t > m^*) \right) I (m_t > m^*) + \theta_2 \left( (m_t \leq m^*) \right) + \delta_{\text{crisis}} + \delta_{\text{fuel}} + \delta_{\text{fitri}} + \epsilon_t
\]

where \( d_t = \begin{cases} 
1 & \text{if } m_t \leq m^* \\
0 & \text{if } m_t > m^* 
\end{cases} \)

Meanwhile the estimation and testing procedures for threshold growth of money supply is the same as the procedure above.

### 3.2. Data

We use CPI data, output gap, exchange rate, and M1. These data is obtained from Bank Indonesia (BI) and BPS. For the analysis, we use the monthly data from 1980 to 2008 (see Table 1).
IV. RESULT AND ANALYSIS

4.1. Threshold Effect on the Exchange Rate Depreciation

Table 3 below shows the results of TSLS estimation of the equation (2) without the presence of threshold effect (by setting $\gamma_1 = \gamma_2$). From this table we can see that all the parameters are significant, except for constant. By using the adjusted HP filter as a proxy in the calculation of potential output, we find that the coefficient of exchange rate depreciation (yoy) is -0.050 and the coefficient of M1 growth is 0.021. These results show that in average the impact of exchange rate depreciation on inflation is still greater than the impact of the money supply growth.
To estimate the threshold of exchange rate depreciation, we use equation (2). The threshold value in search has a value ranging from -30% to 0%. With an increase of 0.06% there are 500 candidates of the threshold value. From these 500 threshold values, the lowest SSR value is 408.25, at the level of 8.4%. This means that the threshold depreciation amounted to 8.4%.

Table 4 shows the results of model estimation using the adjusted HP filter to calculate the potential output. From the table we can see that the impact of exchange rate depreciation on inflation, when the level of depreciation is greater than or equal to 8.4%, is for 0.056, while the impact, when the exchange rate depreciation rate is below 8.4%, is 0.045. Both coefficients above are significant at the level of 1%.

The horizontal line in Figure 1 shows the 90% of confidence interval. The area below the horizontal line forms the region of acceptance. The $LR(g)$ statistic will be nil at the optimal threshold. From the figure we can see that the confidence interval for the threshold exchange rate is too wide. The area below the line where $LR(g) = 5.94^5$ has the value ranging from -23.52% to -2.64%. This shows that the estimation of threshold value effect for the exchange rate depreciation is not too accurate.

To test whether there is a difference between a linear and a threshold model, we performed 1000 times bootstrapping. We followed the procedure suggested by Hansen (1997) to yield the critical value.

---

5 This is the critical value for 90% confidence interval from Table 1 Hansen (2000).
Figure 1: The value of likelihood ratio and 90% of confidence interval for the threshold of exchange rate depreciation

![Graph showing the value of likelihood ratio and 90% confidence interval for exchange rate depreciation threshold.]

It was found that most of the $F_{upp}$ are superior to the value of $F_{oa}$, which is -12.12, where the $p$-value is 0.957. This shows that we cannot reject the null hypothesis where $\gamma_1 = \gamma_2$. Thus, it can be concluded that there was no significant difference in the impact of the exchange rate depreciation on inflation at the level below and above the threshold. In other words, the impact of exchange rate depreciation on inflation is linear, that is equal to 0.05% for every 1% of depreciation rate.

As for the robustness check, we use various alternative models, which are the model by that use the peak-to-peak output gap and model by adopting asymmetric ties between inflation and output, which is the L-shaped function\(^6\). This alternative model can be seen in Table 5.

Table 6 shows the estimation results with and without the threshold effect. From this table we can see that the coefficient of the exchange rate depreciation is below or equal to its

---

Table 5.

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Gap Measurement</th>
<th>Output Gap Function</th>
<th>ER Dep.Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Peak-to-Peak</td>
<td>Linear</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Peak-to-Peak</td>
<td>Linear</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Adjusted HP Filter</td>
<td>Non-Linear</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Adjusted HP Filter</td>
<td>Non-Linear</td>
<td>Yes</td>
</tr>
</tbody>
</table>

\(^6\) According to the results of the 3rd chapter of the Doctoral Thesis of Wimanda (2010), the Phillips curve in Indonesia is more suited to be modeled with the L-shape function with wall parameter of 8.5%. This function is actually a parabolic function where the impact of the output gap to inflation would be enormous if the output gap is close to 8.5%.
### Robustness check for Phillips curve with the threshold of exchange rate depreciation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model-1</th>
<th>Model-2</th>
<th>Model-3</th>
<th>Model-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.007 (0.186)</td>
<td>0.011 (0.192)</td>
<td>-0.325*** (0.122)</td>
<td>-0.358*** (0.127)</td>
</tr>
<tr>
<td>Inflation (-1)</td>
<td>0.714*** (0.043)</td>
<td>0.730*** (0.048)</td>
<td>0.694*** (0.037)</td>
<td>0.705*** (0.041)</td>
</tr>
<tr>
<td>Inflation(1)</td>
<td>0.223*** (0.059)</td>
<td>0.199*** (0.067)</td>
<td>0.249*** (0.051)</td>
<td>0.233*** (0.056)</td>
</tr>
<tr>
<td>Output Gap Linear (-9)</td>
<td>0.071** (0.03)</td>
<td>0.081** (0.032)</td>
<td>-0.0003** (0.00016)</td>
<td>0.0004** (0.00017)</td>
</tr>
<tr>
<td>Output Gap Non-Linear(-9)</td>
<td>-0.048*** (0.009)</td>
<td>-0.057*** (0.013)</td>
<td>-0.047** (0.009)</td>
<td>-0.054*** (0.011)</td>
</tr>
<tr>
<td>Exchange Rate Dep(-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange Rate Dep(-1) &lt;= Threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold &lt; Exchange Rate Dep(-1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1 Growth(-2)</td>
<td>0.027*** (0.008)</td>
<td>0.030*** (0.009)</td>
<td>0.027*** (0.008)</td>
<td>0.031*** (0.008)</td>
</tr>
<tr>
<td>Dummy Crisis</td>
<td>1.228** (0.536)</td>
<td>1.154** (0.547)</td>
<td>0.652 (0.405)</td>
<td>0.462 (0.422)</td>
</tr>
<tr>
<td>Dummy Fuel</td>
<td>2.944*** (0.683)</td>
<td>2.973*** (0.693)</td>
<td>2.772*** (0.648)</td>
<td>2.805*** (0.665)</td>
</tr>
<tr>
<td>Dummy Fitri</td>
<td>0.551** (0.215)</td>
<td>0.548** (0.218)</td>
<td>0.554*** (0.208)</td>
<td>0.554*** (0.213)</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.991 (0.991)</td>
<td>0.991 (0.991)</td>
<td>0.992 (0.991)</td>
<td>0.991 (0.991)</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>1.103 (1.116)</td>
<td>1.116 (1.066)</td>
<td>1.066 (1.091)</td>
<td>1.091 (1.091)</td>
</tr>
<tr>
<td>SSR</td>
<td>400.161 (408.247)</td>
<td>373.986 (390.569)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold ER</td>
<td>-8.40</td>
<td>-8.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.999</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
- The number between parentheses is the error standard.
- ***, **, and * indicate the significance level at the level of 1%, 5%, and 10%.

threshold value \( \gamma_1 \). And above its threshold value in model 2 and model 4 \( \gamma_2 \) the value is negative and significant. We found that the threshold value is equal to the threshold value on the previous model, at the level of -8.4%. Coefficient value \( \gamma_1 \) of \( \gamma_1 \) is in the range of -0.054 to -0.057, while the coefficient value of \( \gamma_2 \) is relatively the same at -0.041.

After performing as much as 1,000 times bootstrapping, model 2 and model 4 yield the same conclusion with the main model. Overall, from the bootstrap test statistics, there is not any statistical significance on these variables. The \( p \)-values range between 0.966 and 0.999. This implies that there is no significant difference between the impact of exchange rate depreciation on inflation, above and below its threshold value.
If we compare model 1 and model 2, as well as model 3 and model 4, we can see that the value of SSR for the threshold model is greater than the value of the SSR on the linear model. This confirms the above conclusion.

Figure 2 above illustrates the impact of exchange rate depreciation on inflation. From this picture, we can see that the slope in solid blue line is the same for every point. This linear impact (solid blue line) is more preferable than the non-linear impact of (dashed brown line).

4.2 Threshold Effect on the Money Growth

To estimate the threshold value for the money supply growth, we use equation (8) with the output gap, which is calculated based on the adjusted HP filter. This search for the threshold value starts from 0% to 40%, with an increase of 0.08. This means that there are approximately 500 candidates for the threshold value. We found that the threshold value for the M1 growth was 9.84%.

Table 7 shows the estimation results of threshold with using the adjusted HP filter as a measurement of the output gap. Given that the results of the main variables are quite robust, that all coefficients are statistically significant, we can then immediately analyze its threshold results. From the table, the coefficient of the money supply growth, below or equal to 9.84% (\( \theta_1 \)), is 0.099, while the coefficient of the money supply growth above 9.84% (\( \theta_2 \)) is 0.032. Both coefficients are significant at the level of 1%.

7 This value gives the smallest SSR.
The Impact of Exchange Rate Depreciation and the Money Supply Growth on Inflation: the Implementation of the Threshold Model

This result implies that there are differences in the impact of the M1 growth on inflation, above or below its threshold value at 9.84%. As an illustration, shall M1 grow by 5% this month, and then there will be an additional inflation of 0.5% in two months to come. Meanwhile, shall M1 grow 10% this month; there will be then an additional average inflation of 0.98% within 2 months.

<table>
<thead>
<tr>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.361</td>
<td>0.150</td>
<td>-2.405</td>
<td>0.017</td>
</tr>
<tr>
<td>0.695</td>
<td>0.039</td>
<td>17.947</td>
<td>0.000</td>
</tr>
<tr>
<td>0.241</td>
<td>0.054</td>
<td>4.468</td>
<td>0.000</td>
</tr>
<tr>
<td>0.053</td>
<td>0.022</td>
<td>2.455</td>
<td>0.015</td>
</tr>
<tr>
<td>-0.047</td>
<td>0.009</td>
<td>-5.257</td>
<td>0.000</td>
</tr>
<tr>
<td>0.099</td>
<td>0.030</td>
<td>3.341</td>
<td>0.001</td>
</tr>
<tr>
<td>0.032</td>
<td>0.008</td>
<td>3.877</td>
<td>0.000</td>
</tr>
<tr>
<td>1.229</td>
<td>0.516</td>
<td>2.384</td>
<td>0.018</td>
</tr>
<tr>
<td>2.983</td>
<td>0.656</td>
<td>4.549</td>
<td>0.000</td>
</tr>
<tr>
<td>0.583</td>
<td>0.207</td>
<td>2.821</td>
<td>0.005</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.361</td>
<td>0.150</td>
<td>-2.405</td>
<td>0.017</td>
</tr>
<tr>
<td>0.695</td>
<td>0.039</td>
<td>17.947</td>
<td>0.000</td>
</tr>
<tr>
<td>0.241</td>
<td>0.054</td>
<td>4.468</td>
<td>0.000</td>
</tr>
<tr>
<td>0.053</td>
<td>0.022</td>
<td>2.455</td>
<td>0.015</td>
</tr>
<tr>
<td>-0.047</td>
<td>0.009</td>
<td>-5.257</td>
<td>0.000</td>
</tr>
<tr>
<td>0.099</td>
<td>0.030</td>
<td>3.341</td>
<td>0.001</td>
</tr>
<tr>
<td>0.032</td>
<td>0.008</td>
<td>3.877</td>
<td>0.000</td>
</tr>
<tr>
<td>1.229</td>
<td>0.516</td>
<td>2.384</td>
<td>0.018</td>
</tr>
<tr>
<td>2.983</td>
<td>0.656</td>
<td>4.549</td>
<td>0.000</td>
</tr>
<tr>
<td>0.583</td>
<td>0.207</td>
<td>2.821</td>
<td>0.005</td>
</tr>
</tbody>
</table>

This result implies that there are differences in the impact of the M1 growth on inflation, above or below its threshold value at 9.84%. As an illustration, shall M1 grow by 5% this month, and then there will be an additional inflation of 0.5% in two months to come. Meanwhile, shall M1 grow 10% this month; there will be then an additional average inflation of 0.98% within 2 months.

![Figure 3: The value of likelihood ratio and 90% confidence interval for the threshold of M1 growth: first point](image)

Once the threshold value is identified, the next important question is how accurate are these estimates. This requires the calculation of the confidence regions around the threshold value. Figure 3 illustrates the value of likelihood ratio and the threshold value, as well as 90%
confidence intervals. As explained above, the confidence region is calculated by taking the values of M1 growth where the value of \( LR(M1) \) is below the horizontal line. From this figure it shows that the confidence interval for the money growth is quite narrow, around 7.12% - 10%. This indicates that the estimated threshold value is accurate enough.

The next step is to test whether the threshold value exists by performing bootstrapping. By generating new samples, repeated by 1,000 times for the percentile estimation of the asymptotic null distribution \( F_{\alpha}^* \), we find that the \( p \)-value is 0.001. Thus, the null hypothesis (linear model) can be rejected and it concludes that there is a threshold value for the M1 growth.

After finding the first threshold value, we seek the possibility of another threshold value. We can find three regimes at the same time, but this would be very inefficient in terms of computation time. Chong (1994) and Bai (1997) showed that the sequential estimation is consistent, so that it can avoid the problem of calculation. This means that we can fix the first threshold figure, en then seek the second one by assuming that the first threshold is already fixed.

After finding the first threshold value, we seek the possibility of another threshold value. We can find three regimes at the same time, but this way is very inefficient in terms of computation time. Chong (1994) and Bai (1997) showed that the sequential estimation is consistent, so that it can avoid the problem of calculation. This means we can make the fix-it figures that the first threshold then seek a second threshold value by assuming that the first threshold has been fixed.

