AN EARLY-WARNING SIGNAL OF SOVEREIGN DEBT CRISIS IN INDONESIA

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Abstrak

Sovereign debt crisis yang terjadi di negara-negara Eropa telah menimbulkan pertanyaan apakah negara berkembang akan sangat rentan mengalami krisis utang. Penelitian ini menganalasis perkembangan utang dan *early-warning signal* terhadap kemungkinan munculnya *sovereign debt crisis* di Indonesia. *Empirical Tree Analysis* merujuk kepada metodologi *Binary Recursive Tree* (BRT) yang disusun berdasarkan indikator kerentanan, indikator ketahanan, dan indikator keuangan untuk melihat analisis menyeluruh terhadap peluang terjadinya krisis Utang Luar Negeri (ULN) di Indonesia. Penelitian ini mencakup data tahunan dari 2004 sampai 2014 dengan menggunakan data ULN pemerintah, GDP, ekspor, pendapatan pemerintah, utang sektor publik, *debt service ratio*, dan *yield rate* dari obligasi pemerintah. Berdasarkan hasil penelitian ini, ULN Indonesia dikategorikan aman yang ditunjukkan dengan *trend* menurun pada rasio *debt-to-gdp* dan rasio *debt-to-export* serta *upward slopping* pada *yield curves*. Hasil dari empirical tree analysis memprediksi bahwa Indonesia tidak akan mudah mengalami krisis pada satu tahun ke depan. Namun di sisi lain, Indonesia tetap memiliki beban ULN yang tinggi yang ditandai dengan *trend* meningkat pada *debt service ratio*. Oleh karena itu, perbaikan kebijakan berdasarkan hasil penelitian ini menjadi sangat penting untuk diperhatikan dan diimplementasikan.

Klasifikasi JEL: E66, F34, C45, H63
Kata Kunci: Sovereign debt crisis, perkembangan ULN, Binary Recursive Tree (BRT), early-warning signal

Abstract

The occurrences of sovereign debt crises in the Euro nations has raised the question of whether developing countries are also very vulnerable related to the debt crisis. This paper seeks to analyze the debt performance of Indonesia and produce an early-warning signal on the occurrence of sovereign debt crisis in this country. The empirical tree analysis based on the Binary Recursive Tree (BRT) methodology is adopted on the vulnerability

indicators, sustainability indicators and financial debt indicators to gain an insight on sovereign debt crisis of Indonesia. This study covers from year 2004 until 2014 using annual data of government debt, GDP, exports, government revenue, public debt, debt service, and yield rate of government bond. Based on the overall result, Indonesia's external debt is sustainable as showed by the decreasing trend in debt-to-GDP ratio, debt-to-export ratio, and an upward slopping of yield curves. The empirical tree analysis predicts one year in advance that Indonesia is not crisis-prone. However, Indonesia still possesses higher debt burden since the debt service ratio shows an upward trend. Thus, it is important that policy improvements based on these findings need to be implemented.

## I.	INTRODUCTION

The failure of bailout in Europe from the 2008 global financial distress have resulted the debt crisis in the Euro area. The sovereign debt crisis is deeply intertwined with the banking crisis and macroeconomic imbalances that afflict the Euro area. Shambaugh (2012) provides an accessible overview of the Euro's broader economic crisis. Even if the crisis was not originally fiscal in nature, it is now a full-blown sovereign debt crisis. The crisis had adverse economic effects for the worst hit countries with unemployment rates in Greece and Spain hitting 27 percent. It also had a major political impact on the ruling governments in 8 out of 17 Euro countries; contributing to power shifts in Greece, Ireland, Italy, Portugal, Spain, Slovenia, Slovakia, and Netherlands.

According to Reinhart and Rogoff (2011), banking crisis increases the prospect of a sovereign debt crisis. Sometimes, but not always, the foundation upon debt default have been associated with currency crises and banking crises (Manasse, Roubini and Schimmelpfenning, 2003). It is documented that a fall in the value of the Thai baht triggered domestic bank loan defaults in Indonesia, thus, resulted in the multi-dimensional crisis in Indonesia in 1997. There were few connections between the Thai and Indonesian economies; hence, the basic shock seems to be non-fundamental in nature. The bank loan defaults led to large fiscal transfers to banks and consequently to sovereign default.

Learning from the 1997 crisis, Indonesia developed a social safety net to cope with and lessen the impact on people's welfare. As a result, when the advent of the global crisis in 2008 witnessed a wave of economic downturn in developing countries, Indonesia was strong enough to counter that large external shock. Along with China and India, Indonesia is one of the three countries that still have a positive economic growth during that crisis. The economic growth increased gradually from 4.6 percent in 2009 to 5.12 percent in 2014 (Statistics Indonesia, 2014). Indonesia's domestic economy proved very resilient since there were only limited companies depend on the stock market on the economy. The economic performance of Indonesia has been getting better over the years.

However, the occurrences of sovereign debt crisis in the Euro nations, which is supposed to not happen given their strong economic position, has raised the question of whether developing countries such as Indonesia is also very vulnerable related to the debt crisis. Moreover, the Euro zone debt crisis and its slow economic recovery could have a negative impact on the economies of emerging countries.

