

**School of Economics and Finance  
Curtin Business School**

**Fiscal Policy's Role in Stabilising the Economy in Indonesia**

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## DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person, with the exception of the conference paper that I presented at the 5<sup>th</sup> European Business Research Conference in Rome, Italy, 10-11 September 2015, with the title “Wagner’s Law and Dynamic Government Spending in Indonesia” that was co-authored by Garry MacDonald, Julian Inchauspe and myself.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature : 

Date : 17/02/2017

## ABSTRACT

This PhD thesis contributes to a better understanding of the role played by fiscal policy within the Indonesian economy. The purpose of this study is to analyse both the long-term and short-term issues facing policy makers when using fiscal policy to stabilise the economy. The study concentrates on the Indonesian economy, using data from the period of 1980 to 2014.

The thesis begins with a review of the literature on the use of fiscal policy as a stabilising tool within the macro economy. It also provides an up-to-date review of the implementation of fiscal policy within the context of recent developments in Indonesia's economy.

The bulk of the thesis consists of two key contributions. The first (in Chapter 4) deals with examining the historical role of fiscal policy and its relationship to government expenditure and macroeconomic activity in the long run. This section focuses on one specific interpretation: the validity or otherwise of Wagner's Law in the presence of price dynamics. Co-integration, causality tests and an analysis of the cyclical components of economic activity are used to examine the nature of the relationships among the variables. There is evidence in favour of Wagner's Law and confirmation of a strong counter-cyclical relationship between the cyclical components of GDP and government expenditure, suggesting that government expenditure has acted to stabilise the economy in Indonesia.

The second key part (in Chapter 5) uses a variety of econometric techniques to devise appropriate measures of the size of dynamic fiscal multipliers and, in particular, develops measures of the effectiveness of discretionary fiscal policy. The focus is on the identification of the fiscal multipliers based on the study of Mountford and Uhlig (2009) and apply the tools of Vector Auto Regression (VAR), Structural VAR using sign restrictions, Granger Causality and impulse-response identification methodology. There is evidence of strong causal links within the set of variables in the VAR and among the simulations, it was found that a deficit-spending scenario could be used to stimulate the economy in Indonesia and had the highest values for the measurements of the size impacts of its multipliers.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Chapter Outline**

This chapter consists of six sections. Section 1.2 explains both the background and the motivation of the thesis. Section 1.3 presents the key research questions and objectives. Section 1.4 discusses the key contributions the thesis makes to the literature. Data sources are identified in Section 1.5. Last but not least, the organisation of the thesis is presented in section 1.6.

### **1.2 Research Background and Motivation**

Indonesia is a fast-growing economy by world standards. The annual real Gross Domestic Product (GDP) growth rate in Indonesia averaged 5.6% during the period 1980-2014, while the Association of Southeast Asian Nations (ASEAN) region and the world in general, during the same period, exhibited rates of 5.3% and 3.5%, respectively. Economies in the Major Advanced Economies (G7) and the European Union (EU) were even lower at 2.58% and 1.78%, respectively (see Table 1.1 below).

The strengths of Indonesia's economy lie in its relatively large work force, diverse natural resources and strategic location in South East Asia. Unlike many developed economies, Indonesia has a relatively young age profile, with about 50% of its 255 million-population being below the age of 30. The remarkably large domestic consumer market of Indonesia has the obvious advantage that it reduces the dependency of Indonesia on exports and provides a solid level of demand for domestically produced goods and services. Also, unlike many primary producers, Indonesia does not depend on a single natural resource, such as coal or oil. It is a major producer of a wide range of natural products, including timber, tin, iron, gas, gold, nickel, spices and cocoa. Because of its location, Indonesia is viewed as a country that has dynamic economic and trading potential (Winarto 2015). Moreover, Indonesian markets are largely untapped and, as the middle class develops, they have the potential to grow strongly. Looking forward, the Indonesian economy is expected to become

the seventh leading economy in the world by 2030 and then to become more dominant in the international arena (Oberman et al. 2012).

Table 1.1 Comparison of the Average Annual GDP Growth (%) Among Indonesia, G7, European Union, ASEAN and World 1980-2014.

Year	Indonesia	G7	European Union	ASEAN	World
1980-1989	6.53	3.02	2.26	5.72	2.30
1990-1999	4.83	4.15	2.09	4.33	3.13
2000-2009	5.25	1.42	1.75	5.04	3.88
2010-2014	5.84	1.74	1.02	5.50	3.94
<b>Average</b>	<b>5.60</b>	<b>2.58</b>	<b>1.78</b>	<b>5.30</b>	<b>3.50</b>

Source: World Economic Outlook Database, April 2016.

Indonesia is also considered to be one of the East Asian “miracle” countries because of its current economy and its rapid economic development (Stiglitz 1996). From the early 1980’s into the late 1990’s, Indonesia’s post-oil boom was complemented by the government’s financial deregulation and a renewed liberalisation that expanded into the business sector very rapidly. Output grew by over 7% per annum from 1989 to 1997, positioning Indonesia as one of the key “miracle” economies. According to Van Zanden and Marks (2013), Indonesia has ushered in a new phase of economic growth associated with the inflow of substantial foreign investment, particularly directed towards export-oriented manufacturing sectors.

Despite its relatively healthy macroeconomic performance, the elimination of obstructions to economic growth and the reduction of workforce disturbances over wages still remain as challenges within the economic infrastructure that are encountered within the Indonesian economy.

This thesis is motivated by various affairs relating to current policy. It has frequently been argued that Indonesia’s fiscal situation has led to policy dilemmas in the past. In the last decade, its level of government spending accounted for 16.6% of GDP, which can be considered relatively low. In Developing Asia<sup>1</sup> and Organization for Economic Cooperation and Development (OECD) countries, such spending accounts for 27.8% and 46.3% of GDP, respectively. A key policy dilemma has been whether or not

<sup>1</sup> Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Kiribati, Laos, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Samoa, Sri Lanka, Thailand, Timor Leste (East Timor), Tonga, Vanuatu, Vietnam (Source: International Monetary Fund).

Indonesia should emulate fiscal policy rules used in developed countries. A prominent example of this is Financial Law No.17/2003. This policy rule resembles the Maastricht Treaty's rule, used in the EU. It states that there should be a limit on annual government deficits at 3% of GDP, while accumulated debt should not exceed 60% of GDP. Kuncoro (2015), Sacchi and Salotti (2015) and Badinger (2009) show that this fiscal policy framework is ultimately beneficial to economic growth and macroeconomic stability. Questions have, however, been raised about the constraints associated with this rule in Europe, since EU governments have struggled to restore full employment in recent years. It is somewhat early to make a full assessment of the Financial Law in Indonesia; however, policy makers have pointed out that it may not be adequate for the specific case of a developing economy such as Indonesia's (Bova, Carcenac, and Guerguil 2014). This kind of fiscal rule may well be necessary but, for a country that has such a different economy and type of social structure as Indonesia, it may not be sufficient because other essential problems might not be addressed. Issues surrounding the sustainability and allocation of budget, such as the enormous subsidisation of energy (both consumption and production), underspending in social welfare and infrastructure, narrow income base, allocation rigidity, discretionary spending decisions, lack of quality and efficiency in policy implementation (procurement, timing) and weak fiscal institutions, lead to complex fiscal policy management questions (Ikhsan 2014).

Fiscal policy has important macroeconomic implications— both in the long run and the short run. Traditionally, it has been used as an instrument for economic management because of its ability to directly influence the level and composition of aggregate demand in the economy. Changes in the instruments of fiscal policy have clear impacts on aggregate demand, the pattern of resource allocation and the distribution of income (Bunea-Bontas and Petre 2010). The first implication of unrestricted fiscal policy is the so-called automatic stabilisation effect, which does not require any short-term policy makers' decisions or budgetary preparation. On the other hand, stabilisation can also result from governments actively deciding to modify government taxes or expenditures because of changes in economic activity. For these discretionary policy decisions, the impacts of fiscal policy on economic activity, through private consumption and investment, need to be carefully evaluated (Galí, López-Salido, and Vallés (2007) in order for policy makers to be able to effectively “fine-tune” the

economy. As is well known, such fine-tuning is not easy, and examples of public finance measures that failed to stabilise European economies, from the mid-1970's to mid-1990's, have been confirmed by many researchers, including Fatas et al. (2003), Gali et al. (2003), Wyplosz (2002), Hallerberg and Strauch (2002) and Melitz (2000). In some of the episodes covered within this literature, fiscal expansions frequently happened during economic booms, while fiscal contractions occurred in periods of low growth. Therefore, rather than smoothing the business cycle, fiscal policies have actually exacerbated economic fluctuations. Overall, discretionary fiscal policies often override automatic stabilisers and, in some cases, they may contribute to economic instability (Fatas et al. 2003).