We begin by considering the possibility of another threshold value between 9.84% and 40%. With a value addition by 0.075 there are 400 candidates for the threshold value. It is found that the smallest SSR is when the threshold is at 17.13%. This means that 17.3% is the second threshold candidate. TSLS estimation results can be seen in Table A (see Appendix). Although these entire M1 growth coefficients are significant at level of 1%, but after conducting the bootstrapping, we found the \( p \)-value at 0.177 which is slightly larger than 10%. Thus, the null hypothesis from these 2 threshold regime cannot be rejected. In other words, the relationship between inflation and the M1 growth is linear by the time M1 grows above 9.84%.

The next effort to search the threshold candidate is between 0% and 9.84%. We selected 350 values and found the minimum SSR at the point of 7.08%. TSLS Estimation results with 2 thresholds: 9.84% and 7.08% can be seen in Table 8. From the table we can note that the coefficient of M1 growth, when it grows under 7.08%, is 0.146; when it grows between 7.08% and 9.84%, the coefficient is 0.088, and when it grows over than 9.84%, the coefficient
The Impact of Exchange Rate Depreciation and the Money Supply Growth on Inflation: the Implementation of the Threshold Model

The value of the likelihood ratio decreases to 0.033. All of the above coefficients are significant at the level of 1%. This shows that a higher M1 growth of M1, will cause less impact on the inflation.

Figure 4 shows that the minimum likelihood ratio is found at the threshold point of 7.08%. Its 90% confidence interval is quite narrow, which is from 6.94% to 8.04%. This indicates that 7.08% is a potential candidate for the second threshold.

<table>
<thead>
<tr>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.404</td>
<td>0.151</td>
<td>-2.671</td>
<td>0.008</td>
</tr>
<tr>
<td>0.687</td>
<td>0.038</td>
<td>18.160</td>
<td>0.000</td>
</tr>
<tr>
<td>0.252</td>
<td>0.053</td>
<td>4.772</td>
<td>0.000</td>
</tr>
<tr>
<td>0.049</td>
<td>0.021</td>
<td>2.318</td>
<td>0.021</td>
</tr>
<tr>
<td>-0.045</td>
<td>0.009</td>
<td>-5.152</td>
<td>0.000</td>
</tr>
<tr>
<td>0.146</td>
<td>0.049</td>
<td>2.997</td>
<td>0.003</td>
</tr>
<tr>
<td>0.088</td>
<td>0.030</td>
<td>2.922</td>
<td>0.004</td>
</tr>
<tr>
<td>0.033</td>
<td>0.008</td>
<td>4.003</td>
<td>0.000</td>
</tr>
<tr>
<td>1.151</td>
<td>0.506</td>
<td>2.276</td>
<td>0.024</td>
</tr>
<tr>
<td>2.954</td>
<td>0.645</td>
<td>4.580</td>
<td>0.000</td>
</tr>
<tr>
<td>0.602</td>
<td>0.204</td>
<td>2.951</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Figure 4: The value of likelihood ratio and 90% confidence interval for the threshold growth M1: second point

A formal test is carried out by bootstrapping samples. By replicating samples and repeating it by 1,000 times, we find the p-value at 0.004. Thus, we reject the null hypothesis of the 2 regimes. Based on these tests, we conclude that there are 3 threshold regimes for the M1 growth.
Next we look for another threshold value candidate between 0% and 7.08%. With an addition of 0.028%, we evaluated 250 candidates. Of the 250 these candidates, we found that the SSR value is the lowest at the point of 4.93%.

Table B (see Appendix) presents the TSLS estimation result with four regimes. All coefficients are significant, except the coefficient for M1 growth from 0% to 4.93% ($p$-value = 0.273). The formal testing through bootstrapping produces $p$-value by 0.191. This indicates that the relationship of inflation with the M1 growth is linear when M1 grows between 0% and 7.12%. Given that the third threshold is not significant, it is impossible to separate further the samples.

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Gap Measurement</th>
<th>Output Gap Function</th>
<th>M1 Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Peak-to-Peak</td>
<td>Linear</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Peak-to-Peak</td>
<td>Linear</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Adjusted HP Filter</td>
<td>Non-Linear</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>Adjusted HP Filter</td>
<td>Non-Linear</td>
<td>Yes</td>
</tr>
</tbody>
</table>

As for robustness check, again we use a variety of models with the difference that lies in the measurement of the output gap and the non-linear Phillips curve. Table 9 shows the difference.

As shown in Table 10, these empirical results yield some interesting results. First, all coefficients, except the constant and dummy variables for the crisis on some models, are significant. Second, the estimation of the threshold value is the same, 9.84% and 7.08%. Third, the coefficient of the threshold effect is somewhat different, yet the difference is abysmal. The coefficient of M1 growth when growing under 7.08% ranges from 0.156 to 0.160; coefficient of M1 growth when growing between 7.08% and 9.84% ranges from 0.094 to 0.096, and the coefficient of M1 growth when growing over 9.84% ranges from 0.035 to -0.037.

Given that all the $p$-values of the bootstrapping are less than 1%, then we can reject the null hypothesis for the two regimes and prefer to the three regimes. In addition, when compared to the SSR value to the threshold model (model 6 and model 8) and the SSR value on the linear model (model 5 and model 7), we found that the threshold model is better than the linear model.
The Impact of Exchange Rate Depreciation and the Money Supply Growth on Inflation:
the Implementation of the Threshold Model

Table 10: Robustness check for the threshold of M1 growth

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model-1</th>
<th>Model-2</th>
<th>Model-3</th>
<th>Model-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.062 (0.187)</td>
<td>-0.284 (0.183)</td>
<td>-0.279** (0.12)</td>
<td>-0.559*** (0.137)</td>
</tr>
<tr>
<td>Inflation (-1)</td>
<td>-0.714*** (0.043)</td>
<td>0.689*** (0.039)</td>
<td>0.694*** (0.037)</td>
<td>0.672*** (0.034)</td>
</tr>
<tr>
<td>Inflation(1)</td>
<td>0.223*** (0.059)</td>
<td>0.250*** (0.053)</td>
<td>0.251*** (0.051)</td>
<td>0.273*** (0.047)</td>
</tr>
<tr>
<td>Output Gap Linear(-9)</td>
<td>0.074** (0.03)</td>
<td>0.060** (0.028)</td>
<td>0.000334** (0.000161)</td>
<td>0.000333** (0.000153)</td>
</tr>
<tr>
<td>Output Gap Non-Linear(-9)</td>
<td>0.048*** (0.009)</td>
<td>-0.043*** (0.008)</td>
<td>-0.047*** (0.009)</td>
<td>-0.042*** (0.008)</td>
</tr>
<tr>
<td>Exchange Rate Dep(-1)</td>
<td>0.024*** (0.007)</td>
<td>0.156*** (0.049)</td>
<td>0.160*** (0.048)</td>
<td></td>
</tr>
<tr>
<td>M1 Growth(-2)</td>
<td>0.000334** (0.000161)</td>
<td>0.000333** (0.000153)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1 Growth(-2) &lt;= 2nd Threshold</td>
<td>0.007</td>
<td>0.008</td>
<td>0.026*** (0.007)</td>
<td></td>
</tr>
<tr>
<td>2nd Threshold &lt; M1 Growth(-2) &lt;= 1st Threshold</td>
<td>0.156*** (0.049)</td>
<td>0.160*** (0.048)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Threshold &lt; M1 Growth(-2)</td>
<td>0.096*** (0.031)</td>
<td>0.094*** (0.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dummy Crisis</td>
<td>1.235** (0.539)</td>
<td>1.122** (0.503)</td>
<td>0.644 (0.406)</td>
<td>0.633 (0.386)</td>
</tr>
<tr>
<td>Dummy Fuel</td>
<td>2.929*** (0.685)</td>
<td>2.968*** (0.65)</td>
<td>2.752*** (0.649)</td>
<td>2.819*** (0.619)</td>
</tr>
<tr>
<td>Dummy Fitri</td>
<td>0.550** (0.216)</td>
<td>0.608*** (0.205)</td>
<td>0.553*** (0.209)</td>
<td>0.611*** (0.199)</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.991</td>
<td>0.992</td>
<td>0.992</td>
<td>0.992</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>1.107</td>
<td>1.045</td>
<td>1.070</td>
<td>1.014</td>
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<td>SSR</td>
<td>403.146</td>
<td>357.419</td>
<td>376.347</td>
<td>336.461</td>
</tr>
<tr>
<td>1st Threshold</td>
<td>9.84</td>
<td>7.08</td>
<td>9.84</td>
<td>7.08</td>
</tr>
<tr>
<td>2nd Threshold</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>0.005</td>
<td>0.005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks:
- The number within the parentheses is the error standard.
- ***, **, and * indicates the significance level on the level of 1%, 5%, and 10%.

From the test results and analysis above, these empirical results provide strong evidence that the relationship of M1 growth and inflation can be described by three regimes. Figure 5 illustrates this relationship. From the picture, we can see that the slope of the solid brown line when M1 grows up to 7.1% is steeper than the line when M1 grows between 7.1% - 9.8%. Similarly, when M1 grows more than 9.8%, the slope becomes more gently sloping.
V. CONCLUSION

This paper contributes to existing literature in which the threshold determination is done by using the techniques developed by Hansen (1997, 2000). Compared with the definition of threshold conducted arbitrarily, this technique provides some benefits where the threshold value can be determined by the characteristics of the data itself. Furthermore, this technique allows detecting the possibility of other threshold value. If there is only one threshold value fixed one, while in fact there are more than one, then the value of the coefficient can be under/over estimate.

This paper provides a comprehension of the threshold effect of exchange rate depreciation and the growth of money supply (M1) toward the inflation in Indonesia. By using the monthly data from 1980:01 to 2008:12, this model provides strong evidence that there is a threshold effect from the money supply growth on inflation, but it does not find any threshold effect between the exchange rate depreciation and inflation.

All experiments carried out as much as 1,000 times. By using two different output gap measurements, which are the adjusted HP filter and the peak-to-peak method, and two types of inflation-output relationship, which are the linear and L-shape function, our conclusions remain the same. Threshold value of the exchange rate depreciation is 8.4%. However, the coefficient from the exchange rate depreciation at the rate below 8.4% () and the coefficient of the exchange rate above 8.4% () does not differ much. The F-test gives a conclusion that there is no significant difference between  and . Thus, the impact of exchange rate depreciation on inflation is linear for all depreciation rates (which is 0.05).

For the growth of money supply, we find the evidence that there are two threshold values, at 7.1% and 9.8%. The F-test concludes that the effect of these three regimes is
significantly different. This empirical result indicates that the impact of money supply growth on inflation is not linear. The biggest impact on money supply growth is between 0% and 7.1% (i.e. 0.15), moderate impact occurs when the money supply to grow between 7.1% and 9.8% (i.e. 0.09), and the lowest impact is when the money supply grows above 9.8% (i.e. 0.03). As the money supply grows higher, the impact on inflation will be reduced.

In general, our findings are in line with Galbraith’s (1996) who studied the relationship between money supply with output. He discovered that money has a great impact on output if the money supply grows below its threshold value as compared when it grows above the threshold. These findings are consistent with the proposition that monetary policy has little or even no effect when the money supply grows very highly.

These findings provide the conclusion that the impact of money supply on inflation when the money supply grows below 9.8% will be greater than the impact of exchange rate depreciation on inflation. This conclusion is different from previous studies that did not include the threshold effect, where the impact of exchange rate depreciation on inflation is greater than the money supply growth at every level.

Although the impact of exchange rate depreciation on inflation is linear, it does not mean that, as the monetary authority, Bank Indonesia can override the depreciation rate because of the impact is moderate. Furthermore, this study suggests that Bank Indonesia should consider the growth of money supply, in this case M1, considering that the impact of M1 is large enough at the time it is at a level below the its threshold value. Although the impact of M1 growth on inflation is not linear with a smaller impact at the time the M1 growth is over its threshold value, this study does not suggest leaving M1 to grow rapidly.

Our findings above are based on the methodology proposed by Hansen (1997, 2000). However, this study does not explain why higher money supply growth gives a mild impact on inflation. Thus, further studies in the future in this area are needed to explain the reason for this asymmetric effect.