In terms of Indonesia external debt, after the 2008 credit crunch, massive capital inflows into Indonesia contributed to a nearly 50 percent rise in the Rupiah currency's exchange rate against the USD. Moreover, this condition pushed the country's 10-year

government bond yields down to record lows of 5 percent from their 10 to 15 percent pre-crisis range (International Monetary Fund, 2014). Foreign holdings of Indonesian local currency government bonds rose from 14 percent to 34 percent, while the country's external debt nearly doubled in just two years (Bank Indonesia, 2014).

This paper attempts to analyze Indonesia's debt performance and its sustainability during 2004 to 2014 period. Then this paper tries to perform a prognosis of sovereign debt crisis in Indonesia. The paper is organized as follows; the introduction is provided in the first section while the second section provides the objective of study. Section III presents a literature survey. The data and methodology are presented in the section four. Section IV observes Indonesia's debt performance. This section also presents the results from the binary recursive tree technique. Finally, the fifth section presents some concluding remarks and policy recommendations.

II.   OBJECTIVE OF STUDY

Based on the above introduction, this study is constructed on the basis of the following objectives as follows:

i.   To analyze Indonesia's debt performance from 2004 to 2014.
ii.   To measure the sustainability of Indonesia's debt.
iii.   To perform an early-warning signal of sovereign debt crisis in Indonesia.

III.   LITERATURE REVIEW

Sovereign debt crisis can be broadly defined as defaults on debt that is issued by a national government (Ambrose and Kassim, 2013). Moreover, Reinhart and Rogoff (2010b) explain that debt crises involve outright default on payment of debt obligations incurred under foreign legal jurisdiction or the restructuring of debt into term less favorable to the lender than in the original. According to Ciarlone and Trebeschi (2004), a debt crisis can be precisely happen when one or more of the following conditions occur:

1. a country has officially affirmed a moratorium on public or external debt payments;
2. a country has incurred a missed payment on external obligations which adds up to more than 5 percent of the debt service ratio paid by year-end;
3. a country has accumulated arrears of interest and/or principal on external obligations which add up to more than 5 percent of the total external debt outstanding by year-end;
4. a country has signed a debt restructuring or rescheduling agreement; and
5. a country has received a large assistance package from the IMF which is defined as access in excess of 100 percent of quota.

Manasse, Roubini, and Schimmelpfenning (2003) explain that sovereign debt crises are last long and persistence. Based on their empirical evidence, the macroeconomic factors predict a debt crisis and the entry into a debt crisis. Manasse and Roubini (2005) suggest several factors as the core of an empirical model to predict sovereign default. First, measures of solvency depend on public and external debt relative to its ability to pay, such as by GDP, exports, or government revenues. Second, liquidity measures are included stress the risk of a liquidity run, such as short-term debt over reserves. Third, institutional and political factors affect policy credibility and reflect a government's willingness to pursue policies consistent with a sustainable debt path.

To investigate how explanatory variables behave around default episodes, Ciarlone and Trebeschi (2004) show that total external debt-to-GDP significantly increases, the level of reserves as a percentage of total external debt drops significantly, the balance

payment divided by GDP significantly decreases, and short-term debt over reserves increases sharply. In particular, there are some indicators that have been used to analyze a country's debt performance as well as debt sustainability, namely debt-to-GDP ratio, debt-to-export ratio, debt balance to domestic budgetary revenues ratio, debt service ratio, primary balance indicator, yield curve, and yield spread (Ambrose and Kassim, 2013; Greenidge, *etc.,* 2012; Manasse and Roubini, 2005; and Ciarlone and Trebeschi, 2004).

Apart from that, Reinhart, Reinhart, and Rogoff (2012) apply the public debt-to-GDP levels to identify major public debt overhang in their study. Reinhart and Rogoff (2010) examine the experience of advanced countries and emerging markets. It shows that high debt over GDP levels are associated with notably lower growth outcomes. Further, Reinhart and Rogoff (2010b) also determine that high public borrowing can accelerate markedly and systematically ahead of a sovereign debt crisis. As a result, sovereign debt crises have contingent phenomenon to banking crises that it is importantly preceded by rapidly rising private indebtedness.

In order to identify the classification and prediction of debt crises, an early-warning model had been developed by Manasse, Roubini and Schimmelpfenning (2003). The means of logit approach and Binary Recursive Tree (BRT) methodology is employed to predict a debt crisis episode one year in advance. The logit model predicts 74 percent of entries into a crisis while sending out few false alarms. The recursive tree correctly predicts 89 percent of all crisis entries while sending out more false alarms.

Further, Manasse and Roubini (2005) try to build up the previous early-warning model by employing the Binary Recursive Tree (BRT) methodology. By using annual information on 47 economies from 1970 to 2002, this statistical approach helps to derive a collection of rules of thumbs to select explanatory variables, critical values, and identification of crisis-prone types. It is found that not all crises are equal, but they differ depending on whether the government faced insolvency, illiquidity, or various macroeconomic weaknesses and risks. In the case of Colombia, the set of these rules of thumbs had been applied; resulting that Colombia has a crisis probability of 2.3 percent. Also, by using these rules of thumbs, Ambrose and Kassim (2013) analyze the debt performance of Malaysia and a prognosis on the occurrence in the future. The result is that Malaysia's debt increases every year; however Malaysia is not crisis-prone.