An important long-run aspect of Indonesia's fiscal policy to be examined in this thesis revolves around the level of potential output and government spending. This relationship could be seen as a ratio. However, there are more intrinsic aspects to investigate. It is of special interest to investigate the dynamics driving this ratio. In particular, it is relevant to analyse the causal properties. No causality from government spending in relation to output would imply that, in the long run, the Financial Law, for example, would not pose a threat to output growth. Conversely, if government spending is found to be a driver of long-run output growth, then this would constitute a potential disadvantage of the Financial Law. One crucial issue that this thesis aims to investigate is how some specific macroeconomic relationships have evolved over time. More specifically, this thesis tries to analyse the implications of Financial Law No.17/2003 for the existence of Wagner's Law and the size of fiscal multipliers in Indonesia. The data may be subject to a structural break occurring before, on, or after 2003, the year in which Financial Law No.17 was applied that date, and this break may affect different dynamic properties of each time series. Taking into account this characterisation of the problem, this thesis includes not only standard unit root tests but also tests for structural breaks.

The findings should be interpreted within the context of the literature. There is overwhelming evidence in the writings of researchers such as Mann (1980), Goffman and Mahar (1971), Musgrave and Musgrave (1989), Pryor (1969), Goffman (1968), Gupta (1967), and Peacock and Wiseman (1967) suggesting that, in industrialised countries, output growth frequently causes increments in government spending

because these countries typically demand high quality public services. This literature and associated issues are analysed in Chapter 2, which provides a useful overview of the problems and benefits of the use of fiscal policy to stabilise the economy and aid the process of economic growth. A long-run relationship between output and government spending has been observed in developed economies, but it is not generally observed in developing countries (Chapter 2); it is therefore of interest to check where Indonesia stands. These long-run tests are developed in Chapter 4. Since there are two important aspects of fiscal policy, one being the potential ability of fiscal policy to influence the long-run economic outcome and the other its short-run impacts, which might be used by policy makers to stabilise the economy during cyclical fluctuations, the key analysis chapters of the thesis have been divided into two parts. The long-run relationship is explored in Chapter 4, whereas Chapter 5 looks at the short-run impacts of various types of fiscal shock on the economy, which will help in understanding the scope for business cycle stabilisation.

Chapter 5 is concerned with answering questions regarding the ability of Indonesia's authorities to use discretionary fiscal policy to smooth business cycles, and the effectiveness of this process. This short-run analysis involves careful elaboration of the measurement of shocks and identification of the responses of the key macroeconomic variables. The results in Chapter 5 provide estimates of the size and dynamic impact of key fiscal policy measures on the economy. Considering that the literature on these measures for Indonesia's economy is negligible (see Chapter 2), this thesis aims to close this fundamental gap. The short-run analysis concludes the evaluation of fiscal policies in Indonesia. However, before conducting these short- and long-run analyses, Chapter 3 puts the research ideas into the context of the Indonesian economy by providing a useful summary of recent developments within its economy.

Overall, the dissertation addresses fiscal policy questions and dilemmas involving short-run efficiency, crowding in/out and long-run issues. In other words, it provides a detailed analysis of Indonesia's fiscal policy framework that is useful for policy makers, economic analysts and the research community as a whole.

### **1.3 Research Questions and Objectives**

In general, this thesis aims to answer the following questions:

- 1) What has been the long-run relationship between output growth and the level of government expenditure in Indonesia?
- 2) What is the historical interrelationship between the business cycle and the fiscal multiplier in Indonesia?
- 3) What is the role of fiscal policy in Indonesia in the short-run stabilisation and in the long run?

This research has three main objectives:

- 1) Consider recent developments in Indonesia's economy, with particular focus on the role of fiscal policy.
- 2) To look at the relationships among fiscal policies, as measured by government expenditure in relation to key macroeconomic indicators in a long-run framework. In particular, to test the relevance of Wagner's Law by looking at the causal relationship between government activity and economic activity.
- 3) To consider the impact of a range of fiscal stimuli on the Indonesian economy in a dynamic short-run model, in particular a Structural Vector Auto Regression (SVAR) model of the Indonesian economy, which identifies fiscal policy shocks as distinct from the shocks of business cycle and monetary changes, using the methods suggested in Mountford and Uhlig (2009).

### **1.4 Contributions**

This thesis makes the following contributions:

- 1) It develops an understanding of both the role of fiscal policy in the Indonesian economy and its limitations.
- 2) It adds to, and complements, the existing literature on the relevance (or otherwise) of Wagner's Law and, thus, provides understanding of the long-run relationship between government expenditure and economic activity in Indonesia.

- 3) It analyses the impact of fiscal policy shocks in the short run using a structural dynamic model of the Indonesian economy. It is worth noting that this analysis has mostly been done for OECD and developed countries, but this is the first time it has been used in Indonesia and, hence, it provides a benchmark for future research in the area.
- 4) It provides a reference point for policy makers, analysts and businesses within the Indonesian economy (as well as anyone else who is interested in understanding Indonesia's economy), which is supported by empirical methodology that is the standard in macroeconomic analysis of developed countries.

## **1.5 Data Source**

The data for estimation was mainly sourced from Oxford DataStream, the Indonesian Ministry of Finance, Bank Indonesia, the Indonesian Bureau of Statistics (BPS) and International Financial Statistics (IFS). Relevant quarterly macroeconomic data for Indonesia used in this thesis covers the period from Q1 1980 to Q2 2014.

## **1.6 Organisation of the Thesis**

### Chapter 1

The aim of this chapter is to provide a brief background to the research objectives. It describes the thesis contributions, its general methodology, the sources of data, and the thesis structure. Overall, it provides readers with a basic understanding of the entire thesis contents. It includes some discussion on selected macroeconomic and methodological issues, and the expected results.

### Chapter 2

Chapter 2 presents a review of the relevant literature as the theoretical background to support the empirical results in Chapter 4 and Chapter 5. Chapter 2 briefly reviews the fiscal policy stabilisation literature, focusing on the development of fiscal policy stabilisation theory, Wagner's Law, current debates on sizes of fiscal multiplier, the crowding out effect, sustainable public debt theory and fiscal stabilisation.

### Chapter 3

Chapter 3 provides a brief survey of the fiscal policy background within the context of the Indonesian economy and, hence, provides the reader with an understanding of how fiscal policy has been used in Indonesia. It elaborates on: the historical background to the development of fiscal policy; Indonesia's economic growth; key trends in government revenue and expenditure; Indonesia's debt position over the last 20 years; and contains some discussion of the development by the Indonesian government of key fiscal rules. The aim of this chapter is, therefore, to provide an Indonesian context in which to consider fiscal policy.

### Chapter 4

Chapter 4 contains the first, key set of empirical results. It tests the presence (or otherwise) of the Wagner's Law hypothesis in Indonesia and provides a long-run examination of the dynamics of government expenditure in Indonesia. The various tests associated with the well-known Johansen (1995) test for co-integration allow not only the testing of the null hypothesis of no co-integration between the basic key economic series considered in this chapter, but also allows testing of the possible restrictions on key parameters. Further testing, of course, can be conducted depending on the nature of the results. However, these results will provide insights into the appropriate formulation of the error correction models and the existence of a valid long-run relationship, as well as the value of relevant parameter estimators. Furthermore, the vector error-correction framework allows us to consider both the long-run relationship and short-term dynamics between economic activity and government spending, something which is important for this thesis.

### Chapter 5

Chapter 5 presents the second key set of empirical results for this thesis. In contrast to Chapter 4, which took a long-run perspective, the focus here is on the short run and, in particular, on the identification and quantification of various fiscal multipliers for the Indonesian economy. It uses the methodology suggested in Mountford and Uhlig (2009), so that shocks can be identified using sign restrictions on the impulse responses to government spending and government revenue. It considers a dynamic SVAR model of the economy and provides the reader with estimates of the sizes of

key dynamic multipliers for the Indonesian economy. Chapter 5 thereby complementing the work in Chapter 4.

### Chapter 6

Chapter 6 concludes the thesis with general comments, a summary of the main findings and a discussion of both the implications for policy and the potential for future research.

# **CHAPTER 2**

## **FISCAL POLICY STABILISATION: A LITERATURE SURVEY**

### **2.1 Introduction**

This chapter provides a concise overview of the fiscal policy literature relevant to this dissertation. Section 2.2 presents a brief overview of fiscal policy stabilisation theory. The starting point of this section is the traditional classical view of macroeconomics, followed by a discussion of Keynesian perspectives on the use of fiscal policy to stabilise the macro economy. Section 2.3 provides a discussion of the framework for Wagner's Law and related empirical studies. Wagner's Law and the long-run relationship between government and economic activity is the focus of the empirical work that is to be carried out in Chapter 4. Section 2.4 presents a brief summary of the debate on size of fiscal multipliers: some understanding of the empirical magnitude of such multipliers is a key for the practical application of stabilisation policy in Chapter 5. Section 2.5 discuss sustainable public debt theory and fiscal stabilisation. Finally, concluding remarks are presented in the last section.

### **2.2 Classical and Keynesian Underpinnings of Fiscal Stabilisation Policy**

The primary goals of fiscal policy are to maintain economic stabilisation, to preserve resources allocation and to ensure an equitable income distribution (Tanzi 2008). The government uses fiscal policy as a purposeful control of government revenues and expenditures so that economic and social aims can be achieved and growth stabilisation can be maintained (Bunea-Bontas and Petre 2010).