The analysis above is based on partial analysis, using a single equation model, despite the fact that the exchange rate and the money supply are not independent. The use of a more complex model where the exchange rate and money supply are used as endogenous variables to evaluate the threshold value, as found in this study, would be an interesting study. It is worth to be reserved for further study.
REFERENCES


### Table A.
**Phillips curve with the threshold of M1 growth: second point above**

<table>
<thead>
<tr>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.571</td>
<td>0.190</td>
<td>-3.000</td>
</tr>
<tr>
<td>Inflation(-1)</td>
<td>0.689</td>
<td>0.0371</td>
<td>8.537</td>
</tr>
<tr>
<td>Inflation(1)</td>
<td>0.248</td>
<td>0.052</td>
<td>4.751</td>
</tr>
<tr>
<td>Output Gap(-9)</td>
<td>0.052</td>
<td>0.021</td>
<td>2.447</td>
</tr>
<tr>
<td>Exchange Rate Dep(-1)</td>
<td>-0.045</td>
<td>0.009</td>
<td>-5.302</td>
</tr>
<tr>
<td>M1 Growth(-2) &lt;= 9.84%</td>
<td>0.127</td>
<td>0.035</td>
<td>3.502</td>
</tr>
<tr>
<td>9.84% &lt; M1 Growth(-2) &lt;= 17.13%</td>
<td>0.057</td>
<td>0.018</td>
<td>3.079</td>
</tr>
<tr>
<td>17.13% &lt; M1 Growth(-2)</td>
<td>0.038</td>
<td>0.009</td>
<td>3.977</td>
</tr>
<tr>
<td>Dummy Crisis</td>
<td>1.219</td>
<td>0.508</td>
<td>2.400</td>
</tr>
<tr>
<td>Dummy Fuel</td>
<td>2.835</td>
<td>0.643</td>
<td>4.406</td>
</tr>
<tr>
<td>Dummy Fitri</td>
<td>0.543</td>
<td>0.206</td>
<td>2.639</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.992</td>
<td>1.047</td>
<td>358.479</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>1.047</td>
<td>358.479</td>
<td></td>
</tr>
</tbody>
</table>

### Table B.
**Phillips curve with the threshold of M1 growth: third point**

<table>
<thead>
<tr>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.387</td>
<td>0.152</td>
<td>-2.549</td>
</tr>
<tr>
<td>Inflation(-1)</td>
<td>0.684</td>
<td>0.037</td>
<td>18.475</td>
</tr>
<tr>
<td>Inflation(1)</td>
<td>0.256</td>
<td>0.052</td>
<td>4.972</td>
</tr>
<tr>
<td>Output Gap(-9)</td>
<td>0.049</td>
<td>0.021</td>
<td>2.317</td>
</tr>
<tr>
<td>Exchange Rate Dep(-1)</td>
<td>-0.045</td>
<td>0.009</td>
<td>-5.186</td>
</tr>
<tr>
<td>M1 Growth(-2) &lt;= 4.93%</td>
<td>0.085</td>
<td>0.077</td>
<td>1.097</td>
</tr>
<tr>
<td>4.93% &lt; M1 Growth(-2) &lt;= 7.08%</td>
<td>0.169</td>
<td>0.055</td>
<td>3.094</td>
</tr>
<tr>
<td>7.08% &lt; M1 Growth(-2) &lt;= 9.84%</td>
<td>0.085</td>
<td>0.030</td>
<td>2.848</td>
</tr>
<tr>
<td>9.84% &lt; M1 Growth(-2)</td>
<td>0.031</td>
<td>0.008</td>
<td>3.900</td>
</tr>
<tr>
<td>Dummy Crisis</td>
<td>1.116</td>
<td>0.498</td>
<td>2.242</td>
</tr>
<tr>
<td>Dummy Fuel</td>
<td>2.926</td>
<td>0.639</td>
<td>4.576</td>
</tr>
<tr>
<td>Dummy Fitri</td>
<td>0.600</td>
<td>0.203</td>
<td>2.963</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.992</td>
<td>1.034</td>
<td>348.456</td>
</tr>
</tbody>
</table>

S.E., SSR, and adjusted R-squared values are not displayed in the tables.
THE SUSTAINABILITY OF STATE BUDGET
IN DEBT REPAYMENT

Haryo Kuncoro 1

Abstract

This paper is designed to analyze the sustainability of the central government budget in Indonesia over the period of 1999-2009. First, we explore the theoretical background of the fiscal sustainability. Second, we develop a model to capture some factors determining the fiscal sustainability. Unlike the previous studies, we use both domestic debt and foreign debt to assess the fiscal solvency. Finally, we estimate it empirically. Based on the quarterly data analysis, we concluded that the government budget is unsustainable. This is associated with domestic debt rather than foreign debt. They imply that the central government should manage the debts carefully including re-profile, re-schedule, and re-structure them in order to spread the excess burden in the future. Also, the fiscal risks should be calculated comprehensively in order to maintain solvency.

Key words: Domestic debt, Foreign debt, Fiscal sustainability, Primary balance

JEL Classification: E62, H63

1 Lecturer Faculty of Economics, State University of Jakarta (har_kun@feunj.ac.id)
I. INTRODUCTION

Fiscal sustainability is currently the topic of intense discussion among macroeconomic expertise in both developed and developing countries. The discussion is becoming more intense, notably since the economic crisis that took place in 1997, and repeated in 2008. The economic crisis was marked by the increasing government expenditure mainly to overcome the impact of the crisis. On the other hand, government revenue has decreased dramatically.

Such similar situation was also encountered by Indonesia. The economic crisis has made the Indonesian government collapsed under a heavy debt to cover the budget deficit. The government debt has increased by three to four times higher than pre-crisis conditions, and nearly three quarters of this increase is the domestic debt to be paid for bank restructuring (Boediono, 2009).

The obligations of debt closure (interest and amortization) will exceed 40 percent of government revenue for several years, while new financing needs (both foreign and domestic) in the coming years are still highly required to meet the expenditure needs. This will severely limit the fiscal space in the running government, in which the problem has shifted from fiscal stimulus to fiscal sustainability (Rahmany, 2004).

Conceptually, the state budget is said to sustainable if it has the ability to finance all spending during an unlimited period of time (Langenus, 2006; Yeyati and Sturzenegger, 2007). Consequently, fiscal sustainability should also be able to take into account the fiscal risks. Fiscal risks arise when there are direct liabilities occur, which can be predicted in advance, and contingency liabilities as a result of any events beyond control (Brixi and Mody, 2002).

Furthermore, the issue of fiscal risks is an integral part of the discussion about the ability to pay debt (solvency) in the long term. The inability to balance the soaring expenses with the revenue increase obviously endangers the ability of the state budget to pay the debt. To maintain fiscal solvency, the state must be in surplus (Chalk and hemming, 2000).

The main problem of the continuity of the state budget is the presence of deficit budget. The problem is how to keep the budget deficit at a safe level to find the way to finance the deficit. The elucidation of Article 12 paragraph 3 of Law no. 17 of 2003 on State Finance states that the budget deficit is limited to a maximum of 3 percent and a maximum debt of 60 percent of gross domestic product (GDP).

The occurrence of a fiscal risk improperly anticipated will burden the budget and affect the economic growth targets with the different scope and depth of effects between the
developed countries with the developing countries. Fiscal risks that occur in developed countries will lead to the burden on the budget and potentially inhibit the economic growth.

In developing countries, the implications are far more severe. The occurrence of fiscal risks that burden the budget will spread quickly on the overall economy, encourage the capital outflow, and even change the direction of economic growth. Furthermore, within developing countries with weak economic institutions, expectations of fiscal risks will affect the behavior of economic agents that potentially discourage economic growth despite the fiscal risk is yet to take form (Barnhill and Kopits, 2003).

This paper seeks review of fiscal sustainability with the case of Indonesia. To arrive at these targets, the government debt profile would be firstly observed. Next, the conceptual review on fiscal sustainability will be conducted along with the previous studies. The research method shall be delivered in the fourth chapter. Empirical estimation results will be shown after. And finally, this paper shall be concluded with several notes.

II. INDONESIAN DEBT PROFILE

Debt is an integral part of fiscal policy within the framework of the overall economic management policies. Debt becomes the consequence of the deficit state budget posture. Configuration between deficit and debt (domestic and foreign) can be observed in Figure 1. In addition to covering up the deficit, the debt is also used for debt refinancing.
The large nominal of Indonesia’s debt has accumulated from the previous regime. If we trace back, since the regime of Old Order, Indonesia has used foreign loans to finance its development. Foreign debt is used during the first period of 1966 to reconstruct the economy after the political turmoil. After that, the New Order regime has several fixed donor countries, united in the IGGI (Intergovernmental Group on Indonesia). Every year, IGGI provided funds (from ADB, World Bank, IMF, UNDP, and several major developed countries) to finance development spending, designed within the state budget.

During the oil boom in the 1970’s foreign debt increased rapidly to encourage economic growth. High oil prices were followed by a high debt. As one of the oil exporting countries (at that time), Indonesia has a windfall profit as a sort of “guarantee” to obtain new loans from creditor countries (Kuncoro, 1997). Foreign debt and high oil revenues have increased economic growth. In that period, the rate of economic growth record was high, on the average of 20 percent in a year.

Surprisingly, when oil prices declined in the first half of the 1980s the debt still increased. World economic recession and trade protection imposed by most trading partners were the main causes. Percentage of total foreign debt to GDP increased from 26.8 percent in 1980 to 53.6 percent in 1986.

In the late 1980s and during the economic boom in the mid-1990s, long-term foreign debt was dominated by the state-owned enterprises, in particular, and private cooperates. Government debt increased because PERTAMINA was largely expanded. BULOG took foreign debt to assure the food security. As a result, debt repayment to exports ratio at end of the 1980s, rose to an average of 40 percent. In 1992, IGGI was disbanded and replaced by the CGI (Consultative Group on Indonesia).

During the Asian financial crisis in mid-1997, the foreign debt increased significantly from more than $136 billion in 1997 to more than Rp 151 billion in 1998, mainly due to the depreciation of the rupiah. At that time, the government of Indonesia has experienced a fall in revenue and, on the other hand, an increased government spending to cope with socio-economic impacts arising from the crisis.

In the era of reformation, the government and Parliament make the political decisions that the deficit must be financed by domestic financial resources. Therefore, the CGI was dissolved in 2007. As a result, total domestic debt stock (Government Securities) has soared ten folds (100 trillion in 1998 to nearly 1.000 trillion in 2009). In just one decade, domestic debt has been higher than external debt (Figure 2). As a result, public debt interest is also skyrocketing. Interest payment on domestic debt is two-times higher than the foreign debt.
Most government debt is due in early 2000. Consequently, the interest payments and amortization swallow a 40% portion of the total state budget expenditure. The other important expenditures are education (20 percent), subsidies for fertilizer and energy (15 percent) and transfers to regional governments (26 percent). This composition of expenditure is, of course, very limited to fiscal space.

Although the fiscal space has decreased, the Indonesia’s debt ratio has shown a consistent downward trend over the last decade (Figure 3). In line with the ongoing economic recovery,
national income experiences a stable growing trend (an average of 4.5 percent per year). With this condition, in 2000, for example, the ratio of Indonesia’s total debt, which reached 89 percent, has decreased to 32 percent in 2009.

These debt ratio figures are much better than the other countries also affected by the crisis. Compared with some other countries with relatively similar income per capita level, such as the Philippines, Argentina, and Turkey, Indonesia’s debt ratio is also better, even with developed countries like America, Britain, Italy, and Japan (Figure 4).

III. THEORY

The above map of government debt raises concerns over how far the sustainability of the state budget to cope with all the obligations that follow. Theoretically, so far there is no restriction on fiscal sustainability which can be generally acceptable. Macro-economic literatures introduce three definition approaches of a fiscal sustainability. The first approach is based on the accounting rules that link the fiscal and debt conditions:

$$D_{t+1} = (1+r) D_t + (R_t - G_t)$$

If the deficit (the difference between revenue and expenditure, $R - G$) in the current budget is financed with a debt $D$, then the amount of debt in the next budget period ($t+1$) will be at $D$ itself plus the burden of interest rate ($r$).

The element of $(R - G)$ is the primary balance (PB) apart the debt interest payments. By rearranging equation (1) above, we shall obtain
\[ D_{t+1} - D_t = D_t = r D_{t-1} - PB_t \]  

(2)

From equation (2) above it can be concluded that:

a. If \( PB_t = 0 \), then the debt would be increased by the interest of the previous debt;

b. If \( PB_t < 0 \), then \( \Delta D_t \) is positive, which means that the principal of government debt will continue to rise;

c. If \( PB_t > 0 \), then \( \Delta D_t \) is negative, which means that the principal of government debt will continue to decline.

Following this accounting approach, fiscal sustainability can be achieved if there is no debt. Even if the government should owe one, fiscal sustainability conditions can still be maintained if the amount of additional debt is proportional to the surplus value of PB.

Equation (2) if disclosed in the relative form to the national income (GDP or \( Y \)) will become:

\[ \Delta \left[ \frac{D}{Y} \right]_t = r \left[ \frac{D}{Y} \right]_{t-1} - \left[ \frac{PB}{Y} \right]_t \]  

(3a)

\[ \Delta d_t = r d_{t-1} - pb_t \]  

(3b)

The second definition approach of fiscal sustainability is described by its relation with solvency. Dinh (1999) states the fiscal solvency of a country is highly dependent on the net worth of assets and liabilities of the states, which can be simply defined as net worth = assets - liabilities. If the net worth shows a negative value then the country is in insolvent condition.

Following (3), the distribution toward GDP brings the consequences that the Y growth should also be taken into account. If Y grows at \( g \), then the addition to the debt will become:

\[ \Delta d_t = \frac{r - g}{1 + g} d_{t-1} - pb_t \]  

(4)

If there is no addition of new debt (\( \Delta d_t = 0 \)), then

\[ pb_t = \frac{r - g}{1 + g} d_{t-1} \]  

(5)
From the definition (5) above, a country can be addressed as a net debtor (as reflected by \( d > 0 \)) will face two possibilities as follows:

a. If \((r-g) > 0\), then to achieve the fiscal solvency, it requires surplus in the primary balance by the value of \(pb\).

b. If \((r-g) < 0\), even if a country has already a loan stock of \(d\), it is possible to have a budget deficit (measured in the primary balance) without risking the fiscal solvency as long as the deficit does not exceed the value of \(pb\).

Thus the amount of loans of a country may indirectly describe its fiscal sustainability. A country with a low debt level will be still facing the problem of fiscal solvency under a poor economic prospect, as reflected in \((r-g) > 0\). Conversely, a country can have a relatively high lending rates without endangering its fiscal solvency due to a bright economic outlook, technically reflected as \((r-g) < 0\). But it should be noted that this sort of thing does not mean a country can have a level of borrowing is too high. The most serious risk when interest rates are high and low economic growth prospects.