IV. METHODOLOGY
4.1. Data
The study uses debt performance indicators of Indonesia such as government debt, real GDP, exports, government revenue, public debt, debt service, and yield rate of government bond. In particular, some data set of debt burden indicators will be presented, such as short term debt to reserve ratio, debt-to-GDP ratio, debt-to-export ratio, and debt to service ratio. Since it is hampered by accessible data, the study covers from year 2004 to year 2014 in the form of annual data. The sources of data are gathered from Bank Indonesia, Ministry of Finance, Statistics Indonesia, Indonesia Stock Exchange, Indonesia Bond Pricing Agency, and International Monetary Fund (IMF).

4.2. Methodology
The main approaches in this study can be categorized into two analyses namely Indonesia's debt performance and an early-warning system of sovereign debt crisis. To observe Indonesia's debt performance, this study uses a deep analysis of debt-to-GDP ratio, debt-to-export ratio, debt service ratio, and yield curve. This approach assesses a sustainability of Indonesia's debt. Meanwhile, an early-warning signal of Indonesia's debt

crisis applies the empirical tree analysis developed by Manasse and Roubini (2005).

4.2.1. Yield Curve

The relationship between the rates of return (yield) on financial instruments across different maturities is known as the term structure of interest rates. A yield curve depicts the term structure by drawing a set of yield of a financial asset at different maturities, describes the relationship among short-term, medium-term and long-term rates at a given point in time (Rose and Marquis, 2009). This "term structure" can be used to assess market expectations for growth and inflation and the future path of monetary policy. Kettell (2002) defined yield curve as a graph that shows the yields-to-maturity (vertical axis) for identical securities of various terms to maturity (horizontal axis) as a particular date.

A yield curve may change along any of at least three different dimensions, which are level, slope or curvature (Rose and Marquis, 2009). A change in the level of the yield curve means that interest rates all along the curve move roughly in parallel, shifting the whole curve up or down. In contrast, the curve's slope or steepness changes when shorter-term interest rate rise or fall by greater amount than longer-term interest rate. The curvature of a yield curve may change when interest rate in the middle of the maturity spectrum are impacted, such as by a shift in economic condition of moderate length. These various dimensions of a yield curve suggest that these curves are far more complex and more intimately connected with the economy and government policy changes.

Based on slope, the types of yield curve are divided into three: upward sloping, flat, and downward sloping yield curve (Figure 4.1). First, upward sloping indicates the normal situation whereby the borrowers must pay higher interest rate for longer-term loans than for the short-term loans. This shape shows the yield will rise as the maturity rises because the longer maturity, the bigger the risks faced by investor, thus the higher the return should be. This type of curve is the most common occurrence. Second, the flat sloping curve shows that the interest rate in the long run will be the same with the short run interest rate. Simply to conclude that the interest rate remain constant with all maturities. Third, the downward sloping curve means that longer-term financial assets presently carry lower interest rate than shorter-term assets. A downward sloping yield curve will be observed only when the market place believes that interest rates are going to decline substantially. However, it is rare to happen because it will make the market panic due to the coming recession prediction. However, the design of the yield curve, like many predictive tools, embodies contradictions that disturb even as they offer information. As an indicator, the yield curve points to the particular uncertainties of the economy to come. The curve does not merely indicate; like all indicators, it also produces its own uncertainties.

Figure 4.1. The Shapes of Yield Curve
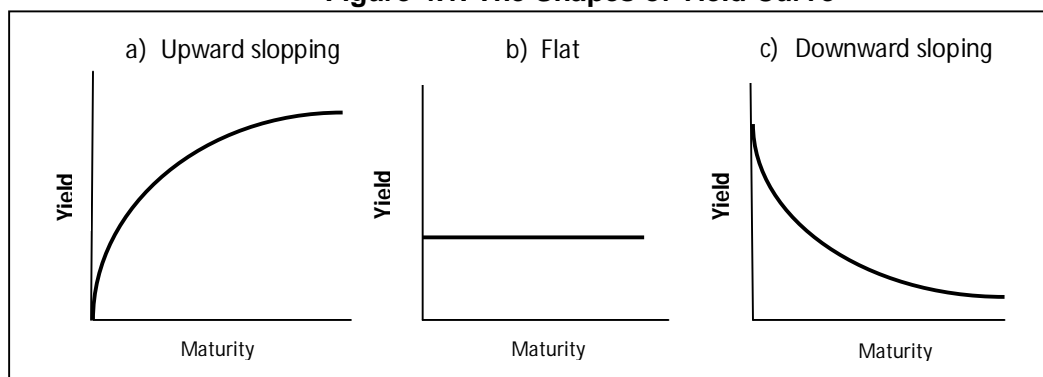
4.2.2. The Binary Recursive Tree

The Binary Recursive Tree (BRT) is employed in this study to produce a prognosis on the occurrence of sovereign debt crisis in Indonesia. Binary recursive partitioning is known as a technical procedure of the CART (Classification and Regression Tree) methodology. BRT is a computer intensive data mining technique that selects explanatory variables, their critical values and their interactions in order to identify "safe" from "crisis prone" types (Manasse and Roubini, 2005). The process is binary because parent nodes are always split into exactly two child nodes and recursive because the process can be repeated by treating each child node as a parent. The key elements of a CART analysis are a set of rules for (Briemann, *et al*., 1983); (i) splitting each node in a tree; (ii) deciding when a tree is complete; and (iii) assigning each terminal node to a class outcome (or predicted value for regression).