Theoretically, all fiscal policy discussions trace back to classical and Keynesian views. Over recent decades, the perception of the role of fiscal policy has radically changed. Fiscal policy effectiveness as an instrument of macroeconomic management has been widely debated in the literature. This is partly because empirical studies have found different, and sometimes conflicting, results. In this section, the traditional classical

and Keynesian literature on this issue is briefly reviewed. The aim is to provide a simple background on the historical development of fiscal policy stabilisation theory that will link to the empirical analysis in Chapters 4 and 5, rather than providing an exhaustive survey of the theory. There is little to no literature on the topics being analysed for Indonesia; and a further discussion of the Indonesian economy is provided in Chapter 3.

### **2.2.1 The Traditional Classical View of Macroeconomics**

Adam Smith's "The Wealth of Nations", published in 1776, is commonly considered to be the seminal contribution to the origin of the classical view of economics. Smith's "invisible hand" view asserts that markets function best with no government intervention. Smith (1776), Ricardo (1951), Malthus (1836) and Mill (1848) made further contributions to this idea. Adam Smith's view of free markets was not only accepted widely, but also seemed to be convincing at the time. According to Smith (1776), the most efficient allocation of economic resources arises when individuals (consumers, businesses and investors) are freed to make economic decisions based on their own interests. Value theory, to determine prices in the economic market, is used in the classical view of economics. Wages, technology, production decisions and interest payments for producing the item determine an item's value.

From a microeconomic perspective, it is well-known that market failures lead to Pareto-inefficient outcomes that often contradict free-market ideas. Adam Smith's view of an efficient free-market economy was formalised by Arrow and Debreu (1954) in a general equilibrium model that led to the welfare theorems. Later literature has shown that welfare theorems do not hold under market failures such as public goods imperfect competition, externalities and imperfect information (Varian 1992).

From a macroeconomic perspective, the classical view can be represented through an inelastic Long-Run Aggregate Supply (LRAS) curve. Supply-side factors, such as the level of capital stock and its productivity, the labour supply size and its productivity, and other relevant input, are suggested by the classical view as the key determinants of real GDP. A rise in aggregate demand without any increase in aggregate supply will therefore have no impact on output but will, rather, impact only on prices (inflation).

In regard to flexibility of prices and wages, it is a classical assumption that prices and wages are fully flexible, therefore markets clear efficiently. According to the classical model, a fall in wages as a result of the fall in demand for labour occurs when aggregate demand drops. This decrease in wages would ensure that markets clear and that full employment can be maintained. The classical theory also stresses the rationality of individuals in making decisions in the market. Classical economists also assume that individuals are not subject to large changes in their confidence levels and, usually, that people are rational.

In classical economic theory, therefore, government expenditures are not a major force. In contrast, it is believed that business investment and consumer spending should be the main drivers of the economic growth of a nation. Classical theorists argue that some valuable economic resources that are needed by businesses and individuals are taken away by government expenditures – a simple expression of the idea of crowding out. As a result, an increase in government spending simply leads to a fall in private spending and has no impact on economic activity. In the context of the empirical work in Chapter 4, this view suggests that there should be no positive causal link from government spending to economic activity. Indeed, it could be that economic growth is retarded if the government spending is less “efficient” than the private spending that it crowds out. In terms of policy recommendations in relation to government expenditures, the government does not need to intervene in managing the economy because the classical model is self-regulating and always moves efficiently to equilibrium.

The most important feature in the classical view is a suggestion that the free market should be able to operate freely. For example, reducing the ability of trade unions to reduce wage flexibility might be one suggestion. Classical economics is, therefore, often viewed as the precursor of supply-side economics - emphasising the role of supply-side policies in enhancing long-term economic growth.

Thus, providing long-term solutions for economic problems is the focus of classical economics. In developing classical economic theories, important parts are played by taxes, government regulations and the effects of inflation. Also considered by classical economists are both the way recent economic theory may alter or improve the free-market environment and the impacts of other current policies.

Regarding the money market, classical theory believes that income that is not directly spent becomes a saving when entering the money market. This saving will be injected as investment into the economy, leading to increased accumulation of capital. To ensure that there is no idle money, borrowers pay interest to savers. The payment of interest to savers is an incentive for lending within the money market. Market participants will want to lend and save more if the interest rate increases. In contrast, the borrowers are reluctant to borrow if there is a high interest rate. Accordingly, under the influence of the prevailing interest rates, the market is likely to re-equilibrate.

In Smith's prominent book (1776), there was a fundamental idea that a nation's wealth was based on trade, not on gold. Total wealth improves if two parties have an agreement to exchange things of value as they realise a profit. Compared to modern libertarian economics (which is a political philosophy that upholds liberty as its principal objective), classical economics differs, particularly in understanding the role of the nation in delivering the common goods and services. Smith (1776) acknowledged that there were fields in which the provision of public goods, for example health and education, might be necessary to the extent that they are likely to be underprovided by the market. In line with this thought, the greater portion of costs of these public goods should be borne by those who are best capable to afford them.

According to classical economists' views, when there is no coercion, markets usually regulate themselves. Smith (1776) described this as a metaphorical "invisible hand" that allows markets to attain their natural stability, once buyers can select from a variety of suppliers. The importance of competition and the dangers of monopolies were constantly emphasised by Smith (Hollander 1987).

Engel (2010) points out that the most prevailing contribution of the classical view is the emphasis it provides on trade in economic development. This credence in trade comes from Ricardo's (1821) law of comparative advantage and the thoughts of Smith (1776) regarding the advantages of specialism and subsequent trade in those goods and services, which can lead to profits from trade. The foundation for one of the three major theories of growth in economics (i.e. classical growth theory, which focused on production, technological advancement, capital accumulation, division of labour and population growth) was provided by the ideas of Smith (1776) and Ricardo (1821), along with Malthus (1836).

To sum up, the classical view commonly argues that the intervention of government is unnecessary and, in some cases, can even be counter-productive, due to the economy's self-regulating nature. In other words, in the context of economic policy, the proper role of government should be a "hands off" position rather than one of actively attempting to stabilise the economy or promote long-run growth. This simultaneously provides members of a society with a guarantee of full employment and with the desirable goods and services that they want.

### **2.2.2 Keynes and the Role of Fiscal Policy in Stabilising the Macro Economy**

Keynesian economics grew out of the Great Depression of the 1930's, which was a period of massive unemployment of both people and resources, and it argued strongly against the "self-regulating/equilibrium" perspective of classical economics. Keynes (1936), in his *General Theory*, focused on short-run aggregate demand issues, believing that aggregate demand ought to be stimulated by public policy during sluggish economic downturns. Keynes' argument was that, under full employment, equilibria could exist and market forces would be incapable of moving the economy back to its full employment equilibrium level. Keynesian theory also claims that economic activity can be improved by government spending when there is not enough business investment or consumer spending. Businesses and individuals usually lack the resources for generating instantaneous results via business investment or consumer spending during periods of depression and recession, whereas the government, through fiscal or monetary policies (or a combination of the two), can provide immediate economic results. It is perhaps not surprising that these ideas (and, indeed, the works of Keynes) were brought back to the fore in the aftermath of the 2008 Global Financial Crisis, when many economies (including those of Australia and Indonesia) turned to previously somewhat neglected fiscal policy options to stimulate demand in the economy.

As a result, the Keynesian view places more emphasis on the role of aggregate demand when analysing the cause of a recession and the way to overcome it. Keynesians also give more attention to demand-deficient unemployment. In response to the current crises in Europe, for instance, Keynes might argue that the high unemployment level is, to some extent, due to the high level of savings and the resulting low growth of

aggregate demand being insufficient to raise the level of economic growth. Keynes (1936) argues that the confidence of consumers and businessmen can fall in difficult times. This can cause investment and demand to drop significantly. The fall in confidence can lead to investment decreasing drastically and savings rising rapidly, which can go on for a long period in the absence of policy change. Regarding policy recommendations, Keynes' theory suggests that government has to intervene, particularly in the case of a recession. The fall in private sector investment needs to be counterweighted by government spending. Moreover, as borrowing could help to raise the whole aggregate demand, government borrowing becomes necessary. Keynesians do not reject supply-side policies, but they argue that supply-side policies may not always be adequate. For example, the major problem of the absence of demand cannot be handled by supply-side policies.

A critique of the classical theory adds to the Keynesian theory of employment. In this critique, Keynes (1936) argues that there is no guarantee that investors and savers meet the equilibrium in the money market as they may have incompatible plans. The same is true in the labour and the goods markets, due to the rigidity of wages and prices. With respect to the plans of saving and investment, Keynes (1936) claimed that investors and savers are different groups that need financial intermediaries (banks) because they do not necessarily interrelate. In a recessionary period, even though the interest rate is extremely low, investment might not be equivalent to saving. This causes three problems. The first is that the sales prospect of borrowers is very poor. The second is the possibility of banks becoming bankrupt when they lend their money. The last is that savers usually delay their savings until the rate of returns is higher. As a result, a liquidity trap occurs. When the economic condition looks disappointing, banks are likely to be more selective when lending their money to businesses or individuals. Nevertheless, their unwillingness to lend contributes to the worsening of the economic position.