The third definition approach of fiscal sustainability third approach that develops the accounting approach requires a discount factor on the debt. This method is popular in economic literature as the present value constraint approach of the debt. The innovation in this method is by making the next iteration until \(k\) period for equation (1), as follows:

\[
D_t = \sum \frac{1}{(1+r)^{1+k}} \{ D_{t+1+k} - PB_{t+k} \} 
\]

(6)

The limit value for an infinite time of the first element in the right hand side of equation (6) will end up (asymptotically) by converging to zero*). The equation that remains will be

\[
D_t = - \sum \frac{1}{(1+r)^{1+k}} PB_{t+k} 
\]

(7)

For the record, the minus value of \(PB\) is a deficit and the plus value is a surplus.

Equations above are described as the intertemporal government financing constraints. Equation (7) states that the amount of government debt at a given time should be as large as

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2 Persamaan yang bersangkutan ketika tidak sama dengan 0 (nol) menunjukkan adanya Ponzi Game. Sebuah istilah yang diambil dari nama pencetusnya, Charles Ponzi (1919) untuk menyatakan utang baru untuk menutup utang lama sedemikian rupa sehingga hasil akhir sebesar nilai tertentu yang tidak sama dengan nol.
the present value of the primary balance deficit in the future (Cuddington, 1996). That means that the debt growth must be lower than the growth rate (Buiter, 2002). If the condition is met then the budget policies are categorized sustainable.

These three definitions above give the same understanding, that fiscal sustainability is the fiscal capacity to implement various government policies and programs by maintaining macroeconomic stability in the emphasis in keeping the state debt to GDP ratio relatively constant. Some of the concepts mentioned above later inspired a variety of empirical research to assess the fiscal sustainability.

In general, the developing research can be categorized into four perspectives (Arnone, Bandiera, and Presbitero, 2005), namely (1) optimization model, (2) non-optimization model, (3) fiscal space model, and (4) disincentive effects model. Optimization model examines fiscal sustainability with emphasis in the loan costs. Non-optimization model monitors the dynamics of debt by connecting it to the growth rate of loan interest.

Model (3) observes changes in fiscal space due to the expense for the loan interest. In the end, this model would detect the consequences on the economic growth when the government maintains fiscal space in order to maintain fiscal sustainability. More in-depth, model (4) expands the impact analysis of the currency depreciation, deficit, inflation, and uncertainty on fiscal sustainability. In a glance model (1) is an empirical operation of the accounting approach. Meanwhile, model (2), (3), and (4) describe the solvency approach and the present value constraint approach.

Hamilton and Flavin (1986) were the first to examine fiscal sustainability. In the framework of optimization models, their question was whether the ongoing deficit remains in control of the long-term budget sustainability. They use a fixed rate in their analysis for the U.S. data. The conclusion is the presence of compatibility between the deficit and the ability to pay debts.

Wilcox (1989) developed this approach of Hamilton and Flavin (1986) by assuming that the interest rates are no longer fixed. The result of his studies with non-optimization model showed that America’s debt remains sustainable as far as fluctuation in the interest rate changes is stationary. Both studies confirmed that long-term sustainability (the ability to pay debt) is achieved through short-term sustainability (deficit stability control).

In addition to the standard factors above, some researchers began trying to identify other factors in the frame of fiscal space model. Buiter (1993) identified that high rate inflation will increase the primary deficit by lowering the real value of tax revenue. As a result, debtor countries have difficulties in their fiscal operations. Consequently, adjustment of debt maturity
with the period of tax revenues (tax smoothing) would be a solution for fiscal sustainability (Barro, 1997).

Buiter (1997) identified other factors that also affect fiscal sustainability, that are the exchange rate, foreign exchange reserves, consumption expenditure and government investment spending. Within the complexity of these problems, Buiter (2002) suggested that government debt is used only for investment spending purposes in order to promote fiscal conservatism. Meanwhile, the tax increase only as a constant part of GDP.

In connection with the exchange rate, Turner (2002) noted that the demand for U.S. dollar-denominated bonds will generally increase when the monetary regime use free (floating) exchange rates. This is because the confidence toward exchange rate in developing countries and emerging markets is still generally low.

Calvo (2003) found an interesting example of the economic impact to the fiscal burden. In 1981-83 Mexico experienced a sudden stop, which is the cessation of a large numbers of capital inflows into the country. This is due to the declining confidence from investor in the performance of the economy and uncertain political situation. As a result, foreign reserves of Mexico have decreased by 20 percent of GDP.

Mendoza and Oviedo (2004) pioneered the analysis of foreign debt sustainability by introducing a natural debt limit (NDL). Natural debt limit is the annuity value of the fiscal balance in times of fiscal crisis. The result of their studies for the four countries in Latin America shows that the ratio of debt to GDP varies above the NDL, thus the solvency is also different.

Similar researches for the case of developing countries have been conducted, for example by Yamauchi (2004) for the case of Eritrea, Yilanci and Ozcan (2008) for the Turkey, and Makin (2005) for south-east Asian countries. These studies do not provide any firm conclusion about the fiscal sustainability. The diversity of these results is due to the characteristics of fiscal policy and macroeconomic environment which typically occur in each country.

Researches on debt that took place in Indonesia, especially domestic debt, are still rarely performed. This is understandable because the domestic government bond market began only in 2001. Consequently, most of the research that developed in Indonesia is still devoted to foreign debt. Kuncoro (1999) obtain empirical fact that the deficit policy, financed from foreign loans, crowd out private investment whose consequence is the lack of the role of foreign debt in economic growth. Saleh (2002) examined the role of foreign debt in the Indonesian economy with similarly negative result. The null contribution of the foreign debt is mostly caused by its inability in creating domestic revenues.
In Indonesia, the new fiscal risks itself appear explicitly in the state budget of 2008. Previously, fiscal risks are implicitly expressed, there are even less attention devoted to them. The awareness toward fiscal risk arose after the 1997 economic crisis. Study by Soelistijaningsih (2002) showed that debt risk could be reduced by diversifying the loan currency. These results are supported by the findings of Mark (2004). Indonesia’s fiscal sustainability can only be maintained in the absence of heavy depreciation.

PPE UGM and BAF (2004) concluded that Indonesia’s foreign debt is large since the cost of borrowing is cheaper than the cost of domestic debt. This is reason of the low efficiency of foreign debt. However, PPE UGM and BAF (2004) confirmed that Indonesia’s debt is still relatively safe from the risk of default. On the other hand, Ulfa and Zulfadin (2004) obtained rather ambiguous results. Some fiscal policies which they identified (such as budgeting reforms) have reduced the contingency liabilities in the form of debt reduction. On the other side some fiscal policies would increase the contingency liabilities (in the form of deposit insurance schemes).

Related to fiscal decentralization since 2001, Kuncoro (2005) examined the impact of contingent liabilities in the form of transfers on economic growth and regional disparities. The result of his study proved that local governments respond over-actively these transfers. As for the implication, the central government transfers are required to allocate a greater amount in order to reduce disparities between regions.

Hanni (2006) examined the factors affecting Indonesia’s fiscal sustainability. The result of his study concludes that some external macro economic variables are important determinants for fiscal sustainability. Jha (2009) incorporated the oil price factor into the analysis of fiscal sustainability. The results of his analysis for 32 countries in Asia (including Indonesia) stressed that oil price fluctuations have significant impacts on fiscal sustainability through the amount of subsidy and the amount the government revenue.

Departing from these identifying results of the determinants of fiscal sustainability, the currently developing researches lead to the detection of fiscal vulnerability due to debt burden. Ciarlone and Trebeschi (2006) examined the external debt burden of developing countries. They found little correlation of these key factors in estimating the debt crisis.

Tunner and Samake (2006) found the probability of fiscal vulnerability can be reduced by making fiscal adjustments. Celasun, Debrun, and Ostry (2007) studied the possibility of fiscal sustainability in 5 developing countries. The most interesting finding is that the fiscal policy itself is an important factor in creating the risk of fiscal vulnerability.
IV. METHODOLOGY

Many studies above suggest several important things. Firstly, the configuration of the
government budget will bring an enormous impact on the economy. Secondly, external factors
appear to be more dominant in influencing a country’s fiscal condition. Third, so far there has
been no specific study in Indonesia, which estimates the future fiscal condition associated with
the integration of all external factors aforementioned.

This study seeks to bridge the gaps in the empirical study of fiscal policy in Indonesia by
taking the synthetic angle studies. Unlike the models in previous research, the first innovation
of this research is in analyzing the problem by using 2 types of debt: the domestic debt (DD) and
foreign debt (FD).

\[ D_{total} = DD + FD \] (8)

Following equation (2), the basic model of fiscal sustainability Indonesia (8) can be
reformulated as

\[ \Delta D_{total} = f (DD_{t-1}, FD_{t-1}, PB_t) \] (9)

Equation (9) is still in absolute form. With no intention to change it, it can be transformed
into a relative form of the ratio to GDP.

\[ \Delta (RD_{total})_t = \alpha_0 + \alpha_1 (RDD)_{t-1} + \alpha_2 (RFD)_{t-1} + \alpha_3 (RPB)_t + \mu_t \] (10)

Equation (10), derived from equation (5), implicitly assumes that the interest rate and
economic growth (EG) are constant.

These assumptions will be dismantled by bringing it explicitly as explanatory variables.
Furthermore, several other variables are included in the model as a control. Associated with
two kinds of debt, foreign interest rates (r) and domestic interest rate (SBI) will be displayed. In
connection with foreign debt measured in domestic currency, depreciation (Dep) is also used as
explanatory variables. The completed models is as the following:

\[ \Delta (RD_{total})_t = \alpha_0 + \alpha_1 (RDD)_{t-1} + \alpha_2 (RFD)_{t-1} + \alpha_3 (RPB)_t + \alpha_4 (r)_t + \alpha_5 (SBI)_t + \alpha_6 (EG)_t + \alpha_7 (Dep)_t + \mu_t \] (11)

The second innovation of this research is that the sustainability of the state budget is
estimated with the quarterly data during the post-crisis period (1999-2009). The data required
for the purposes of this study are generally already available on a quarterly basis to facilitate the
The Sustainability of State Budget in Debt Repayment

implementation of the execution model. One exception occurs in the primary balance. The data available from official publications are the annual data. The data are then linearly interpolated in such a way that fit with other data.

In general, the data are obtained from Bank Indonesia, Ministry of Finance (cq DMO, Debt Management Office), and the Central Bureau of Statistics. The variables that will be used are specified as follows. The debts analyzed here are the central government debts (not including Bank Indonesia, state enterprises/BUMN, prefectural enterprises/BUMD, or local government). The U.S. Federal interest rates are used as representative foreign interest rates. SBI interest rate of period of 3 months is placed as domestic interest rates*). Depreciation is calculated as the percentage changes in the middle exchange rate of Rupiah against the official publication of the BI of U.S. dollar. Similarly, economic growth is calculated as the percentage change of GDP at constant price of 2000.

V. RESULT DAN ANALYSIS

The assessment result of fiscal sustainability model is presented in Table 1 below. With the significance of 92 percent, domestic debt is believed to encourage an increase in total government debt amounted to an average of 36 percent. On the other hand, with a smaller significance, foreign debt pushes down total government debt by 20 percent. This last result supports the government’s claim that the ratio of government debt to GDP showed a consistent decline.

Increasing foreign interest rates tends to reduce the ratio of total debt level by 22 percent. According the theoretical framework, the influence of this exchange rate in debt should be positive. Fortunately, this coefficient is not statistically significant at the 95 percent of confidence level. The most probable interpretation is that the negative value is solely related to the decrease of the ratio of government debt that was taking place. On the other hand, foreign interest rates during the analysis period experienced an improving trend.

Change in SBI rates will increase the burden of total debt (especially the domestic debt) by 27 percent. If compared, the coefficient of the effect of the rising domestic interest rates (in absolute terms) is higher than the effect of rising foreign interest rates. These results support the findings of the study by PPE UGM and BAF (2004) which indicated that the cost of foreign debt is cheaper than domestic debt financing in such a way that efficiency is also higher.

3 Suku bunga yang lebih cocok sebetulnya adalah BI rate sebagai suku bunga kebijakan. BI rate itu sendiri baru diintroduksikan sejak 2005. Oleh karena itu, suku bunga SBI dapat dianggap merepresentasikan suku bunga kebijakan.
The depreciation of rupiah against foreign currencies has significantly brought an increase in ratio of total government debt stock by 14 percent. The value of government debt is largely denominated into U.S. Dollars. With the same amount of foreign debt, the government expenses will be 14 percent heavier with a 1 percent decrease of depreciation of rupiah against U.S. Dollar. These results are also consistent with the results of studies by Soelistijaningsih (2002) and Mark (2004), that the debt diversification into several foreign currencies will ease the burden of government debt.

Economic growth also had an impact in increasing the ratio of government foreign debt by 5 percent. Economic growth reflects the dynamics of the economic strength of society. Increasing the economic power would bring an impact in increasing the public demand for goods and services, including the public goods supplied by the government. Consequently, the government has to increase its supply in the form of increased spending. When the amount of expenditure cannot be sustained by domestic revenues, increasing debt would become the inevitable last alternative.

When compared with the coefficient of SBI rates, the magnitude of this economic growth is smaller such that the coefficient (SBI - EG) > 0. This condition is a prerequisite to achieve fiscal solvency while assuming that the configuration support of the state does not experience any changes. These results indicate that the state budget is still under a safe condition to meet all the government’s debt obligations.
The Sustainability of State Budget in Debt Repayment

Last variable as the determinant of total government debt in the above model is the primary surplus of state budget. The RPB coefficient shows a minus value. These results are in accordance with the theory in the previous chapter. If the primary balance surplus increase can be maintained, for example in the value of 1 percent, then the additional government debt can be reduced by an average of 61 percent. This, once again, means that reduction in debt burden requires the primary balance surplus through budgetary discipline.