CART method is to look at all possible splits for all included variables. For instance, consider a data set with 215 cases and 19 variables. CART considers up to 215 times 19 splits for a total of 4085 possible splits. Any problem will have a finite number of candidate splits and CART will conduct a brute force search through them all. Once a best split is found, CART repeats the search process for each child node, continuing recursively until further splitting is impossible or stopped. Splitting is impossible if only one case remains in a particular node or if all the cases in that node are exact copies of each other (on predictor variables). CART also allows splitting to be stopped for several other reasons, including that a node has too few cases.

CART has generated what is called a maximal tree. It examines smaller trees obtained by pruning away branches of the maximal tree. Unlike other methods, CART does not stop in the middle of the tree-growing process, because there might still be important information to be discovered by drilling down several more levels. Once the maximal tree is grown and a set of sub-trees are derived from it, CART determines the best tree by testing for error rates or costs. With sufficient data, the simplest method is to divide the sample into learning and test sub-samples. The learning sample is used to grow an overly-large tree. The test sample is then used to estimate the rate at which cases are misclassified (possibly adjusted by misclassification costs). The misclassification error rate is calculated for the largest tree and also for every sub-tree. The best sub-tree is the one with the lowest or near-lowest cost, which may be a relatively small tree.

CART does not suffer from the statistical deficiencies that plague conventional stepwise techniques. CART will typically be far more accurate on new data. The empirical tree performs quite well with respect to standard early-warning system models: it correctly predicts 82.9 percent of states, 93.9 percent of crisis, and 79.9 percent of non-crisis states; moreover, it does even better in predicting crisis entries (88.9 percent) than states, while sending a limited number of "false alarms" (Manasse and Roubini, 2005).

V.   RESULT AND ANALYSIS
5.1.   Debt-to-GDP Ratio

Reinhart, Reinhart and Rogoff (2012) and Greenidge, *etc.* (2012) had applied the debt-to-GDP ratio as one of major factors that affects country's economy. Thus, the value of debt-to-GDP ratio is important to assess a country's debt performance and debt sustainability (Ambrose and Kassim, 2013). The higher value of this ratio, the less likely will a country pay back its debt. Thus, an increasing debt-to-GDP ratio shows an increasing risk of default and an unsustainable debt (Ambrose and Kassim, 2013).

To compare the performance of debt-to-GDP ratio in Indonesia and some countries, International Monetary Fund (2014) analyzed that developed countries have greater debt ratios than those of developing countries. A debt-to-GDP ratio of Indonesia is among the lowest compared to those countries with the biggest GDP. This condition represents a healthy condition of Indonesia compared to many countries that are in difficulties to ease external debt.

Figure 5.1 plots the changes from 2004 to 2014 in order to observe the trend in debt-to-GDP ratio of Indonesia. The debt-to-GDP ratio decreases from 2004 to 2008, increases from 2008 to 2009, decreases from 2009 to 2011 and increases onwards. The descending trend from 2004 to 2014 shows that the risks default for Indonesia is decreasing steadily; suggesting that Indonesia's external debt is sustainable.
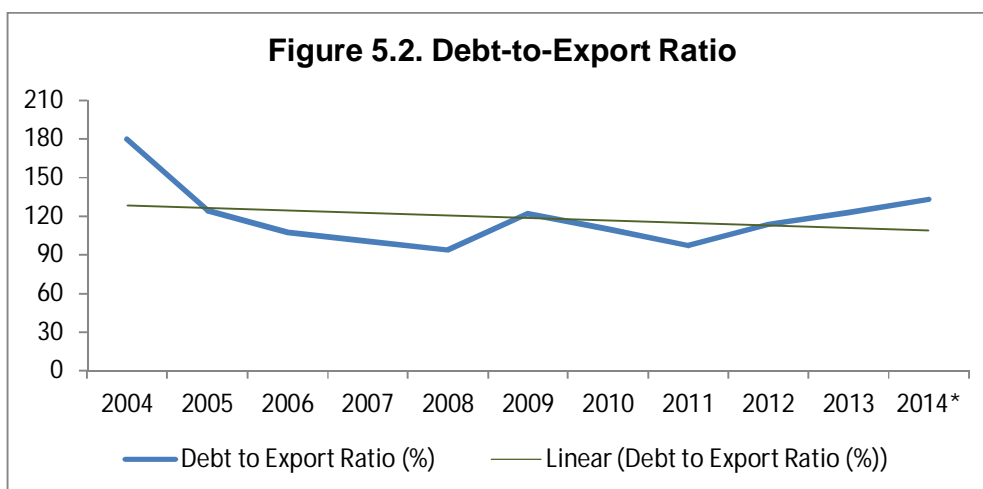