Keynes (1936) also suggested that, unlike as in classical theory, wages and prices tend to be rigid. In particular, wages are unlikely to fall in the situation of deficient demand— because workers usually do not accept lower wage offers, particularly if the wages are not enough to support their living standards, whereas classical theory suggested that they should be lowered to restore equilibrium. It also takes time for

wages to rise to equilibrium levels in the presence of contracts. With respect to prices, companies have a preference to reduce production and to cut back on employment and output, rather than reducing prices. Their ability to behave in this way is strengthened in situations where they hold a degree of monopoly power. This rigidity of wages and prices argues against the classical belief that any disequilibrium in the economy could be automatically corrected by wage/price flexibility.

One of the key empirical relationships based on the Keynesian model, which was developed in the 1950s and 60s, was the famous Phillips curve relationship that posited a trade-off between inflation and unemployment (Phillips 1958). In its original formulation, the Phillips curve model suggested the presence of a trade-off between inflation and unemployment and stated that policy makers had a “menu of choices” from which they could accept higher inflation in a trade-off for lower unemployment. Therefore, policy makers could choose to prioritise either unemployment or inflation. In order to influence the level of inflation and economic growth, fiscal and monetary policy can be applied by policy makers. This trade-off was suggested by Phillips curve analyses from the 1950s to 1960s. For instance, in the case of low inflation and high unemployment, aggregate demand is stimulated by policy makers. While the traditional Phillips curve model has been replaced by the expectations-augmented versions of Friedman and Laidler (1975) and Mavroeidis, Plagborg-Moller and Stock (2014), this short-run trade-off still exists and is the core of the New Keynesian models that lead to a short-term role for fiscal and monetary policy, despite the absence of any long-run trade-off between inflation and unemployment.

The emphasis therefore, in traditional Keynesian theories, is on the presence of market imperfections such as externalities, incomplete information, sticky nominal variables and various adverse effects of economic fluctuations. The best possible actions cannot be taken by private markets alone. As a consequence, increasing or decreasing government activity may be preferred. Government debt can be increased in order to finance government consumption if economic activity is lower than the optimal level, such as in the case of low consumption and high unemployment. Lodewijks (2003) suggests that traditional Keynesians focus on both the adverse effects of economic fluctuations and the policy possibilities for alleviating these impacts via counter-cyclical policy.

In conclusion, Keynesians argue that there is no internal mechanism to guarantee full employment in a market economy, especially in the short-run. Therefore, the role of fiscal policy as an effective instrument of economic stabilisation is emphasised. Keynes also claims that, primarily, government spending and the level of demand have significant impacts upon the health of an economy. Unemployment can exist if government spending is insufficient. Inflation can be the result if government spending is excessive. As a consequence, Keynes argues that the government has some responsibility for both the inflation and unemployment outcomes within the economy because there is an activist role for fiscal (and monetary) stabilisation policy, through the appropriate management of government revenues and expenditures, to provide guidance to the performance of the economy.

A Keynesian perspective on the macro economy would argue that there is scope for the fiscal policy actions to influence the economic outcome, in both the short- and long-run. This idea will be the focus of the two key empirical chapters of this thesis. In Chapter 4, the long-run relationship between economic activity and government spending will be examined and an attempt made to draw conclusions about the causal links between these two variables. This will be done within the context of an analysis of Wagner's Law, and the next section reviews, briefly, the literature on this idea. In the short-run, the impact of government spending depends on the size of fiscal policy multipliers, and this will be the focus of Chapter 5. Therefore, the following subsection (2.4) looks, briefly, at the literature on fiscal policy multipliers and crowding out, which plays an important role in determining the impact of fiscal policy actions on the economy.

### **2.3 Wagner's Law**

In addition to examining the short-run relationships between economic activity and government spending, this thesis also looks at the possibility of long-run relationships among the data. In this context, particular attention is given to Wagner's Law, which postulates exactly such a long-run relationship between government and economic activity (Wagner 1911). Using both cross-sectional and time-series data sets, Wagner's Law has been examined empirically in a wide variety of different countries, including both developed and developing economies. Many of these papers have focused on testing whether a long-run causal relationship exists between government

expenditure and income and they have used a wide variety of econometric approaches: see Alkitoby (2006), Chang (2002), Kumar, Webber and Fargher (2012), Babatunde (2011), Samudram, Nair and Vaithilingam (2009), Iniguez-Montiel (2010), Kolluri, Panik and Wahab (2000), Legrenzi (2004), Lamartina and Zaghini (2008), Ying-Foon, Cotsomitist and Kwan (2002), and Oxley (1994). The findings in this literature are mixed and the methodology used varies widely with differing degrees of econometric sophistication. In particular, there has been little done in the context of the Indonesian economy, using more recent econometric tests based on the co-integration framework. Therefore, this research investigates Wagner's Law by testing whether a long-run stable relationship between government spending and economic activity exists in Indonesia, and this is described in Chapter 4. Wagner's Law predicts that output growth will be followed by a proportionally higher growth in government spending. Since the majority of empirical studies have been conducted in developed countries that already have established infrastructure, it is interesting to test whether these findings apply to the case of Indonesia.

### **2.3.1 Basic Concept of Wagner's Law in Modern Literature**

The characteristic of the empirical relationship between public expenditure and economic growth is open to alternative interpretations. One view, associated with Keynes, would be that discretionary changes in public expenditure are used by governments to stabilise cyclical fluctuations and to develop capital infrastructure. This view implies that, if causality exists between public expenditure and economic activity, it would flow from the former to the latter. Although relevant, this Keynesian view does not explain why the level of government spending as a proportion of GDP would need to grow over time.

The theory about why government spending may increase faster than output as an economy develops has been associated with Wagner (1911). More specifically, the long-run relationship between government expenditure and output, with causality running from economic growth to spending in the long-run, has been dubbed Wagner's Law. Wagner (1911) argued that there are three primary reasons for increased government expenditure. Firstly, economic growth, modernisation and industrialisation cause substitution of public for private activity. This pushes governments to produce more regulations for private-sector activities that lead to

increased government expenditure. Secondly, the demand for basic infrastructure, especially health and education, leads to a further increase in government spending as real income rises. (Wagner asserts that these facilities will be more efficient if conducted by government rather than the private sector.) Finally, Wagner argues that governments should improve economic efficiency in monopolistic and imperfect-competition market structures through large-scale investment. Overall, it was Wagner's view that economic development would be accompanied by increased participation of the public sector in the economy. It must be added that, in modern economies, it is particularly important to consider that, as a country develops, there is increased reliance on technological development, which drives long-term growth through various, sizeable spill over effects. For research and development to work, governments need to invest in developing an adequate institutional framework covering, *inter alia*, property rights, competition policy, and regulations and patents. Therefore, it could be put forward as a hypothesis that emerging economies in which government participation increases relative to income may have higher income growth over the long-run. This is, of course, assuming that government spending crowds in private development of technologies with spill over effects that outweigh the policy cost. Unproductive government expenditure, that crowded out private investment, such as financing wars or inefficient bureaucracy, would not lead to long-term growth.

The Wagner hypothesis has attracted a lot of interest in the public economics literature and been tested both over time and across countries. Despite the fact that Wagner did not provide mathematical equations for his hypothesis, some economists have proposed econometrics models for testing it. The first wave of research focused on the industrialised Western economies. The most important original empirical formulations in this literature can be found in the following papers: Mann (1980), Goffman and Mahar (1971), Musgrave (1969), Pryor (1969), Goffman (1968), Gupta (1967), and Peacock and Wiseman (1967). A more recent branch of literature has focused on studying Wagner's Law for emerging countries, using both cross-sectional and time-series data sets. Examples of this approach can be found in: Alkitoby et al. (2006), Chang (2002), Kumar, Webber and Fargher (2012), Babatunde (2011), Samudram, Nair and Vaithilingam (2009), Iniguez-Montiel (2010), Kolluri, Panik and Wahab (2000), Legrenzi (2004), Lamartina and Zaghini (2008), Ying-Foon, Cotsomitist and Kwan (2002), Oxley (1994) and Inchauspe, Kobir and MacDonald

(2015). The results in this literature are varied, with some finding evidence of a long-run relationship and others not. In the next section, the framework for Wagner's theory is briefly reviewed, followed by a more detailed look at some of the key results.

### **2.3.2 A Theoretical Framework of Wagner's Law**

The German economist Wagner (1911) was perhaps the first to propose a direct hypothesis that the expansion of government spending is positively related to economic development. Therefore, as a country's output increases, the size of that country's public sector, relative to the whole economy, rises too. In other words, public expenditure is an endogenous variable that is determined by the growth of national income.

As noted above, Wagner (1911) argued that there were three primary reasons for increased government expenditure as the economy grew and that economic development would be followed by relative growth of the public sector in the economy. Particularly during periods of industrialisation, he argued that we would expect the government expenditure relative to the economy might grow at a level greater than the level of output growth. The Wagner hypothesis has attracted enormous interest in the macroeconomics literature and has been tested for different economies and countries.