The primary balance surplus points the position of the real fiscal space. Unfortunately, the primary surplus during the period of analysis is still relatively low (an average of only 6.84 percent of the GDP). Such minimal volume resulted in small primary surplus availability of funds that can be utilized for the reserves of debt repayment in case of any unanticipated shocks in the future. Other consequence is that the stimulus in domestic economy would absorb the impact of the crisis in order to spur economic growth which is not sufficient. Thus, the effort to preserve the primary balance surplus is the key in managing policy of the state budget.

The second condition is the coefficient of PB fiscal sustainability of -1 (one). The measurement is taken under 2 procedures: the ANOVA test and $\chi^2$ to prove whether the coefficient on PB really meets the formula, which is equal to -1. The test results are presented in Table 2.

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>df</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>3.531335</td>
<td>(1, 36)</td>
<td>0.0683</td>
</tr>
<tr>
<td>Chi-square</td>
<td>3.531335</td>
<td>1</td>
<td>0.0602</td>
</tr>
</tbody>
</table>

Null Hypothesis Summary:

<table>
<thead>
<tr>
<th>Normalized Restriction (= 0)</th>
<th>Value</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 + C(4)</td>
<td>0.385393</td>
<td>0.205085</td>
</tr>
</tbody>
</table>

Restrictions are linear in coefficients.

Both procedures scored 3.3513 for the value of F and $\chi^2$ of each count. With the initial hypothesis of C(4) = 1, the conclusion is that to accept it, the degree limit of confidence at 90 percent is required. That is, at the risk error of 5 percent, the sustainability of the state budget is not supported by the data. If the risk of error is to be raised by 10 percent, the sustainability of the new state budget is acceptable.
The test results above indicate a message that the sustainability of the state budget is still very fragile. This fragility is related to economic circumstances that may occur. Consequently, the risk of this fiscal fragility should be anticipated early on. Anticipation that can be taken is (if supported by political decisions) to arranging the budget according to the multi-year system, which means that the state budget for the next 3 years, for example, is set in the running year. The experience of Australia, Canada, Germany and the Netherlands in the preparation of the state budget, is worth adopted to be a model by the government.

As an additional illustration, Australia and New Zealand have incorporated the explicit contingent liabilities and contingent expenditure in the government financial reports. Italy and the United States put it in the budget approval of the loan by doing the present value on the amount of the value. Progress like this then spread to many other developing countries like Colombia, Malaysia, and Philippines, particularly for the risk of infrastructure projects that are guaranteed by the government (Subyantoro, 2008). All of these are projected in order to minimize the potential range of risks that will arise.

Apart from all that, the main conclusions of this study are in opposite with results of previous research in Indonesia, which generally found the fiscal sustainability. Differences conclusion is possible because the differences in data, methods, and the definition used. The use of annual data (as did previous research) tends to eliminate fluctuations in the period of 1 year in a way that it gives in general an idea of fiscal sustainability. This study would cover fluctuations in quarterly periods and in fact give a different picture.

VI. CONCLUSION

This paper has provided empirical facts about fiscal sustainability with a case study in Indonesia. Review on quarterly data give different results with previous studies on the same theme based on the annual data. The main finding is that Indonesia’s fiscal strength has not been achieved despite having solvency for the payment of domestic and foreign debt. The source of this discontinuity is the debt burden which increases far more rapidly than the increase in foreign debt.

This study implies that the issuance of Government Securities (SUN) needs to be done with such prudence by considering the burden of payment of maturing government securities. SUN maturity should be adjusted to the ability of the state budget for the respected year. In this regard, a careful study on the other burdens of the state budget needs to be more properly calculated. Therefore, the fiscal risk exposure should appropriately serves as a guide in each issue of SUN.
In terms of foreign debt, shifting the burden of debt can be done through re-profiling, rescheduling, and debt restructuring for the burden can be distributed in accordance with the maturity. The expenses need to be aligned also with the burden of domestic debt maturity. The ratio of foreign debt of the government did show a declining trend. This momentum needs to be best utilized in order to minimize the risk of remaining debt. To reach this end, sectional, regional, fiscal, monetary, and foreign policy coordination have to be optimally synergized.

A decline of the government debt to GDP ratio does not necessarily mean an increase in the government’s financial position. This is due to the possible sale of the state companies, depletion of sources of public ownership, and decline in government fixed capital. Another possibility that needs to be looked out for is the search for new debt, especially those off budgets to cover the old debts with the same amount.

In addition to fiscal sustainability, the government also needs to consider the possibility of another fiscal burden if the economy is experiencing internal problems. The quasi-fiscal activities of Bank Indonesia, state and prefectural enterprises, can be a contingent liability if they are not managed properly. Internal Finance of Bank Indonesia, state and prefectural enterprises are indeed separated from the state finances, but their involvement in debt and business is also public, publicly guaranteed and semi guaranteed because the government is still the owner of the shares and there are the reason of “too big to fail”.

Further studies on the fiscal sustainability Indonesia is still open to be done. A more in-depth study can be conducted to examine the sources of fiscal fragility. Study of fiscal sustainability by considering the assumptions used in each preparation of the state budget, such as the oil price and oil production (oil lifting), is certainly interesting to be observed. Remaining weaknesses in this study can be covered by including the factors and scales from the monetary side.
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This paper investigates the relative importance of monetary transmission channel to inflation of passing persistent shock to the risk premium. The findings show that nominal exchange rate depreciation, triggered by a more persistent shock to interest risk premium, worsens the state of the economy in the short- and long-run. Such distinctive shocks effect is transmitted through the economy that typifies lack of response of consumer price disinflation to interest rate tightening caused by high real rigidity, strong cost channel of interest rate, strong cost channel of exchange rate pass-through and weak demand-side channel of exchange rate pass-through. This study suggests a proper monetary policy response, which is the smallest interest rate increases within the feasible set of monetary policy responses that the model recommends, to minimize the adverse effects of the shocks.

JEL Classification: F41; E52; D58
Keywords: Exchange rate, Balance of Payment, Monetary transmission and policy, Dynamic General Equilibrium.
I. INTRODUCTION

Adverse exchange rate shocks frequently hit Indonesia. Such particular shocks might occur in terms of frequent one time shocks or in a more persistent way during a longer period. The currency crisis that badly hit the country in 1997-1998 can be considered as a severe persistent shock to the risk premium that devalued the exchange rate and altered the economy's dynamic equilibrium. Invaluable lesson should be continuously learned to pursue better monetary management in anticipating possible recurrence of such crises. Better understanding of monetary transmission mechanism and its consequence to monetary policy limitation is therefore necessary and worthwhile.

Cost channel of monetary policy has been increasingly explored for the case of developed economies. Barth and Ramey (2001) provide empirical evidence for cost channel of monetary policy based on industry level data. Ravenna and Walsh (2006) shows that, if nominal interest rate adjustment directly affect real marginal cost, then interest rate policy directly affects inflation. They also show that any shock to the economy with the presence of the channel will generate a trade-off between stabilizing inflation and stabilizing output gap. Chowdhury, et al. (2006) applied a structural approach to find that the estimated direct cost effects of short-run nominal interest rates significantly contribute to the inflation dynamics in the majority of G7 countries. Agénor and Montiel (2008) noted that the interest rate cost channel has been proposed as an explanation of the “price puzzle” phenomenon, which was labelled by Eichenbaum (1992) referring to the existence of a positive correlation between increases in the short-term interest rate and the price level in Sims’ (1992) empirical anomaly finding.

Existing empirical studies on Indonesia’s monetary transmission compiled in Warjiyo and Juda Agung (2002) did not include cost channel of interest rate. However, the study, which employed VAR method, found “price puzzle” in response to monetary policy tightening. This phenomenon is usually linked to either VAR misspecification or the possible existence of a strong cost channel of monetary policy. As an emerging economy with relatively low labour productivity, it is likely that capital accumulation has been the main source of Indonesia’s output growth. Hossain (2006) estimated a Cobb-Douglas production function to find that capital accumulation accounts for 60 percent source of growth in Indonesia for the last forty years. It is in the spirit of the Young (1995) paper that claimed that growth in East Asian countries was mainly driven by high rates of capital formation. Combined with higher lending rate, lower capital productivity, and lower wage than those in advanced economy, one can argue that capital share (capital owner’s income as a fraction of GDP) is greater than the labour share. This argument enhances the importance of investigating cost channel of monetary policy.
This study uses a new Keynesian dynamic general equilibrium model of a small open economy involving four domestic economic players, namely the household, the firm-producer, the government, and the central bank, which interact with the foreign economy. The model characterizes the household’s money-in-the-utility function and the firm’s constant elasticity substitution production that employs labour, capital goods, and domestic and imported raw material. Interest rate policy is transmitted to the new Keynesian Phillips curve type of inflation through channels of aggregate demand, exchange rate pass-through, and cost of capital. I assume that the expectation channel of monetary policy is fully credible. It corresponds to agent’s rational price expectation and perfectly credible monetary authority, which utilizes a simple interest rate policy rule contingent to the state of shock. Shock to interest rate risk premium is applied through a covered interest rate parity determination of exchange rate. The model is adapted and developed from optimizing models with staggered wage and price-setting, which have been widely used in the literature on inflation and monetary policy3.

The model is employed to observe the effect of short term persistent shock to the risk premium on the performance of an economy, which is intended to be close to the structure and behaviour of Indonesia’s economy. The focus of this study are the relative importance of monetary transmission channel that pass the shock and interest rate response to inflation and how monetary policy should respond optimally to the particular type and state of the shocks, given the distinctive monetary transmission.

This paper shows that nominal exchange rate depreciation triggered by persistent shocks to interest risk premium worsens the state of the economy in the short- and long-run. The shocks are transmitted through the economy characterizing lack of response of consumer price disinflation to monetary policy contraction resulted from high real rigidity, strong cost channel of interest rate, strong cost channel of exchange rate pass-through, weak demand-side channel of exchange rate pass-through, and weak aggregate supply channel of interest rate.

The study suggests a proper monetary policy response, which is the smallest interest rate increases within the feasible set of monetary policy responses that the model recommends, to minimize the adverse effects of the shocks. Other economic policies might be necessarily complementary to the limited span of monetary policy that can in turn help strengthening aggregate demand channel of interest rate. The most important one is policies that help reducing capital share of economy’s output and consecutively could weaken the cost channel of interest rate.

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2 According to Input-Output Table 2005, the share of return on equity in total value added is 64%, while the employee’s salary contributes 34% of total value added.

3 See, for example, Ravenna and Walsh (2006), Christiano et al. (2005), Smets and Wouters (2003), Erceg and Levin (2003), Woodford (2003), and Murchison (2004). The first two incorporated interest cost channel for monetary policy.
The organization of the rest of this paper is as follows. Section 2 presents a dynamic equilibrium model with prices and wage stickiness. Section 3 presents simulation scenarios, parameter calibration and model solution. Section 4 analyses simulation result. Section 5 concludes the study and infers some policy recommendations.

II. THEORY

This paper investigates the relative importance of monetary transmission channel to inflation of passing persistent shock to the risk premium. There are lots of literatures on this topic and one of the fast growing approach is the dynamic general equilibrium framework.

This study extends the dynamic general equilibrium model used and explained in detailed in Hutabarat (2007). This paper extends the model by incorporating interest-rate risk premium on foreign-denominated asset as a function of ratio of net foreign debt to GDP. Then, balance of payment block is developed that results in equations of current account, capital account, trade and service account, and net foreign asset. Moreover, I assume that the government also collects income tax on capital goods lessor’s and the firm owner’s dividend in addition to wage income tax in the previous model. I also change the Cobb-Douglass production technology with a constant elasticity of substitution technology to allow lower elasticities of factor inputs’ demand with respect to input prices. The model’s extension is described as follows.

2.1. The Household

The dynamic budget constraint is expressed in domestic currency’s nominal and real terms as follows.

\[ P_t c_t + (M_t^d - M_{t-1}^d) + (B_t^{HG} - B_{t-1}^{HG}) + (s_t B_t^{H*} - s_{t-1} B_{t-1}^{H*}) + P_t (k_t - (1 - \delta)k_{t-1}) \]
\[ \leq i_{t-1} B_{t-1}^{HG} + \tilde{r}_{t-1} s_t B_t^{H*} + P_t^{im} + (1 - \tau_t)(w_t l_t + z_{t-1} p_t k_{t-1} + \Pi_t) \]  
\[ c_t + (m_t^d - m_{t-1}^d) + (b_t^{HG} - b_{t-1}^{HG}) + (q_t b_t^{H*} - q_{t-1} b_{t-1}^{H*}) + (k_t - (1 - \delta)k_{t-1}) \]
\[ \leq -\frac{\pi_t}{1 + \pi_t} m_{t-1}^d + r_{t-1} b_{t-1}^{HG} + \tilde{r}_{t-1} q_{t-1} b_{t-1}^{H*} + P_t^{im} + (1 - \tau_t)(w_t l_t + z_{t-1} k_{t-1} + \Pi_t) \]

Sources of household’s revenues are income from supplying labour services (wages), selling imported goods, renting capital goods to the firm, owning firm (dividend) and selling the previous period’s depreciated capital goods, as well as interest income on government bonds and foreign assets.
I assume that the household’s net foreign asset position is negative, \( (B_t^H < 0) \) meaning that the household is a net debtor of foreign asset. I further assume that foreign investors require a risk premium, \( \kappa_t \), for the rate of interest, \( i_t^{*} \), of foreign currency-denominated loans they extend to the domestic household, so that \( (1 + i_t^{*}) = (1 + i_t^{*})(1 + \kappa_t) \). Hence the principal and interest income from foreign asset is \( (1 + i_t^{*} \tau) = (1 + \kappa_t \tau) B_t^{H} < 0 \).