Figure 5.1. Debt-to-GDP ratio
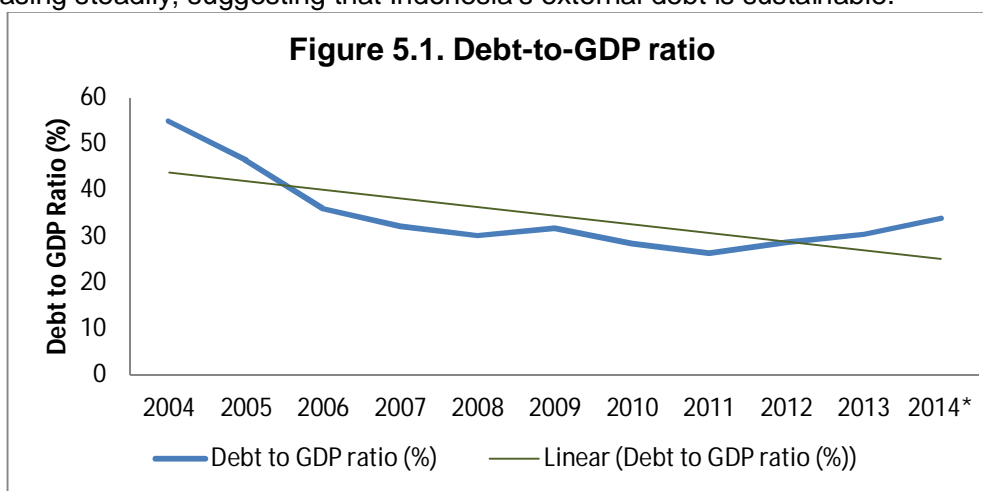
Source: Bank Indonesia and Ministry of Finance (2014)
        *) Data per second quarter of 2014

5.2.   Debt-to-Export Ratio

The definition of debt-to-export ratio is ratio of total external debt to a country's export earnings (Bank Indonesia, 2004). This ratio assesses the federal government debt in relation to its total amount of export. According to Ambrose and Kassim (2014), this ratio is important to measure a country's independent sustainability. When the debt-to-export ratio is higher, then the government debt is higher too and this country will be more depend on others to serve its loan.

The graph of debt-to-export ratio of Indonesia is shown in Figure 5.2. Debt-to-export ratio has seen to fluctuate during the given period. In general, the overall trend of debt-to-export ratio of Indonesia is decreasing from the year 2004 up to the year 2014. The decreasing trend line indicates that Indonesia is independently sustainable.

Figure 5.2. Debt-to-Export Ratio

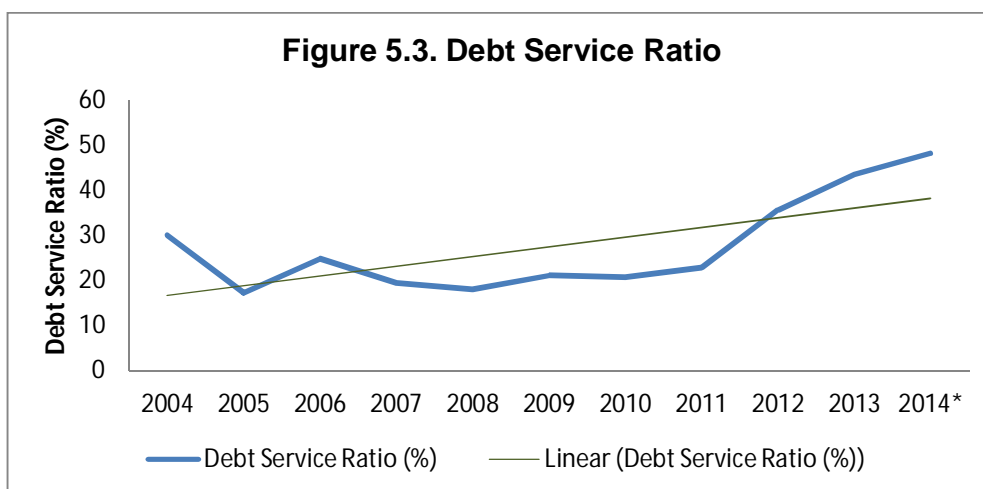Source: Bank Indonesia and Ministry of Finance (2014)
*) Data per second quarter of 2014

However, weakening of world's export market causes debt-to-export ratio in Indonesia to grow since 2011. As for the ascending trend from 2011 until 2014, Indonesia's debt load is again getting higher. Thus, to offset the decline in world's export demand for domestic goods, the government should concentrate on policies which could absorb domestic consumption and investment optimally as a big country with fourth largest population in the world. The government should post upturn national export and keep debt-to-export ratio to be well maintained at safe level through 2014.