There are several models of Wagner's Law that have been empirically examined by various researchers over the decades. They will be examined in two sections, looking first at work undertaken in the period of roughly 1960 to 1980 that used either time-series or cross-sectional studies but ignored the time-series properties of the data (for example did not consider the possibility that the data might be non-stationary I (1) processes) and then, in the second sub-section, looking at more modern work that has explicitly considered the time-series properties of the data.

#### **2.3.2.1 The Time-Series Studies in the Period between 1960 and 1989**

Let us first examine Peacock and Wiseman (1967); their formulation suggests that public expenditure should consistently and smoothly rise at a level higher than the level of rise in national income. They also believe that the growth of public expenditure is related to changes in public services demand. The main cause of those

demand changes are population and income per capita growth, but other aspects are considered as factors that can lead to a higher level of government activity, such as technology, scientific progress, a developing division of labour, transport and communications. The level of government expenditure is a function of national income.

This interpretation becomes the first modern analysis in reviving Wagner's Law and the modern measurement of government spending as a fiscal activity. Peacock and Wiseman (1967) were, in some way, proposing a rival model to Wagner's Law, based on a supply-side time-pattern approach to public spending growth in Britain that rejected the theoretical foundations of Wagner's Law and its validity in explaining the pattern of state activity growth. They found that state activity displayed a step-wise rather than gradual pattern of government growth. Wagner (1911) did not suggest a precise functional form of the relationship between the size of public spending and economic development.

The time-pattern of public expenditure growth was the primary concern of Peacock and Wiseman (1967). The importance of supply-side crises such as depressions was emphasised. Unlike Wagner (1911), they argue that the greater role of government during these times leads to increases in the tolerable burden of taxation. After the crisis has passed, the crisis level of taxation tends to remain high because the expanded bureaucracy will act to ensure its continued new levels of funding, even though it is for a different set of post-crisis expenditures. Their hypothesis has been referred to as being based on a displacement effect, with the key characteristic of public expenditure being that it is flexible but rapidly upward during crises, but it is inflexible and downwards after the crises (Bird 1972).

A second, slight variation on this theme was suggested by Gupta (1967), who incorporated the growth of population into the model. The time-pattern of public expenditure growth for a group of countries was examined. These countries were: the USA, the UK, Canada, Sweden and Germany. Gupta (1967) suggested that Peacock and Wiseman (1967) were looking for the association between "social disturbance", such as war, and the amount of government expenditure growth related to economic growth. Gupta (1967) argued that the concept of a tolerable burden of taxation adopted by Peacock and Wiseman (1967) can explain shifts in the level of public expenditure

throughout wars and crises, but cannot explain the shift in the level of public expenditure during a depression, since taxes are reduced during this period. Gupta (1967) explained that combining other methods of financing than additional taxes, such as deficit financing, with the Peacock and Wiseman (1967) idea of a tolerable burden might provide a better explanation. Gupta (1967) may have been the first to devise rigorous statistical tests for a displacement effect, separately testing for a change in the proportion of government expenditure and whether social upheaval is associated with the change in the income elasticity of public spending in relation to economic growth.

The displacement effect hypothesis of Peacock and Wiseman (1967) could not explain why a change in the level of public expenditure per capita was associated with the great recession in Canada and the United States, Gupta (1967) justified this on the grounds that the shift related to the great depression occurred because of too much new expenditure. For instance, welfare services, subsidies and assistance, generated by the great depression, were mostly deficit financed. In most of the countries included in the tests, the results of Gupta's study (1967) suggested a limited acceptance of Wagner's Law. Both are in time-series and cross-section setups. However, Gupta (1967) suggested that a non-linear analysis of government expenditure with relation to income could be followed to test for the existence of Wagner's Law. Thus, a non-linear model of Wagner's Law was introduced by Gupta (1967). He suggested that modelling Wagner's Law this way might give a better understanding of the behaviour of government expenditure related to national income, over time and across countries. His results did not contradict Wagner's Law but he did not develop his non-linear model further into a sensible form that places boundaries on government's share of spending. However, this non-linear interpretation marked a significant step forward in the development of the interpretations of Wagner's Law, since Gupta (1967) was the first to recognise that the growth of government relative to national income could follow a non-linear process.

A third approach was proposed by Goffman (1968), and it is often referred to as the absolute version of Wagner's Law. Goffman (1968) used a simple model in which the dependent variable is the level of government spending and the measure of development is the level of GDP per capita. Goffman (1968) did not use standard

econometrics methods, such as OLS but, rather, simple ratios between the dependent and independent variables. Based on those ratios, the government expenditure elasticity can be examined with respect to GDP per capita over various points in Government Expenditure (GE)/GDP space.

Goffman (1968) assessed government growth at absolute rates and suggested that Wagner provided little reason for measuring the rise of public expenditures in proportion to income. Gupta (1967) suggested that Wagner's proportional rise relies on Wagner's typically Germanic view of the state. In other words, Goffman (1968) suggested that Wagner (1911) thought that it was desirable for the state to grow at a rate that would increase the share of state functions with output. Goffman (1968) criticised previous studies of Wagner's Law in that they presented their results in terms of the rising or falling of the ratios of public expenditure relative to income, instead of in terms of the values of the elasticities. The view of Goffman (1968) about the elasticity of demand in Wagner's Law led to the proposal that the percentage change in GDP leads to a greater percentage change in expenditures.

While Goffman and Mahar (1971) are critical of some previous studies, there are two major issues with their work. Firstly, they ignore the potential for an endogenous regressor brought about by the potential simultaneity between GE and GDP/Population (P). Secondly, even though they argue for analysis couched in terms of the elasticity of GE with respect to GDP per capita in favour of the ratio GE/GDP, they appear to ignore some elasticity issues. For the elasticity of GE with respect to GDP/P to be greater than unity, the linear form of their interpretation requires a negative intercept for GE, implying negative GE scores for low levels of GDP/P. Furthermore, the linear form must mean that the limit to the measure of elasticity described here must approach one. Thus, as GDP/P grows larger, GE growth approaches equal proportions with GDP/P growth so that GE/GDP reaches the same maximum level. However, there is no guarantee that this maximum is less than one.

The next formulation was proposed by Pryor (1969), who analysed the growth of public expenditure in market economies and centrally planned economies. The market economies included the USA, West Germany, Austria, Ireland, Italy, Greece and Yugoslavia. The centralised economies included Czechoslovakia, East Germany, the USSR, Hungary, Poland, Romania and Bulgaria. Unlike the previous works, Pryor

(1969) interpreted Wagner's Law so that, in growing economies, public consumption expenditure becomes an increasingly larger component of the national income. This interpretation is different from those of both Gupta (1967) and Peacock and Wiseman (1967) in that Pryor (1969) narrowed the definition of government expenditure to include only government consumption expenditure. According to Slemrod, Gale, and Easterly (1995), it is easy to envisage causality from Gross National Product (GNP)/P to GC/GNP where GC is a measure of government consumption. Reversing this causality is not very plausible, so that simultaneity is not likely. Thus, the Pryor (1969) model does not suffer from an endogeneity problem.

Pryor (1969) mainly aimed to compare market economies with centrally planned economies. This was focused on the study of "Comparative Economic Systems". Wagner applied his hypothesis to market economies where free competition prevailed in the market, and democracy was an important feature of the state's expenditure process. However, the analysis by Pryor (1969) is differentiated from other previous analyses in that it attempted to examine the impacts of various types of conditions and variables on the forms of Wagner's Law. For instance, he examined the effect of economic development on government consumption for different economic systems instead of for a group of countries with the same economic system. His results suggested that two types of country did not seem to fit his interpretation of Wagner's Law: those with either highly underdeveloped or highly developed economies. Pryor (1969) then employed not only cross-sectional but also time-series data to test for Wagner's Law and discovered that Wagner's generalisation seems applicable in both cases for countries that are in the process of transforming their economies from rural agricultural to urban industrial. He thought that this stage might be described as the beginning of an industrial economy. Pryor (1969) also disaggregated government consumption to observe the behaviour of the different components over time, along with the development of the economy.

Pryor (1969) found mixed results when he disaggregated government consumption into different components and tested with cross-sectional data. On the one hand, he found that empirical tests using the internal security, foreign aid, and research and development categories did not contradict Wagner's Law. On the other hand, he found that economic development seemed to have little explanatory power for the military,

welfare, education or health expenditure categories. However, in almost all time-series samples, per capita income significantly affected government consumption.

Another popular hypothesis was proposed by Musgrave (1969), whose interpretation of Wagner's Law assumes a functional relationship between the ratio of total government spending to GNP and per capita income. Musgrave (1969) examined economic factors that might support the hypothesis of an increasing share of government expenditure in GNP, by studying the development of a country from low to high per capita income in the course of economic growth. His version is differentiated from other versions of Wagner's Law in several ways. Firstly, his interpretation considers shares instead of absolute levels and, so, is less likely to suffer the endogeneity problem. Secondly, following Wagner, Musgrave (1969) considered the cause of particular types of public expenditure. He accepted the distinction between defence and civilian functions but his choice did not conform to Wagner's choice of expenditure categories: protection, general administration, economic administration and education. Instead, Musgrave (1969) asserted that civilian expenditures might be better examined in economic categories such as public capital formation, public consumption and transfers.