I follow Al-Eyd and Hall (2006), Murchison, et. al (2004), and Schmitt-Grohe and Uribe (2003) in defining the country-specific risk premium, \( \kappa_t \), which depends on net foreign debt-to-GDP ratio. The risk premium is also subject to a shock process, \( \varepsilon_t^\kappa \), representing unforecastable changes in foreign investor’s preferences on domestic assets.

\[
\kappa_t = \varsigma \left( \frac{s_t B_t^H}{e_{t}^B_{t} y_t} - 1 \right) + \varepsilon_t^\kappa
\]  

where \( \varsigma \) is scaling parameter. The equation says that foreign asset interest-rate risk premium depends on net foreign debt, exchange rate, output, and exogenous shock to the risk premium. An increase in net foreign debt (or a decrease in net foreign asset) negatively affects the ability of domestic resident to repay the debt. Exchange rate depreciation increases the amount of domestic currency required to pay foreign debt and, in turn, worsens domestic resident’s ability to repay their foreign debt. A declining real income worsens the economy’s capability for foreign debt repayment. Risk premium on the foreign debt is absent when foreign asset equals foreign debt and negative if net foreign asset is positive. The later means that the domestic household can enjoy a lower-than-world interest rate for its foreign debt.

From the maximization of household utility function with respect to labour supply and consumption, we can find the real marginal cost of working of the form

\[
m_{i}^w = \left( A_t^\lambda (v-1) c_t^\sigma (\alpha_L y_t) \lambda \right)^{1/\lambda} \]

The household rents out capital goods to the firm with real rental rate of capital, \( Z_t \), which is obtained by combining the first order condition of utility maximization with respect to real capital stock and nominal domestic bonds as follow

\[
Z_t = \frac{r_t + \delta}{1 - E_t \tau_{t+1}}
\]
Real rental price of capital that the household-lessor charges to the firm should cover real interest rate, depreciation rate of capital and the expected future income tax rate.

Real marginal cost of imports equals real import price equation when prices are fully flexible, which is equal to real exchange rate.

\[ mc^m_t = q_t \]  

(6)

Nominal exchange rate is obtained by combining the first order condition of the household’s utility maximization with respect to nominal domestic and foreign bonds, which implies covered interest rate parity.

\[ s_t = E_t s_{t+1} \left( \frac{1+i^*_t}{1+i_t} \right) (1+\kappa_t) \]  

(7)

In order to obtain the household’s financial assets and financial account, we can elaborate the equality of nominal budget constraint (1.2) by substituting the firm’s real profit \((\Pi_t = y_t - w_t l_t - p^m t m_w t - z_t - 1 k_t - 1)\), capital accumulation equation, \([k_t = (1 - \delta)k_{t-1} + iv_t]\), and the decomposition of real investment as domestic and imported capital goods \((iv_t = iv_t^d + im_{t^{kg}})\). We can further substitute the decomposition of imported goods as finished goods, intermediate goods and capital goods \((im_t = im_t^{fm} + im_t^{im} + im_t^{kg})\), and take into account that domestic output, \(y_t\), is supplied to the domestic household as consumption goods \((c_t^d)\), to the firm as additional capital goods \((iv_t^d)\), to the government as consumption and investment goods \((g_t)\), and to the foreign importers as exported goods \((x_t)\). These substitutions result in the household’s dynamic real budget constraint that can be rearranged to get the household’s real financial assets of the form

\[ b^H_t = (x_t - q_t im_t) + g_t + [(1+r_{t-1})b^{HG}_{t-1} + (1+r^*_t)(1+\kappa_{t-1})q_t b^{H*}_{t-1}] - \tau_t y_t - \left( m^d_t - \frac{m^d_{t-1}}{1+\pi_t} \right) \]  

(8)

where \(b^H_t\) is the household’s real financial investment on the government bonds and foreign bonds in period \(t\). It is equal to their net real revenues as exporter and importer and as the supplier of goods to the government, plus the principal and interest real income from the previous period’s financial investment, minus real income tax expenditure and changes in real money holding.
2.2. The Firm-Producer

The firm produces output using a Constant Elasticity of Substitution (CES) production technology that utilizes labour, capital, and foreign and domestically produced intermediate goods as production input. The aggregate real output of the economy follows Murchison et al. (2004) to take the form

$$y_t = \left( \frac{1}{\alpha_L} (A_t l^d_t)^{\frac{v-1}{v}} + \frac{1}{\alpha_K} (u_t k_{t-1}^d)^{\frac{v-1}{v}} + \frac{1}{\alpha_M} (im_{tm}^r)^{\frac{v-1}{v}} \right)^{\frac{1}{v-1}}$$

where $\alpha_L, \alpha_K, \alpha_M$ are labour, capital and import share, respectively, which are assumed to be constant and forms a constant return-to-scale technology of production, and $v$ is the elasticity of substitution between factor inputs. The objective of the firm is to choose the level of factor inputs that maximize its present discounted values of lifetime real profit, which is the deviation of total real revenues from total real cost.

$$\Pi_t = \left( \frac{1}{\alpha_L} (A_t l^d_t)^{\frac{v-1}{v}} + \frac{1}{\alpha_K} (u_t k_{t-1}^d)^{\frac{v-1}{v}} + \frac{1}{\alpha_M} (im_{tm}^r)^{\frac{v-1}{v}} \right)^{\frac{1}{v-1}} - w_t l^d_t - p_t m_t^r - z_{t-1} k_{t-1}$$

Employment equation is given by the first order condition with respect to labour demand

$$l^d_t = \frac{\alpha_L A_t^{\frac{1}{v}} y_t^{\frac{v-1}{v}}}{w_t^{\frac{v}{1-v}}}$$

From the first order condition of the firm’s profit maximization, we can obtain the demand for the imported intermediate goods of the form

$$im_{tm}^r = \frac{\alpha_M y_t^{\frac{v}{1-v}}}{p_t^{\frac{1}{v}}}$$

The firm’s stock of capital goods required for production is obtained from the first order condition of the firm’s profit maximization with respect to capital:

$$k_t = \frac{\beta \alpha_K E_t^v u_{t+1}^{\frac{v-1}{v}} E_t^v y_{t+1}^{\frac{v-1}{v}}}{z_t^{\frac{1}{v}}}$$
Real marginal cost of producing goods is derived from the firm’s real cost minimization problem in which the aggregate firm chooses the level of factors inputs that minimize total real cost, $tc_t = w_t \ell_t + p_t^m k_t + z_{t-1}$, subject to CES production function (9). The aggregate firm’s real marginal cost, $mc_t^d$, is expressed as a function of real wage, real rental price of capital, real import price and the level of technology of the form:

$$mc_t^d = \frac{w_t}{A_t} \left( 1 + \frac{1}{\alpha_L} \left( \frac{w_t}{A_t} \right)^{\gamma-1} \left( \alpha_K \left( \frac{n_t}{z_t-1} \right)^{\gamma-1} + \alpha_M \left( \frac{1}{p_t^m} \right)^{\gamma-1} \right) \right) \frac{1}{(\gamma-1)}$$ (14)

The new Keynesian Phillips curve in deviation from steady-state follows Calvo’s staggered price setting mechanism (Calvo, 1983).

$$\pi_t^d = \beta E \pi_{t+1}^d + \left( \frac{(1-\theta)(1-\beta\theta)}{\theta} \right) mc_t^d$$ (15)

where, $\pi_t^d = \ln P_t^d - \ln P_{t+1}^d$, $\pi_t^d = P_t^d - P_{t-1}^d$ and $\theta$ is degree of domestically-produced goods price stickiness.

Replacing real marginal cost with the discrepancy between actual output and natural output (output gap) is inappropriate in dynamic general equilibrium model since output gap $(y_t / y_t^n)$ in such model is not a measure of business cycle that can be linked to the movement of real marginal cost. Natural output is the level of output that would prevail if nominal rigidities are absent in the economy. For example, Clarida, et al. (1999, p. 1665) define the “natural level of output” as “the level of output that would arise if wages and prices were perfectly flexible.” We can interpret natural output as the output that corresponds to the condition where all firms act competitively by setting their price at nominal marginal cost, implying a constant unit mark-up. Natural output $(y_t^n)$ in dynamic general equilibrium model does not stand for trend level of actual output in monopolistically competitive market with nominal rigidity.

2.3. The Fiscal Authority

Government expenditure is financed through collecting income tax on the importer’s, capital goods lessor’s, and firm owner’s dividend or issuing domestic- and foreign-denominated bonds. The government’s nominal dynamic budget constraint is expressed as

$$B_t^{GH} + s_i B_t^{G^*} + \tau_i P_t y_t + M_t^s - M_{t-1}^s = (1 + i_{t-1}) B_t^{GH} + (1 + i_{t-1}) (1 + \kappa_t) s_i B_{t-1}^{G^*} + p_t g_t$$ (16)
where \( B_t^G = B_t^{GH} + s_t B_t^{G*} \) is government revenue from issuing domestic bonds \( (B_t^{GH}) \) and foreign bond \( (B_t^{G*}) \), \( \tau_{t} P_y \) is tax revenue, \( (M_t^P - M_t^{s,P}) \) is seignorage revenue, \( g_t \) is real government spending, and \( \pi_t \) is nominal exchange rate. The government real debt, which comprises its debt to the household and to the foreign economy, \( b_t^G = b_t^{GH} + q_t b_t^{G*} \), takes the form

\[
b_t^G = g_t + \left( (1 + r_{t-1}) b_{t-1}^{GH} + (1 + r_t^*)(1 + \kappa_{t-1}) b_{t-1}^{G*} \right) - \tau_t y_t - \left( m_t^s - \frac{m_{t-1}^s}{1 + \pi_t} \right) \tag{17}
\]

Fiscal policy rule takes the form of tax rate reaction function that ensures the sustainability of fiscal balance. The government’s objective is to achieve and maintain a fixed ratio of primary fiscal deficit-to-GDP.

\[
\tau_t = \tau_{t-1} + \Theta \left( \frac{g_t - \tau_t y_t}{y_t} - \psi \right) \tag{18}
\]

where \( \tau_t \) is tax rate policy response, \( g_t \) is real government consumption, \( y_t \) is real output, \( \Theta \) is fiscal policy response parameter, and \( \psi \) is a constant parameter representing the target of real primary fiscal deficit-to-GDP ratio.

### 2.4. Real Net Foreign Debt and Financial Account

Real net foreign debt, \( d_t^* \), is obtained from the household’s and the government’s real budget constraints. It is used to finance trade deficit and repay the previous period’s foreign debt.

\[
d_t^* = (im_t - x_t / q_t) + (1 + r_t^*)(1 + \kappa_{t-1}) d_{t-1}^* \tag{19}
\]

Financial account (foreign debt flow), \( FA_t \), is the total of changes in the government’s net foreign debt and changes in the private sector’s net foreign debt. We can get the national debt flow from the household and the government’s nominal budget constraints by assuming that government’s domestic debt equals the household’s holding on government bonds, that foreign residents do not hold government domestic-denominated bond \( (B_t^{GH} = B_t^{HG}) \), and the equilibrium of money holds.

\[
FA_t = (P_t^* im_t - P_t x_t / s_t) - [(1 + i_t^*)(1 + \kappa_{t-1}) - 1] B_{t-1}^* \tag{20}
\]
2.5. The Goods Market Equilibrium

The equilibrium of goods market is defined by resource constraint that equate the aggregate demand for output with the aggregate supply of output (2.1) of the form

\[
c_t + g_t + iv_t + x_t - im_t = \left( \frac{1}{\alpha_{LV}} \left( A_i l_i^d \right)^{\frac{v-1}{v}} + \frac{1}{\alpha_{Kr}} \left( u_i k_{i-1} \right)^{\frac{v-1}{v}} + \frac{1}{\alpha_{Mr}} \left( im_{it} \right)^{\frac{v-1}{v}} \right)^{\frac{v}{v-1}} \tag{21} \]

2.6. The Monetary Policy

The central bank is implicitly part of the government that supply money to the household through government consumption. Thus, bank lending channel is nonexistent in this model. The central bank affects inflation through aggregate demand, aggregate supply, exchange rate, and cost channel of interest rate policy. It employs a forward-looking Taylor-type interest rate policy rule as defined in Clarida, et al. (1999). It is a short term nominal interest rate response to the forecast of next period inflation gap, which is the deviation of the forecast of future inflation from its inflation target, while also taking into account the smoothness of interest rate movement.

\[
i_t = \chi i_{t-1} + (1 - \chi) \left[ \bar{\pi} + \pi_t + \alpha_{\pi} (\pi_{t+1} - \pi_{t+1}^T) \right] \tag{22} \]

where \( \bar{\pi} \) is the steady-state level of real interest rate and \( \pi_t^T \) is inflation target path at period \( t \), \( \chi \) is interest rate smoothing parameter, and \( \alpha_{\pi} \) is monetary policy response parameter.

Monetary policy does not respond to discrepancy between actual output and natural output (output gap). If monetary policy responds to such measure of output gap it aims to achieve the flexible price level of output under perfectly competitive goods market, which is higher than the trend of actual output under monopolistically-competitive market with inflexible price \( (y_t^n > y_t) \). If monetary authority achieves the target of natural output, it will tend to conduct an inflationary-biased policy because it could continuously generate accelerating inflation \( (\pi_t > E_t \pi_t) \), given zero average value of supply shocks (Sorensen et al., 2005). By using policy rule that only respond to inflation gap, it is assumed that monetary policy does not only aim to achieve inflation target directly but also the target of output indirectly. However, the target of output for stabilization policy provided by new Keynesian Phillip curve is the trend level of actual output \( (\tilde{y}_t) \).
Interest rate policy is passed-through to aggregate demand via three transmission channels. First, real interest rate affects consumption through substitution and income effect. Second, real interest rate determines capital goods procurement cost hence influence demand for investment. Third, policy rate has an effect on nominal exchange rate and then is transmitted to real exchange rate as a determinant of foreign demand for domestic good. The latter is also called as monetary transmission through indirect pass-through effect of exchange rate.