5.3.   Debt Service Ratio

Bank Indonesia (2014) defines debt service ratio as ratio of requirements of external debt principal and interest to current account receipts. If a country has incurred a missed payment of interest and/or principal which adds up to more than 5 percent of the debt service ratio paid by year-end, then a debt crisis will occur (Ciarlone and Trebeschi, 2004). Thus, it is needed to observe debt performance through debt service ratio. A high debt service ratio of a country reflects a heavier debt burden and possesses an unhealthy international finance. In order to serve debt, a country must earn more on its exports (Ambrose and Kassim, 2013).

Figure 5.3 presents an increasing movement of debt service ratio of Indonesia. Although the debt-to-export ratio has a downward trend, the graph of debt service ratio shows an upward trend which reflects an unhealthy international finance due to higher debt burden. Beside the differences in trend line, debt-to-export and debt service ratio still depict a high ratio in risky level by 133 and 48 percent, respectively (Bank Indonesia, 2014). The bigger the debt service ratio and the debt export ratio, the heavier the external debt. Thus, all parties should give a big concern about the aforementioned ratios, especially for debt service ratio.

Figure 5.3. Debt Service Ratio

Source: Bank Indonesia and Ministry of Finance (2014)
*) Data per second quarter of 2014

According to Bank Indonesia (2014), Indonesia's debt service ratio doubled within 5 years. The ratio grew from 21 percent in 2009 to 48 percent in the second quarter of 2014. A bigger proportion from group of borrower was actually given by the private sector which reached 54 percent from total external debt worth USD 284,880 million in 2014. Consequently, the external debt levels and amortizations grew strongly, particularly for the private sector (World Bank, 2014). Increase of private external debt amortization from 2011 to 2013 was steep, so that debt service ratio increased to 44 percent due to this high private external debt (Bank Indonesia, 2014).

In order to lower debt service ratio to a safer level, all parties must observe growing private debt which drove debt service ratio 2014 to 48 percent. Private sector must be triggered with a deeper insight to what extent external debt would be invested in their business. Currently, many activities of private business are not export oriented, so that the risk of currency mismatch and maturity mismatch increase. The private sector who borrowed money in foreign currency had its revenue not in foreign currency because they invest in business with Rupiah transaction. Consequently, the problem of depreciation could lead to a higher debt repayment. Besides that, the use of overseas foreign debt was more borrowed money invested in the domestic property and service sector. It was quite risky sectors because property credit was on short term basis while overseas debt was on long terms basis. As such condition might cause maturity mismatch because short term investment was financed by money from long term investment (Kusnandar, 2014).

5.4. Yield Curve Analysis

To discern the impacts of the global financial crisis to the Indonesia government bond, Figure 5.4 is presented. The year of 2008 is chosen because at that period, the global financial crisis that is originated from United States happened in the world. Furthermore, 2014 is selected as the reflection of the latest condition of the Indonesia government bond market. In 2008, the yield rate on government bond is higher than in 2014. The yield rate in 2008 moves at the level of yield rate is around 11 to 16 percent for every time to maturity. In contrast, 2014 shows that the level of yield rate is 6 to 9 percent.

There are some reasons behind a steady decline in the yield rate from 2008 to 2014 (Figure 5.4). Firstly, the Indonesia's sovereign rating has risen to the investment

grade level. The upgrades reflect strong and resilient economic growth, low and declining public debt ratios, strengthened external liquidity, and a prudent overall macro policy framework. This also indicates the monetary and price stability as well as sound bank supervision, deeper domestic capital markets, and higher foreign direct investment rates. This improvement will result a decline on investment risk in Indonesia, which will attract a foreign capital inflow. Thus, the bond price will tend to increase and therefore the yield rate will be significantly lower afterwards.

Another factor causes the decrease on the yield rate of Indonesia government bond is due to the fall of Bank Indonesia rate (BI rate) from 9.25 percent in December 2008 to 7.5 percent in September 2014. As a monetary tool to control banks' interest rates and inflation rate, the continuous decrease on BI rate is the signal for the market to lower the interest rate. The decrease in the interest rate will be lowering the cost of borrowing and therefore the inflation rate will be also low and tend to be stable.

Figure 5.4. Yield Curve of Indonesian Government Securities
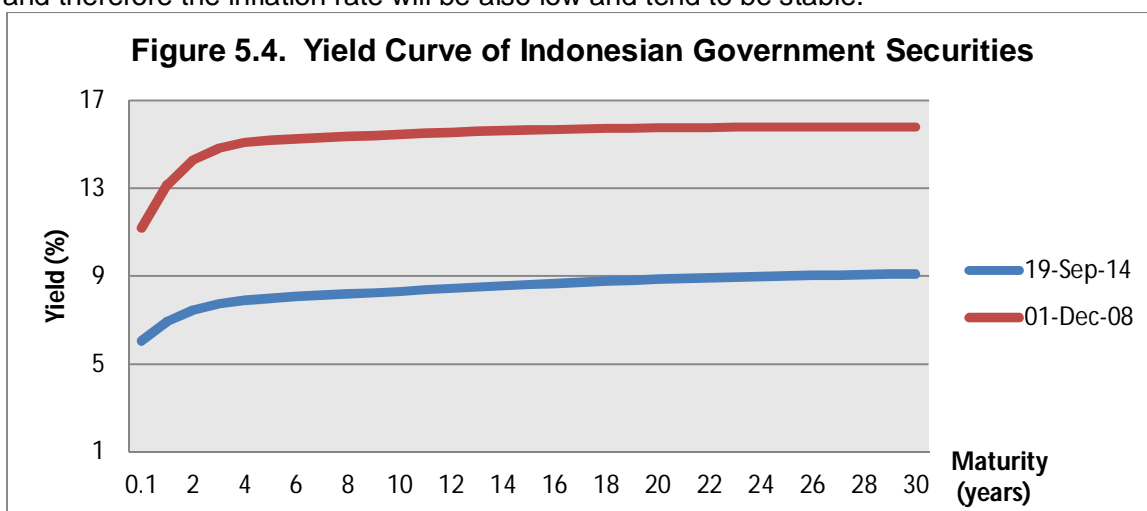