Musgrave (1969) expected that the rise of the public share in total capital formation would be relatively high in the early stages of development, but with less predictable changes thereafter, and that the ratio of transfers would tend to decline with rising income. His rationale was that the facilities for private capital formation are limited in the early stages of development, and public production of certain capital goods might therefore be necessary. However, at a later stage of development, the institutions for private capital formation become more developed and the provision of such capital goods may be left to the private sector. Musgrave (1969) suggests that Wagner's Law covers only the earlier to middle stages of economic development and does not apply to the post-industrialised states. However, Musgrave (1969) also suggests that changing private consumption patterns might call for complementary private investment, so that the net effect on the public spending share depends on each particular case. Regarding the increasing complexity of economic organisation that comes with economic development, Musgrave (1969) suggested that this force may generate demand for a new set of basic public services, which are of a corrective sort.

For example, the emergence of corporations and large enterprises may necessitate the services of regulatory agencies. Musgrave (1969) also considered certain conditioning factors of change that have an important effect on the efficient expenditure share (overall public expenditures to GNP ratio) resulting from the mix of the three forces. These factors accounted for demographic change, technological change, and socio-cultural and political factors.

The final interpretation to be reviewed in this section is from Mann (1980). Over the period from 1925 to 1976, he tested all earlier interpretations of Wagner's Law for Mexico. His results suggested that the versions of Peacock and Wiseman (1967), Goffman and Mahar (1971) and Gupta (1967) supported Wagner's Law in Mexico, since the elasticity coefficients exceeded unity. Opposite results to Musgrave (1969) and Pryor (1969) were obtained with the share models of Wagner's Law. Mann (1980) modified the Peacock and Wiseman (1967) interpretation into a share version and called it a structural model of Wagner's Law. Mann (1980) interpreted Wagner's Law by considering a model of government spending in which income should increase at a level higher than the level of increase in national income. This form is different in that it measures fiscal government relatively, in the form of a share, as did Pryor (1969) and Musgrave (1969) but, unlike those authors, Mann (1980) related this share to the level of GDP rather than GDP per capita. His results claimed that Wagner's Law is supported only between the proportional levels of spending in the overall public sector and the changing industrial and demographic structure in terms of urbanisation.

As can be seen, the literature covered in this sub-section used a variety of techniques and variables; the dependent and explanatory variables of those versions can be summarised, as in the table below:

Table 2.1 Summary of Dependent and Independent Variables in Most Significant Empirical Studies of Wagner's Law

<b>Author</b>	<b>Dependent Variable</b>	<b>Explanatory Variable</b>
Peacock and Wiseman (1967)	Government expenditure	Growth of National Product (GNP)
Gupta (1967)	Government expenditure per capita	GNP per capita
Goffman (1968)	Government expenditure	GDP per capita

Cont.

<b>Author</b>	<b>Dependent Variable</b>	<b>Explanatory Variable</b>
Pryor (1969)	Ratio of government consumption to GNP	GNP per capita
Musgrave (1969)	Ratio of total public expenditure to GNP	GNP per capita income
(Mann 1980)	The proportion of public expenditure to income	National income

### **2.3.2.2 Modern Time-Series Empirical Studies of Wagner's Law**

Most of the time-series studies discussed in the previous sub-section were conducted during the period between 1960 and 1989 and used standard OLS regression in the time-series testing of Wagner's Law. After the 1980's and the widespread acceptance and development of econometric techniques that could be applied in the presence of non-stationary data, the co-integrating regression approach appears to be the most important econometric development in the analysis of Wagner's Law. A great deal has been written recently on the possibility of spurious regression in the context of testing for Wagner's Law or, indeed, for any model where the data sets considered are I(1). Spurious regression can result from applying OLS single equation regression techniques to time-series data without examining the stationary characteristics. Non-stationary series of the same order of integration (usually established by appropriate unit root tests) may be co-integrated, as suggested in Granger and Newbold (1974) and Engle and Granger (1987). That is, they may have a long-run equilibrium relationship and the co-integration test attempts to ascertain the existence of a long-run connection among the variables of the economy.

The co-integration approach is straightforward. Once the degree of integration of the individual variables has been established, it can be determined whether the series are co-integrated. The co-integration approach tests whether a linear combination of the integrated series is stationary, where this linear combination is the co-integrating vector. Studies applying the co-integration approach to Wagner's Law include Bojanic (2013), Pahlavani, Abed and Pourshabi (2011), Chang (2002) and Kolluri, Panik and Wahab (2000). However, Henrekson (1993) is probably the first researcher who raised the issue of spurious regression in testing Wagner's Law. Henrekson (1993) suggested that the findings of existing time-series studies that supported Wagner's Law could tend to suffer from the spurious regression problem because they implemented OLS regression on non-stationary variables. Henrekson (1993) tested the data for

stationarity by applying the ADF tests of Dickey and Fuller (1981), and tested for co-integration using the two-step Engle and Granger (1987) procedure<sup>2</sup>. He also used the Granger (1969) causality test in the second stage error correction model to identify endogenous and exogenous variables in the model.

Chletsos and Kollias (1997) examined Wagner's Law in Greece. Disaggregate data was used and an error correction approach was applied. They found that Wagner's Law was only supported when it was applied to the data on military spending. In terms of other types of government spending there was no evidence to support Wagner's Law, suggesting very limited support for the hypothesis in the context of government spending and economic growth in Greece. Another study conducted by Ahsan, Kwan and Sahni (1996) tested Wagner's Law by applying the Engle and Granger (1987) methodology to time-series data for Canada for the period from 1952 to 1988. A subsequent co-integrating test found significant support for a co-integrating vector and the long-run dynamics was consistent with Wagner's Law. Other existing time-series empirical researches have applied direct estimation methods to time-series data. Some studies have ignored the issue of spurious regression. Courkis, Moura-Roque and Tridimas (1993), for instance, tested Wagner's Law in Greece and Portugal. They assumed the time-series for those countries were stationary and proceeded to test Wagner's Law via the OLS regression method. Therefore, their results might produce spurious regressions and lead to incorrect findings. They emphasised the various elements of movement in government spending and found that policy stabilisation, socio-political background, prices and permanent income were contributing factors in government spending, with different responses across the spending components.

In the case of Indonesia, Permana and Wika (2014), Ismal (2011) and Ramayandi (2003) studied Wagner's Law with different methodologies. Permana and Wika (2014) assessed Wagner's Law in Indonesia after the reformation era, from 1999 to 2011. Using a variety of estimation techniques, including the ARDL bounds test developed by Pesaran, Shin and Smith (2001), which is an alternative way of testing for co-integration and can be applied in the presence of mixed orders of integration amongst the variables, they found support for Wagner's Law.

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<sup>2</sup> The two-step procedure firstly tests for unit roots in the variables, then runs an OLS regression between the variables. If they are of the same order of integration, then tests the residuals of that regression for stationarity.

Meanwhile, the government's size effect on the growth of its economy using time-series data from 1969 to 1999 was also investigated by Ramayandi (2003). He argued that growth had been negatively impacted by the government's size, in the short-run or in the long-run, using Error Correction Model (ECM). There is some question about the applicability of Wagner's Law in Indonesia and Chapter 4 will provide a careful analysis of the data by using up-to-date testing procedures.

Oxley (1994) investigated the existence of Wagner's Law with a careful application of time-series data techniques to the British economy using aggregate data from 1870-1913. This data span represented a potentially conducive time for Wagner's Law, since Britain was in a period of rapid economic growth and industrialisation. He examined the tendency for the growth of government spending in relation to GDP. Oxley (1994) paid particular attention to the time-series properties of the data and noted that "*Co-integration between government expenditure and income is a necessary condition for valid tests of Wagner's Law.*" Oxley (1994 pp. 295) also noted the importance of causality tests in the context of both the long-run characteristics of the data and the short-run data. Following the basic approach of Oxley (1994), Chapter 4 will apply modern time-series techniques to aggregate data in Indonesia and will test the long-run relationship between government spending and economic activity, using the co-integration framework and careful tests of the causal links among the variables. Thus, three important properties of the data will be identified: the data order of integration, the presence or absence of co-integration between government expenditure and economic activity, and the direction of causality in order to examine whether there exists unidirectional causality from income to government expenditure, or vice versa. These will allow appropriate conclusions to be drawn regarding the veracity of Wagner's Law in Indonesia.

After discussion of the long-run relationship between economic activity and government spending, the next section will discuss issues relating to the sizes of fiscal multipliers and will emphasise the short-run impacts of fiscal policy, since the focus of Chapter 5 will be the estimation of such multipliers.

## **2.4 Current Debates on the Size of Fiscal Multiplier**

There is considerable debate in the literature regarding the size of fiscal policy multipliers. Chapter 5 of this thesis uses a Structural Vector Auto Regressive (SVAR) model to attempt to identify the sizes of such multipliers in the case of Indonesia. This section briefly reviews the debate over the size of fiscal multipliers.