Monetary policy is transmitted to consumer inflation through three channels. First, aggregate demand channel of interest rate policy is passed-through to domestic inflation through changes in wages and profit margin. The second channel is interest cost of production channel, which is specifically the interest rate cost of procuring capital goods, either financed by equity or loan capital. Third, monetary policy affects consumer inflation through two exchange rate channels. The first one is through the cost of imported intermediate goods in domestic prices and the other one is through consumption imported-goods inflation. They are named intermediate and immediate direct pass-through effect of exchange rate to consumer price, accordingly.

III. METHODOLOGY

3.1. Model Solution Method

This study solved the static steady-state and the linearised dynamic model in deviation from steady-state using CONOPT solver under GAMS system. This solver employs Generalized Reduced Gradient method of solution for nonlinear programming problems (Rosenthal, 2006 and Drud, 2006), defined as:

\[
\min \text{ or } \max \quad f(z) = J = 0 \quad (\text{performance index}) \quad (23)
\]

subject to vector of implicit log-linear functions

\[
g(z) = g_t(y_{t-1}, y_t, y_{t+1}, x_t; \theta, y, \bar{x}) = \begin{bmatrix}
g_{1,t} (y_{t-1}, y_t, y_{t+1}, x_t; \theta, y, \bar{x}) \\
\vdots \\
g_{m,t} (y_{t-1}, y_t, y_{t+1}, x_t; \theta, y, \bar{x})
\end{bmatrix} = 0 \quad (24)
\]

\[l < z < u \quad (25)\]

\[4\] The interest cost of equity capital channel can also be named “firm’s profitability channel”. The model assumes that changes in interest rate is fully and symmetrically passed-through in the short run to the cost of equity capital, causing profit margin adjusts as well. The inclusion of cost of equity in the interest cost channel relies on two implied assumptions. First, that the firm’s loan-to-equity ratio in Indonesia’s nonfinancial business units is lower than that in developed economies. Second, that the firm’s market power in the former economy is stronger than in the later, causing the likelihood to have the rate of return on equity greater than interest rate cost of equity. It is in line with the view of Chowdhury et al. (2006) that the logic of interest rate effects on firms’ costs also applies when firms are primarily financed by internal funds.
where \( z \) is vector of optimization variables, \( l \) and \( u \) are vectors of lower and upper bounds, some of which may be minus or plus infinity, and \( f \) and \( g \) are differentiable nonlinear functions that define the model. Constraint (6.2) is general constraints and (6.3) is boundary of variables.

The objective function \( f \) is the variable to be minimized or maximized; \( m \) is the number of equations and \( n \) denotes number of variables. Vector \( z \) consists of \( y_{t-1}, y_t, y_{t+1} \) and \( x_t \), which are vector of endogenous lag variables, endogenous contemporaneous variables, endogenous lead variables and predetermined exogenous variables, accordingly. \( \theta \) is vector of parameter, \( \bar{y} \) is vector of steady-state values of endogenous variables, and \( \bar{x} \) is vector of steady-state values of exogenous variables. For \( T \) solution period, the implicit equations for all period are stacked to have a system containing \( M = mT \) equations and \( N = nT \) variables.

\[
g(z) = \begin{bmatrix}
g_1(y_0, y_1, y_2, x_1; \theta, \bar{y}, \bar{x}) \\
g_2(y_1, y_2, y_3, x_2; \theta, \bar{y}, \bar{x}) \\
\vdots \\
g_T(y_{T-1}, y_T, y_{T+1}, x_T; \theta, \bar{y}, \bar{x})
\end{bmatrix} = \begin{bmatrix}
g_{1,1}(y_{1,0}, y_{1,1}, y_{1,2}, x_{1,1}) \\
g_{m,1}(y_{m,0}, y_{m,1}, y_{m,2}, x_{m,1}) \\
g_{1,2}(y_{1,1}, y_{1,2}, y_{1,3}, x_{1,2}) \\
g_{m,2}(y_{m,1}, y_{m,2}, y_{m,3}, x_{m,2}) \\
\vdots \\
g_{1,T}(y_{1,T-1}, y_{1,T}, y_{1,T+1}, x_{1,T}) \\
g_{m,T}(y_{m,T-1}, y_{m,T}, y_{m,T+1}, x_{m,T})
\end{bmatrix} = 0 \tag{26}
\]

Where \( y_0 \) and \( y_{T+1} \) are vector of endogenous lag variables at \( t = 1 \) and vector of endogenous lead variables at \( t = T \), accordingly, which are pre-determined at steady-state values.

### 3.2. Simulation Scenario and Parameter Setting

I conduct a simulation by applying an eight-quarter one percentage point positive exogenous shocks to the risk premium equation. The type, magnitude and length of shock are meant to resemble a moderate currency crisis. The simulation objective is to evaluate the effect of such shocks on economic performance, in particular the exchange rate, balance of payment and monetary policy response. By applying one single type of shock, it is implicitly assumed that other kinds of shocks are not present and the economy is not pursuing disinflation.
I apply shock simulation to the log-linearised version of the model in deviation from steady-state values. As the lag dependent variables take their steady-state values, it means the shocks simulatedly occur in the steady-state of the economy, in which the level of real variables and growth variables, i.e. inflation, are constant, and the level of nominal variables grows at nonzero constant rates. Hence we need to interpret the simulation result for the actual shocks that occur in the economy before the steady-state, in which the level of real and nominal variables can grow at nonzero rates and the level of growth variables are not necessarily constant.

![Figure 1. Illustration of shock simulation to a real variable](image)

When we apply a one-time shock in steady-state, the resulted deviation of a real variable from its constant steady-state equilibrium value means either an expansion or a contraction of the level of such real variable. However, when the shock occurs in dynamic state of the economy, which is before steady-state, it will generally result in either an accelerated or a decelerated level of a real variable except that the magnitude of shock is large enough to contract real variables. Therefore, one may interpret an expansion or a contraction of a real variable in steady-state as an increasing or a decreasing growth of a real variable before steady-state. Figure 1 illustrates the interpretation of the contraction effect on a given real variable of a one-time simulated shock in steady-state. We can infer similar interpretation for a nominal variable in the case of a one-time shock, in steady-state (Figure 2). Meanwhile, the interpretation of the effect on a growth variable of a one-time shock in steady-state is the same with of a one-time actual shock before the steady-state.
Table 1 exhibits parameter calibration. The firm’s, importer’s and wage setter’s future profits are discounted at discount factor $\beta = 0.99$. From consumption Euler equation, we get the steady-state real interest rate that equals the household’s rate of time preference. Setting real interest rate at 0.02 corresponds to the household discount factor, $\vartheta$, at 0.98. The economy’s structure of output and demand for output are assumed to approximately follow current figures. The share of capital goods, labour and imported intermediate goods in the aggregate output of the economy are set at $\alpha_K = 0.5$, $\alpha_L = 0.35$, and $\alpha_M = 0.15$.

Government spending-to-GDP ratio is set at $\alpha_g = 0.18$ and export-to-GDP ratio at. The share of imported consumption good in total consumption, $\alpha_{mcg}$, and imported capital goods in total investment, $\alpha_{mkg}$, are both 0.14. The share of government bond in household’s assets, $\alpha_{HG}$, is assumed equals 0.5, and the share of domestic debt in government liabilities, $\alpha_{GH}$, is 0.6. The ratio of debt to GDP in steady-state is 20%.

I set the real consumption intertemporal elasticity of substitution at $\sigma^{-1} = 0.004$. This low substitution effect assumption is inline with the findings in Kusmiarso et al. (2002) that impliedly indicated the presence of strong income effect. Their study on interest rate channel of monetary transmission using VAR found that an increase in interest rate is initially responded by a negative growth of consumption. However, household consumption follows to decrease when interest rate starts to decrease. Nominal interest rate elasticity of real money holding is
set at $\rho^{-1} = 0.008$, reflecting a lower degree of cashless economy than in developed countries. Real exchange rate elasticity of exports is set at $\eta = 0.2$ in accordance with the associated coefficient in BI’s macroeconometric model. I calibrate the real wage elasticity of labour supply at $\lambda^{-1} = 0.002$. This value is much lower than the elasticity in developed economies commonly used in related research. This reflects a labor market that is characterized by low real wage income, excess supply of labour and low appreciation for leisure time. The constant elasticity of substitution between factor input is set at $v = 0.3$.

Degree of price rigidity of domestically-produced goods, $\theta$, is set at 0.35 implying that the average time between domestic price adjustment is about one and a half quarters. Domestic
price of imported goods is assumed less rigid than domestically-produced goods ($\theta^m = 0.1$), implying that the average duration of import price is 3.3 months. In setting rigidity parameter, I refer to business price setting survey for Indonesia’s economy in Darsono et al. (2002), which found that manufacturing goods prices stay an average of 4.6 months and that exchange rate changes is passed-through to import price in the same quarter. Wage rigidity is assumed at $\theta^w = 0.75$, corresponding to yearly nominal wage changes. However, the reference for wage changes is heavily based on the previous wage inflation rather than on forward looking optimal price setting. This behaviour is reflected in parameter $\gamma^w$ that is equal to 0.9.

Inflation feedback parameter in the simple interest rate rule is set at a value that minimizes present discounted value of dynamic welfare loss over a hundred quarters after the shock. The loss function is symmetric of the form, 

$$L = E_t \sum_{s=0}^{\infty} \beta_s^s \left( (\pi_{t+s} - \bar{\pi})^2 + (\gamma_{t+s} - \bar{y})^2 \right)$$

where monetary policy makers have equal preferences on both inflation and output stabilization. Inflation feedback coefficient is contingent on the magnitude and extent of a shock to the risk premium. I search the optimal policy feedback coefficient by fixing interest rate smoothing coefficient at $\chi = 0.5$, reflecting equally backward- and forward-looking behaviour of monetary authority in formulating interest rate policy.

![Figure 3: Range of Feasible Response Parameter](image)

Figure 3 shows range of feasible inflation feedback parameters when interest rate responds to a future period’s inflation gap. The figures show that the feasible set of the monetary authority response to the risk premium shock is a rising interest rate.
However, the optimal response, which produces the lowest inflation effect and the smallest short-run output contraction, is the smallest interest rate increases within the feasible set. The highest interest rate increase in the set corresponds to the most nonoptimal response. Whenever applies, the optimized responses are depicted on dashes line on the graphics.

IV. RESULT AND ANALYSIS

4.1. Exchange Rate and Balance of Payment

Figure 4-5 and Figure 7-14 exhibit the responses economic variables to an eight-quarter one percentage point shock to the risk premium. Nominal exchange rate contemporaneously depreciates as a response to risk premium shock, but its extent is lowered by immediate interest rate response. The rate of nominal exchange finally achieves a new, weaker steady-state level when the nominal rate of interest returns to and stabilizes at the initial rate, leaving expectation channel works solely. The long run equilibrium of nominal exchange rate becomes weaker to compensate a lower relative price of foreign to domestic goods so that real exchange rate is unchanged in the long run.

Real export follows real exchange rate movement in the absence of changes to foreign demand. With a low elasticity of real export with respect to real exchange rate, real export only moves up by about 0.027%. It then falls below initial steady-state when real exchange rate strengthens several quarters after the shock. Exports returns to its initial steady-state level in the long run.
Following an increase in real import price, real import falls by about 1.6%, much larger than an increase in real exports in the early period of shocks. Foreign price value of imports declines sharply since foreign price quarterly inflation stays the same. On the other side, foreign price value of exported goods also declines accordingly as nominal exchange rate depreciates more than an increase in real export and consumer price. The net effect is a huge jump in trade surplus, exhibiting an inverted J-curve phenomenon. Indonesia’s trade surplus and real exports and imports in the period of currency crisis justify the simulation result, to some extent, in terms of direction of related variables. Figure 6 shows that in the aftermath of currency crisis in 1998, when nominal exchange rate depreciated by 123%, real exports expanded 11.2% and real imports contracted 2.9%, resulted in 83% trade surplus increases.

This result is in line with an empirical study on J-curve effect. Using a VECM model on the quarterly data of Indonesia and its trading partners, Husman (2005) concluded that J-curve phenomenon is not found in aggregate level data. It is only found in the case of bilateral trade account with Japan, South Korea and Germany.
The movement of output, real import price and consumer inflation influence the following cyclical pattern of trade account. Real import rebounds as aggregate demand and output recovered and real import price lessens, resulting in a higher foreign price value of imports. Conversely, external demand for domestic goods decreases due to real exchange rate appreciation leading to a lower foreign price value of exports. Trade surplus is lower than its initial level in the medium run and finally stabilizes in the long-run at a slightly lower level than the initial steady-state value.

Some factors affect trade surplus dynamic. Exchange rate depreciation affects the volume of imports more than that of export since import price is less rigid than domestic price of exported goods. Moreover, imports plunge by significantly more than an upsurge of export in the short-run owing to quite high import content in production structure. In addition, real import price elasticity of imports is higher than real exchange rate elasticity of exports so that the sum of the elasticity is less than unity. The last factor explains why Marshall-Lerner condition does not hold. Hence the shock to the risk premium could worsen trade balance in the long term. Unlike this model simulation’s result, Husman (2005) suggested that Marshall-Lerner condition is satisfied in the overall sample, implying the Rupiah’s depreciation will increase the Indonesia exports in the long-run. She further found that although Marshall-Lerner condition is satisfied, exchange rate elasticity of bilateral trade account is quite small. One percentage change of real exchange rate only increases export to import ratio by 0.37%. Different finding regarding Marshall-Lerner condition might imply an overestimated price elasticity of imports or underestimated price elasticity of exports assumed in this study.
Figure 7. Responses of Balance of Payment Components on the eight-quarter one percentage point shock to the risk premium
(percent or percentage point deviation from baseline initial steady-state)
Short-run improvement of trade account surplus enables the economy to reduce its net foreign debt. Afterwards, as trade account surplus worsens in the medium run and at last stabilises below its initial steady-state level, the economy has to increase net foreign debt continuously in the long-run. In line with net foreign debt’s dynamics, service account deficit improves in the short-run then is getting worse in the long-run, diverging from the initial steady-state level. Overall, deficit current account lessens in the short-run because a better trade account surplus is enhanced by a smaller service account deficit. Ultimately, current account deficit becomes stable in the long-run at a worse level. Financial account surplus decreases in the short-run, then increases in the medium-run and finally reaches a higher steady-state surplus in the long-run.