Source: Indonesia Stock Exchange and Indonesia Bond Pricing Agency (2014)

Based on the slope trend, both yield curves depict an upward sloping (Figure 5.4). This shape shows the positive relationship between the yield and the maturity, or, on the other words, the yield will rise as the maturity rises. This is because the longer maturity, the bigger risk we have, thus the return will also rise. In the future, it also predicts that the economic situation in Indonesia will be in the good condition. Along with strong economic growth, Indonesia will have higher inflation and higher interest rate.

5.5. The Binary Recursive Tree

The Binary Recursive Tree (BRT) can be immediately applied for evaluating default in risks (Manasse and Roubini, 2005). To assess an early-warning signal of sovereign debt crisis in Indonesia, the empirical tree classifies observations into crisis-prone or not crisis-prone (Figure 5.5). Based on the set of rules of BRT method, there are nine variables from dataset: total external debt in percent of GDP; short-term debt on a remaining maturity basis to reserves; public external debt to revenue; real growth; inflation; the U.S. treasury bill rate; exchange rate overvaluation and exchange rate volatility; external financing requirement to reserves; and number of years before a presidential election.

Figure 5.5. "Rules of Thumb" for Sovereign Debt Crisis
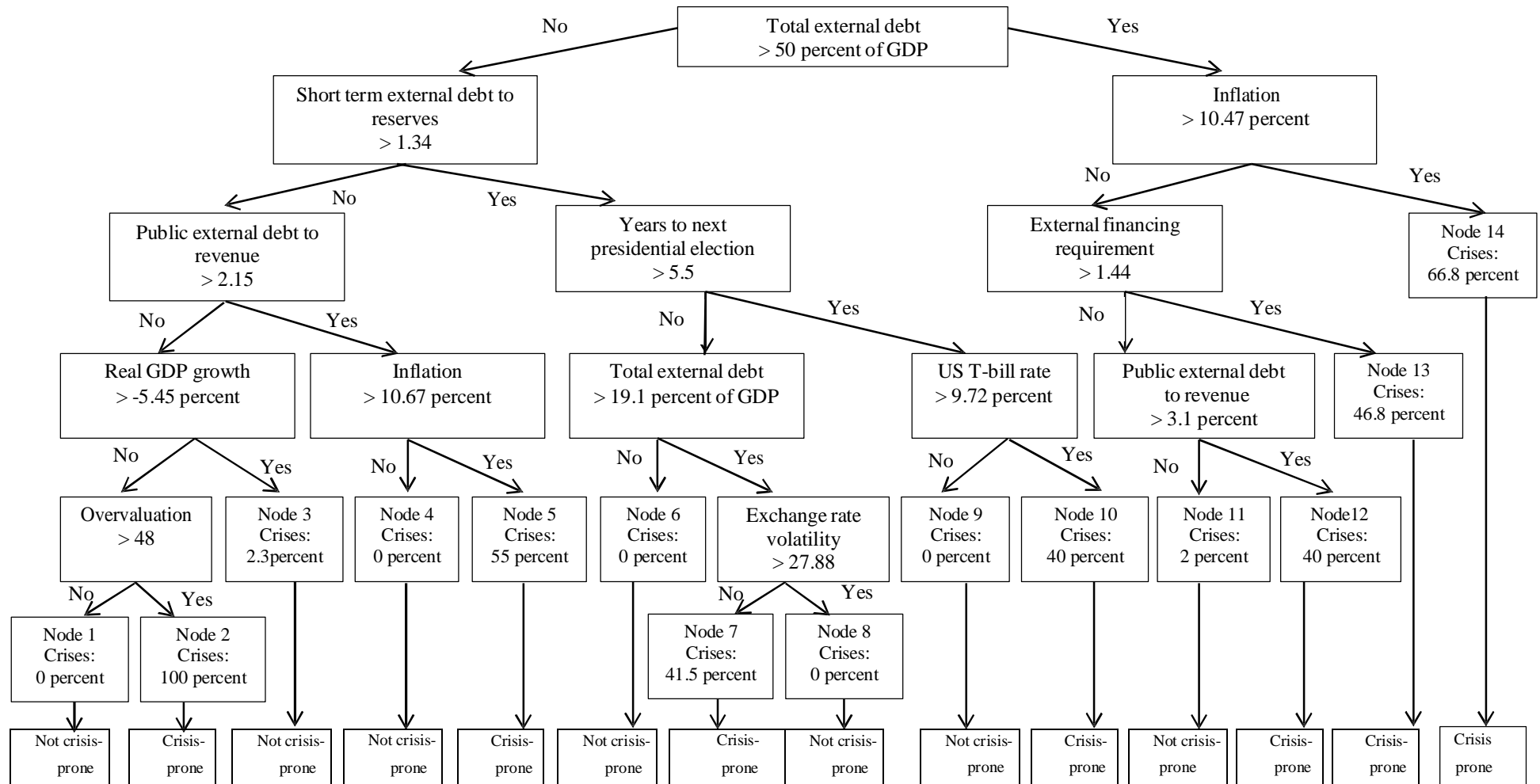
Source: Manasse and Roubini (2005)