Fiscal expansions via increasing government spending and tax cuts are basically aimed at influencing the economy through their multiplier effects. However, the results are not always as effective as intended. As a result, it is vital to identify the circumstances under which any fiscal expansion is relatively effective, or otherwise, at stimulating output. The size of the fiscal multiplier can be small, large, positive or negative. This section discusses the demand- and supply-side effects of fiscal policy and empirical studies of fiscal multipliers.

### **2.4.1 Demand-Side Effects of Fiscal Policy**

Under excess capacity and price rigidity, the fiscal multipliers of Keynesian theory are greater than one and the balanced budget multiplier will be precisely one. (The balanced budget multiplier occurs when an increase in expenditure is matched by an increase in taxes.) The size of the multiplier rises with consumption responsiveness to current income, i.e. the marginal propensity to consume. For that reason, a tax cut multiplier is generally assumed to be smaller than that for a spending multiplier (Hemming, Kell and Mahfouz 2002).

However, in reality, we do not expect fiscal multipliers to have their simple “Keynesian multiplier” effects. Fiscal multipliers are affected by what are referred to as “crowding out” and “crowding in” effects. The term “crowding out” refers to the displacement of private economic activity by public investment initiatives (Buiter 1977). The efficiency of fiscal and monetary policy can be measured by the degree of crowding out. The smaller the fiscal multiplier effect of these policies on the aggregate output, the greater is the degree of crowding out, and vice versa. Since Adam Smith’s systematisation of the existing knowledge of economic theory in 1776, these offsetting effects have been attractive to economists. For example, Smith (1776) mentions such effects as perversions of the productive resources of the economy. Keynes (1936)

refers to the adverse reactions to public investment, the congestion and the diversion of resources from the normal channels of economic activities. Meanwhile, the counteracting effects of public works were mentioned by (Kahn 1931).

The debates and relevant questions usually emphasise the strength and direction of crowding-out effects. In other words, as stressed by Buiter (1977), crowding out is essentially about the magnitudes and signs of fiscal multipliers. An expansion in government spending increases the utilisation of idle resources, as well as productive capital and real private expenditure. As a consequence, this leads to an accelerator known as “crowding in” (Friedman 1978). However, the size of crowding in/out relies on the ratio of induced reduction of private activity to the scale of the rise in government spending. If this ratio is equal to zero, there is no crowding out. If this ratio is greater than zero and less than one, the crowding out is said to be partial. Moreover, there is complete crowding out if this ratio is equal to one (Cebula 1987).

The analysis of crowding out is performed on two broad fronts: the financial and real dimensions of the economy. From a financial point of view, the focus is on the impacts of the financing form of government spending. Keynes (1936) and Kahn (1931) argued that the government’s bidding up for financial resources occurs through loan expansion, the banking system and a rise of interest-bearing debt. As a result, this may cause either increases in interest rates or inflation, or both, in turn affecting private expenditure.

In the real dimension approach, government and private agents are said to compete for the pool of limited resources of an economy. In addition, government consumption and investment may directly affect private consumption and investments. Considering these effects, economists have stressed the likelihood that government actions may, in the long-run, cause a reduction in the stock of the capital of the economy, damaging its prospects for growth. This particular focus on the crowding-out effect has been associated with the work of classical economists. Besides these broad views of crowding out, the discussion has also evolved from the slope of the aggregate supply function, to the slope of the Liquidity-Money (LM)-curve.

Direct crowding out happens when the government provides services and goods that substitute directly for those delivered by the private sector as a component of any

expansion in domestic demand in the economy. In the rest of this section, factors that affect the size of multiplier effects will be analysed. The simplest example of such crowding out is via the private investment channel – increased government spending absorbs private sector savings in the economy and raises real interest rates. The greater the sensitivity of investment to interest rates, the more likely the crowding-out effect is.

The literature has distinguished between the crude classical and Keynesian crowding out as a result of Adam Smith's notion of perversion of resources of the economy and the extension of Kahn (1931) in regard to the likely elasticity of the aggregate supply. A complete crowding out is represented by the crude classical case. This is because restrictions on the supply side of the economy, such as the full employment of factors and the rigidity of the supply-side schedule, have the implication that an expansion of the aggregate demand brought by an active fiscal policy is fully reflected in the aggregate price level. As a consequence, even though government actions may change the public and private shares of a given level of output, they cannot alter the level of output of the economy. Friedman (1978) asserts that the forced saving effect of inflationary pressure indicates that the government can only obtain more resources by depriving the private sector of their use. A vertical aggregate supply curve usually illustrates this type of crowding out.

Due to the rise in government expenditure, aggregate demand expands. The price level increases because real resources are bid up. In turn, this decreases the real balance of the economy and causes disequilibrium in the money market. The interest rates must rise to reduce the demand for money, since the output is fixed at its full employment level. Consequently, changes in government expenditure are compensated in full by offsetting changes in expenditure that is sensitive to interest rates ( $\Delta g = -I\Delta r$ ). This type of crowding out is associated with the work of Patinkin (1965), and a vertical LM schedule can illustrate, as presented in Figure 2.1 below.

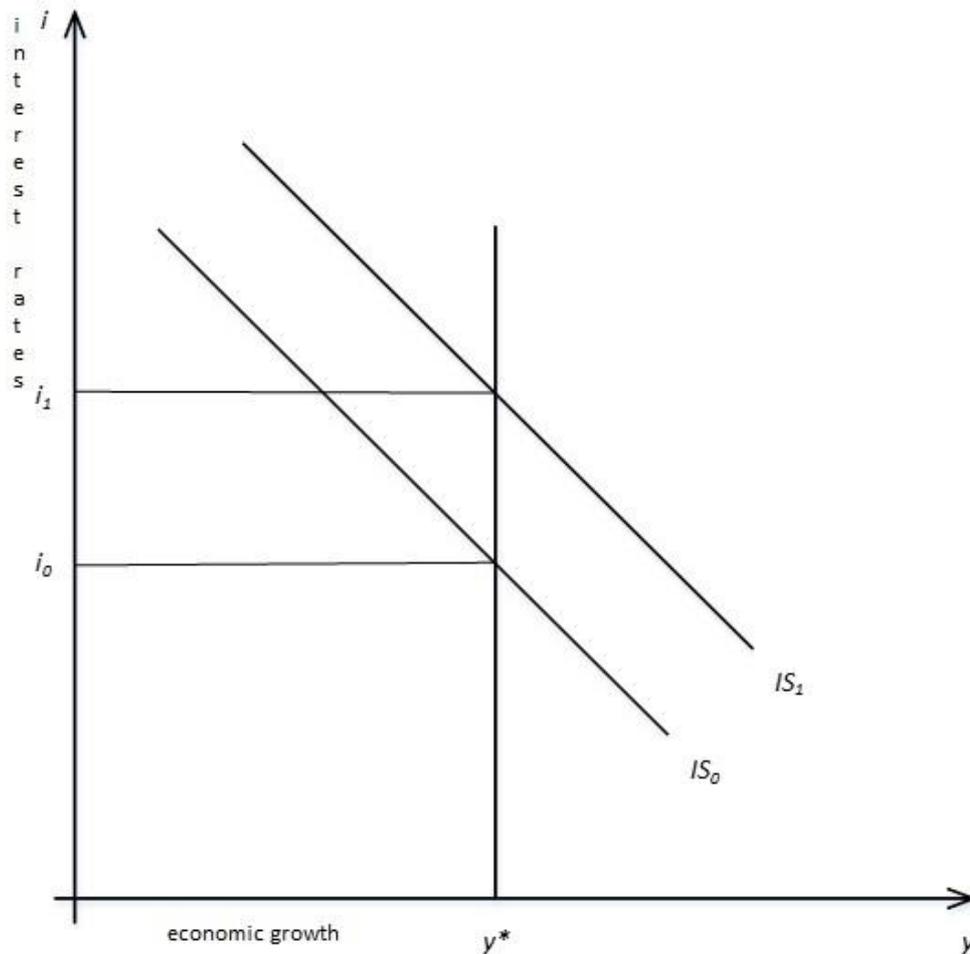


Figure 2.1 Crude Classical Crowding Out

Completely opposing results could be obtained if we assumed that the economy was in a liquidity trap, in which case the LM schedule in the figure above would be horizontal and there would be no crowding out, leading the multiplier to have its simple full Keynesian effect. However, these extreme cases are not attractive. One of the most widely discussed and tested type of crowding out is referred to in the literature as transaction, Keynesian, or Hicksian crowding out [Arestis and Skouras (1985), Buiter (1977), Cebula (1987), Friedman (1978), Kahn (1931), Keynes (1936), Meyer (1983)]. It is also the type of crowding out that the standard text book illustrates. This form of crowding out is associated with the less rigorous assumptions of an upward aggregate supply function and both investment and money demand functions that are responsive to interest rate changes. The figure below explains the mechanism of transaction crowding out.