4.2. Demand for and Supply of Input and Output

Aggregate demand channel of interest rate policy works through exports, consumption and investment. Consumption drops off contemporaneously as the expected lower future consumption outweighs a small decrease in current real interest rate. It further decreases in

![Figure 8](image-url)

**Figure 8.** Responses of demand for and supply of output on an eight-quarter one percentage point shock to the risk premium (percent or percentage point deviation from baseline initial steady-state)
several more periods as real interest rate increases in the following periods. When real interest rate stabilises in the long-run at a lower level than the initial steady-state, consumption stabilises at a higher new steady-state.

Demand for the stock of capital goods, to be utilized in the next period, falls when the shock to the risk premium hits the economy. Expected weakened aggregate demand in the following periods is behind the firm decision to ration its capital stock. This is often called as
firm’s balance sheet channel of interest rate to aggregate demand. A stronger external demand for domestic goods and domestic demand for domestic intermediate and final goods dampen investment demand contraction. The net effect is a fall in aggregate demand for domestic output in the wake of the shock. Thus, exchange rate depreciation triggered by a temporary shock to the risk premium is contractionary to output.

Demand for other factor inputs drops as well. As import price is less rigid, a depreciated real exchange rate leads to a more expensive real import price. Combined with a contemporaneous lowered aggregate demand, this strongly discourages demand for imported intermediate goods.

Employment falls because it is more affected by a much weakened aggregate demand than by a slightly more inexpensive real wage. This result is caused by unitary elasticity of labour demand with respect to real output and low elasticity of labour supply with respect to real wage.

4.3. Costs, Prices and Inflations

A squeezed labour demand brings downward pressure on real marginal cost of working. On the other side, leisure also decreases as demand for consumption goes down hence labour supply increases and puts a downward pressure on real marginal cost of working. Since nominal wage is quite rigid and highly indexed to its past inflation nominal wage is not responsive to changes in real marginal cost of working resulted from immediate adjustment in consumption and output.

Real wage declines because output price goes up and is more flexible than wage. Therefore, the immediate domestic inflation response to a lower aggregate demand is decreasing. In the following period of shock, investment starts to increase and consumption get stronger, causing upward pressure to the real marginal cost of working and wage inflation. Real wage is still below the initial steady-state level temporarily due to a more flexible output price than wage. Therefore, throughout the rest of shocks period the response of domestic inflation to a higher aggregate demand is decreasing.

Low real wage rigidity resulted from high nominal wage rigidity and low prices rigidity can be linked to a high real rigidity. Romer (2006) defines real rigidity as a low willingness of individual firm to change their relative price in response to changes in real output resulting from variations in real aggregate demand. A larger real rigidity corresponds to a greater consideration on competitor prices in price-setting behaviour. It means that when real rigidity is
Romer (2006) explains that, assuming the stylized aggregate demand curve, \( \ln y = \ln M - \ln P \) (where \( M \) reflects factors that shift aggregate demand), real rigidity expression for the representative firm’s profit-maximizing relative price, \( \ln P^* - \ln P = \phi \ln y \), implies, \( \ln P^* = \phi \ln M + (1-\phi) \ln P \) where high real rigidity is indicated by low \( \phi \).

Bank Indonesia’s business price setting survey (Darsono et al., 2002) revealed that cost-based approach is the most widely adopted price setting strategies among manufacturing and trading companies. The finding can justify the presence of price rigidities. It reflects the firm’s reluctance to change prices when no cost changes occur. The survey also found that ‘cost plus variable profit margin’ and ‘competitor prices’ are the next most price setting methods used in manufacturing and retail firms, while ‘market condition’ is not the important factor in price setting policy. The survey results can be interpreted as low price rigidity in response to changes in cost and changes in competitor price. The latter means a high real rigidity5.

Risk-premium-induced exchange rate depreciation is passed-through to domestically-produced goods inflation using three channels. First, direct pass-through via cost of imported

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5 Romer (2006) explains that, assuming the stylized aggregate demand curve, \( \ln y = \ln M - \ln P \) (where \( M \) reflects factors that shift aggregate demand), real rigidity expression for the representative firm’s profit-maximizing relative price, \( \ln P^* - \ln P = \phi \ln y \), implies, \( \ln P^* = \phi \ln M + (1-\phi) \ln P \) where high real rigidity is indicated by low \( \phi \).
Figure 11. Responses of prices on an eight-quarter one percentage point shock to the risk premium

(Percent or percentage point deviation from baseline initial steady-state)
intermediate goods, which has an increasing effect on domestic inflation. Second, indirect pass-through via demand for imported input, which has a decreasing effect on domestic inflation. Third, indirect pass-through via external demand for domestic output. The latter has a decreasing effect on domestic inflation as well since an increased exports put small upward pressure on the rigid wage. Thus, with less rigid output price, it causes a decline in real cost of employment.

A direct cost-push pass-through of exchange rate to domestic inflation strongly dominates its demand side pass-through because of several factors. Firstly, high import content in production structure. Secondly, low real exchange rate elasticity of exports. Thirdly, high nominal wage rigidity, meaning low aggregate demand elasticity of wage inflation. Fourthly, a real import price elasticity of demand for imported intermediate goods. Exchange rate pass-through to consumer inflation is even higher as it is a combination of net cost-push pass-through to domestic inflation and direct cost-push pass-through of imported consumption goods to consumer inflation.

Large weight on cost of capital reflects a strong cost channel of interest rate policy, which gives an upward pressure to domestic inflation. It amplifies the strong pass-through extent of risk-premium-induced exchange rate depreciation to a higher domestic price.

4.4. Tax and Government Debt

As a consequence of smaller aggregate demand and higher interest rate the government faces a reduced tax base and a higher interest payment on the existing debt. Thus, the fiscal authority needs to raise tax rate and increases debt financing to keep its consumption expenditure constant amid pressure from a rising primary deficit. Since tax rule responds to primary deficit, a higher debt interest payment has no strengthening effect on tax increase. Accordingly, government debt is sustainable but the economy needs a longer time to bring down government debt toward its initial path.

An increase in tax rate has a tiny effect in dampening down inelastic labour supply, causing a slight upward pressure on real marginal cost of working. However, its pass-through to wage is in a much smaller magnitude since wage is quite rigid but indexed to inflation. As output price is more flexible than wage, the immediate domestic inflation response to a higher interest rate through aggregate labour supply channel of interest rate policy is decreasing but exceedingly weak.
4.5. Interest Rate

The model recommends the central bank to raise per annum interest rate up to the level that is 1.33 percentage points higher than the initial rate in one year after the initial shock. It then needs to be lowered but stays above the steady-state values for nine quarters, before finally stabilizes around the initial rate of 7%. This interest rate response results in 0.09 percentage point jump in year-on-year consumer inflation. As nominal interest rate increases by more than an increase in consumer inflation, ex ante real interest rate goes up temporarily up to a level that is 1.27 percentage points above the initial steady-state rate of 2%.

It is important to highlight the impact of implementing nonoptimal monetary policy response, which corresponds to the highest interest rate increase among the feasible response parameter. Such policy response results in a worse state of the economy in short-run: a higher nominal interest rate, more persistent consumer inflation, deeper output contraction, more unemployment, higher money balance and more expensive prices and wage. The economy also worse off in the long-run from more depreciated nominal exchange rate, more
expensive prices and wage, higher net foreign debt, higher government debt, larger real money balance, smaller trade account surplus, larger current account deficit and larger financial account surplus.

This simulation reveals how strong the cost channel of monetary policy is. Interest rate increases result in an upward pressure on domestic inflation through an increased cost of capital. The main source of downward pressure to domestic and consumer inflation is a decreasing real cost of importing goods caused by appreciated exchange rate in the economy that features a more flexible import price than domestic price and high import content. Strong cost channel of interest rate policy, more rigid wage than output price and high wage indexation to its past inflation account for lack of response of consumer price disinflation to interest rate increases. This is in line with the properties of small macroeconometric model of Bank Indonesia that predicts a weak power of interest rate tightening in lowering consumer inflation. It suggests that one percentage point increase in interest rate can only reduce consumer inflation by around 0.06 percentage point.

4.6. Money Balance

Real money demand, which is the opportunity cost of holding money by giving up both consuming goods and having return on money, falls off in the short-run and achieves a higher steady-state value in the long-run. The immediate response is not owing to the interest rate rise but rather simply follows the pattern of real consumption. This is due to a high real consumption elasticity of real money demand of despite small changes in consumption. On the other hand, low nominal interest rate elasticity of real money demand () dampens down the effect of relatively
large interest rate increase. Therefore, a weakened demand for consumption goods strongly lowers demand for money holding.

Short-run fall in real money demand is less than consumer price increases. Therefore, when the central bank responds to the risk premium shock by raising interest rate nominal money supply has to be higher to clear money market. In this case, the direction of money and interest rate is contradictory, in the sense that monetary policy is tight in terms of interest rate but loose in terms of money supply.

Table 2 shows that interest rate became positively correlated with currency growth during currency crisis. However, the relation was partly due to a massive increase in liquidity support combined with a large increase in interest rate. Moreover, Figure 15 shows that an increase (a decrease) in Bank Indonesia interest rate policy (SBI rate), which is positively highly correlated with changes in deposit rate, does not necessarily slow down (speed up) the growth of currency in circulation over the post-crisis period. The negative correlation between interest rate and currency growth weakened during the period as shown in Table 2. Since money growth and
policy interest rate could move in the same direction, the tightening or easing stance of monetary policy should, therefore, only be represented and clearly communicated by interest rate policy.

![Figure 15. Direction of interest rate and growth of currency in Indonesia](image)

5. CONCLUSION

This study found that, even with optimal monetary policy response, a nominal exchange rate depreciation, triggered by a two-years shock to the interest risk premium, causes the economy to suffer in the short-run from a higher inflation, lower output, higher nominal and real interest rate, higher cost of capital, lower investment, higher government deficit and debt, higher tax rate, and higher unemployment.

The persistent shocks will also be worse for the economy in the long-run. It is characterised by a weaker long-run equilibrium of nominal exchange rate, more expensive domestic and imported prices and wage, and worse balance of payment (lower trade account surplus, higher current account deficit, higher capital inflow, larger net foreign debt, a higher but sustainable government debt). However, an appropriate monetary policy response, which is the smallest interest rate increases within the feasible set of interest rate responses, should manage to reduce such adverse effects.

Such property of shocks occurs because of lack of response of disinflation to increases in interest rate policy, which stems from the combination of high real rigidity, and strong cost channel of interest rates and exchange rate pass-through. Both aggregate demand channel of interest rates and demand-side channel of exchange rate pass-through have a weak effect on inflation.

Some policy implications might be appropriate. Such characteristics of monetary transmission complicate optimal monetary policy response. The central bank might be better
Monetary Transmission of Persistent Shock to the Risk Premium: the Case of Indonesia

pursuing a lower demand-induced inflation when adverse shock is nonexistent or in the presence of favourable supply shocks. When disinflation is successful, interest rate can, in turn, be lowered and finally helps reducing cost channel of interest rate and strengthen aggregate demand channel.

Since exchange rate shocks and cost-push shocks frequently harm the economy, other policies are necessary to complement monetary policy that can in turn help strengthen aggregate demand channel of monetary policy. The important thing is that the cost channel of interest rate needs to be weakened. It implies that the proportion of domestic income that goes to capital owner, investor or lender, should be reduced. Production structure switching, by increasing labour-intensive goods producers, could be a proper industrial policy to help reducing capital share of output.

Other possible policies are the ones that contribute to the reduction of cost of capital. This model and its simulation result are unable to suggest such policies that directly reduce cost of capital, as the absence of bank lending channel implies the equality of central bank policy rate and bank lending rate. However, when the channel exists, policy suggestions that encourage the reduction of financial intermediary’s marginal cost and profit margin might be able to reduce physical capital cost. Other policies are the ones that help cutting nonmonetary-induced inflation that, in practice, will indirectly reduce cost of capital for a given real interest rate and spread between lending and deposit rate. In this study’s modelling framework, the success of such policies will directly decrease both lending and policy rates. Given that price equals marginal cost plus profit margin, such policies are in the form of (i) reducing nonmonetary-induced marginal cost, (ii) decreasing profit margin, and (iv) enhancing profit margin flexibility to cost increases⁶. Nonmonetary-induced marginal cost, which is not modelled in this study, might take the form of marginal cost of ‘external labour’⁷ and other determinants of marginal cost that are not included in marginal cost equation (equation 14).

Finally, it is important to address the model limitations that should be taken into account when interpreting the simulation result for policy purposes. This model is still deficient in its bank lending channel implying the absence of banks and that the central bank is part of the government. It would be interesting to find out how the economy reacts in the presence of bank as financial intermediary.

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⁶ The price of domestically produced goods can be set as nominal marginal cost multiplied by gross profit margin, \( P = MC^d \times (1 + \mu) \), in which \( MC^d = MC^{dm} + MC^{dm} \), where \( MC^{dm} \) is monetary-induced real marginal cost, as in (14), is nonmonetary-induced real marginal cost and \( \mu \) is net profit margin.

⁷ Cost of ‘external labour’ is the extra cost firms have to spend persistently, for any reasons, for persons who are not the firm’s employees or do not supply their labour in the form of production input.
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