By taking case of Indonesia's data per second quarter of 2014 (Bank Indonesia and Ministry of Finance, 2014), some set of rules need to be done as follows:

1. The first rule splits the branch into two: the total external debt exceeds 49.7 percent of GDP go to the right; and the low external debt-to-GDP ratio goes to the left. As published in the Monthly External Debt Statistics August 2014 of Bank Indonesia and Ministry of Finance, the total external debt of Indonesia is USD 284,880 million while the total GDP is USD 841,420 million. Since the external debt is relatively low (less than 50 percent of GDP), the answer is "no". Thus, one moves down to the left and calculates the short-term external debt to reserves.

$$50\% \times USD\ 841{,}420\ million = USD\ 420{,}710$$

2. The second rule splits with the question "Is short-term debt over reserves ratio above 1.34?". The answer is "no". The short term external debt of Indonesia is USD 58,670 million while Indonesia's reserve is USD 107,678 million. Therefore, the value of external debt over reserves is only 0.54 (less than 1.34). It means that one proceeds to the left branch and determines the external debt to revenue ratio.

$$\frac{USD\ 58{,}670\ million}{USD\ 107{,}678\ million} = 0.54$$

3. The third rule starts asking "Is public external-debt above 215 percent of revenue?" Again, the answer is "no" because the public external debt (USD 153,224 million) over the government revenue of Indonesia (USD 141,053 million) is 1.09 or 109 percent. Since its value less than 215 percent, real GDP growth must be determined.

$$\frac{USD\ 153{,}224\ million}{USD\ 141{,}053\ million} = 1.09$$

4. The fourth rule determines whether the real GDP growth is too negative (above minus 5.45 percent) or not. According to the Statistics Indonesia (2014), the answer is "yes" because the real GDP growth of Indonesia in the second quarter of 2014 is 5.12 percent. Thus, Indonesia has a positive real GDP growth that is associated with a reduced probability of entering crisis.

5. Finally, after identifying macroeconomic variables reflecting solvency and liquidity factors, the terminal node 3 is reached. This result predicts one year in advance that Indonesia in 2015 is not crisis-prone. Indonesia has a crisis probability of 2.3 percent.

In Indonesia, an early-warning signal is created by analyzing some circumstances that are more favorable for reducing debt crisis risks, namely low external debt, low short-term debt to reserves on a remaining maturity basis, low public external debt to revenue and good economic condition. Based on these set of rules, the likelihood of being in a crisis episode is just 2.3 percent which is classified as not crisis-prone.

VI.   CONCLUSION AND POLICY RECOMMENDATIONS

The main objectives of this study are to assess Indonesia's debt performance and produce an early-warning signal of sovereign debt crisis of Indonesia. Based on the overall result, Indonesia's external debt is sustainable as showed by the decreasing trend in debt-to-GDP ratio and debt-to-export ratio. Moreover, yield curves analysis depicts an upward sloping; predicting that the economic situation in Indonesia will be in the good condition. Also, based on the early-warning signal model, the likelihood of being in a crisis episode in Indonesia is just 2.3 percent that is classified as not crisis-prone. However, Indonesia still possesses higher debt burden since debt service ratio shows an upward trend. Debt service ratio increases due to high

private external debt. In order to lower debt service ratio to a safer level, private sector must be triggered with a deeper insight to manage the risk of currency mismatch and maturity mismatch.

In order to improve sustainability of Indonesia's debt service, the result of this study posed a significant implication towards the policy improvements of the economic and financing policies of Indonesia. Firstly, Indonesia needs to encourage local companies to borrow more from domestic creditors instead of foreign creditors. Secondly, even if it is necessary to borrow with foreign-currency denominated loans, the fund should be invested in productive business yielding foreign exchange and the most value-added investments that can increase skills, bring in new technology, develop infrastructure, and increase production. Thirdly, borrowers who are export oriented must actively make market penetration to overseas markets in order to collect revenues in foreign exchange and incorporate Indonesian partners into regional and global supply chain. Lastly, the government should concentrate on policies which could absorb domestic consumption from a growing middle-class population optimally to offset the decline in world's export demand for domestic goods.

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