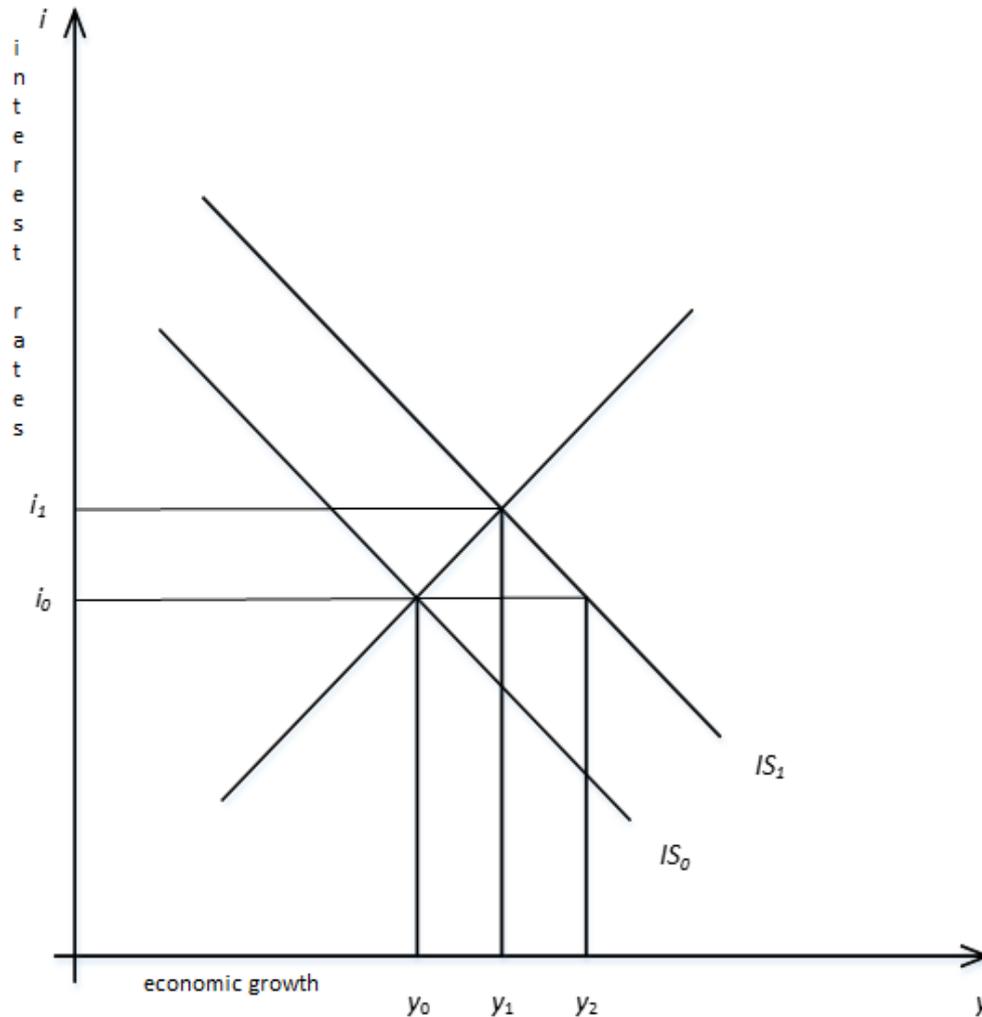


Figure 2.2 Transaction Crowding Out

Under the assumption that the economy has idle real resources and operates below its potential level of production, an initial rise in government expenditure increases the level of output. However, a higher level of real income indicates additional money demand, due to Keynes' transaction and precautionary motives, disturbing the equilibrium of the money market, in which the money supply is assumed to be exogenous. Hence, to free cash from speculative demand, the interest rate must increase. However, interest-sensitive private investments are depressed by this induced rise in the interest rate. Then, the reduction of investments offsets the initial increase in output induced by the government's action, because of their multiplier effect on income. The bottom line is that the size of the multipliers becomes an empirical question related to the relative slopes of the schedules in the figures above.

Nevertheless, even if there is crowding out through interest rates, quite large fiscal multipliers can be expected, particularly when investment is an increasing function of current economic activity. Then the fiscal policy can stimulate private sector investment spending and effectively lead to crowding in effects. An obvious example might be government spending on infrastructure projects that have the potential to stimulate the economy and crowd in private sector investment activity. Another key factor influencing the effectiveness of fiscal policy is, of course, the exchange rate regime and level of openness. Mundell (1960) demonstrates that crowding out via the exchange rate may occur in the open economy. The exchange rate appreciates because of capital inflows that are attracted by higher interest rates. Therefore, the external account deteriorates, offsetting the growth in domestic demand, which comes from a fiscal expansion. The more open the economy, the lower the multiplier. This is due to the fact that a portion of the growth of aggregate demand would be encountered by a net export decrease instead of domestic production increase. The choice of flexible or fixed exchange rate is, therefore, clearly vital in determining the size of fiscal multipliers in an open economy. The traditional argument is that fiscal policy is less effective under flexible exchange rates than under fixed exchange rates because the increase in the interest rates tends to appreciate the domestic currency, reducing net exports (as seen above). However, under fixed rates, to avoid this appreciation, the money supply is expanded by the monetary authority, which has the potential to stimulate the economy.

Price flexibility also affects the extent of crowding out. Usually, partial price flexibility is allowed in neo-Keynesian models (Mankiw 1985). In the case of a closed economy, higher prices that obstruct part of the growth of short-term aggregate demand are caused by a fiscal expansion. On the other hand, the size of crowding out relies on the domestic price responses to shifts in the exchange rate. In the case of a flexible exchange rate in an open economy, the multiplier will be less than one, with price rigidity when prices of domestic products move with the exchange rate, because an exchange rate appreciation makes prices lower. Meanwhile, with regard to price increases through a real increase in the exchange rate, under a fixed exchange rate prices will be deteriorated by the current account. Compared to price rigidity, there will be more crowding out (Taylor 1979).

Crowding out through effects of wealth on aggregate demand will be further influenced by prices, the exchange rate and changes in interest rates, especially when consumption relies on wealth. The nominal values of financial assets usually fall with an increase in interest rates. For the net creditors, crowding out will be reinforced by these wealth effects and will reduce the fiscal multiplier, while the effect of higher prices is more uncertain because there may be contrary impacts on real and nominal wealth.

Multipliers are also affected by the existence, or not, of Ricardian equivalence. Barro (1974) argued that government bonds should not be perceived as private wealth if the discounted value of the associated future stream of taxes is equal to the valuation of the stock of public bonds. As a result, an adjustment in the stock of public debt might not impact on the formation of capital. In other words, capital formation, interest rates and aggregate demand would not have been affected by fiscal effects involving changes in the relative amounts of tax or bond debt finance for a certain level of government spending. However, Barro's point of view depends on the rigid assumptions regarding capital markets and household behaviour, so that the wealth effects of public liabilities are still accepted by the mainstream of literature. While economists cannot provide affirmative evidence of its validity, they have been unable to dismiss it when empirical results favour the theory. Consumers will expect the issuance of government debt to finance a tax cut immediately. That debt will cause higher taxes to be forced on taxpayers or their families in the future. If we assume that taxpayers are Ricardian, in which case they totally understand the government's intertemporal budget constraints and they are forward-thinking, this can have significant impacts on both short- and long-term multipliers. Under such assumptions, permanent income is unaffected and, hence, consumption will not change if there are no liquidity constraints and perfect capital markets exist (Barro 1974). Hence, Ricardian equivalence exists between debt and taxes. A reduction in government saving because of a tax cut is totally offset by increased private saving; this is the implication of perfect Ricardian equivalence. In this situation, the fiscal multiplier is zero and there is no impact on aggregate demand.

Schimmelpfennig, Mahfouz and Hemming (2002) argue that the impacts of changes in lump-sum taxes for a given path of government expenditures are central in the

Ricardian equivalence literature. The way the supply-side impacts of the change affect permanent income also must be considered, with either proportional or progressive taxes. The mechanism of payment in the future will influence permanent income, if an expansionary fiscal policy takes the form of expanded government expenditure. Even though there is no impact on reductions in future expenditure for offsetting a temporary increase in government expenditure, a decrease in consumption and permanent income will occur as a result of a rise in government expenditure financed by higher future taxes. Possible negative fiscal multipliers will be generated, even though the exact magnitude of the resulting drop in economic activity relies on the government expenditure productivity.

Strong assumptions are very important as a basis for Ricardian equivalence. A more powerful connection between consumption and fiscal policy can only be established through a non-altruistic desire to be successful in regard to many of the existing fiscal burdens to generations in the future: imperfect capital markets, partial liquidity constraints, less than perfect foresight and short time horizons (Mankiw, Summers and Weiss 1984) and (Blanchard 1985). As a consequence, at least in its extreme form, Ricardian equivalence has a significant problem in practice.

However, it is also important to know in what circumstances a Ricardian response is more likely. For instance, people who do not have very long time horizons might change their saving behaviour to be ready for increasing taxes in the future, in case a government is constrained by a fiscal rule that expects a fiscal expansion must, at some point, be reversed. The same is true wherever it is perceived that the existing direction of government debt is unsustainable, so that future tax increases will be needed quickly in order to lessen the debt. Even within a Keynesian context, there might be an apparently Ricardian offset to a government's expansionary fiscal stance (Sutherland 1997). Nevertheless, if spending or debt goes over certain upper limit levels, fiscal policy can be apparently Keynesian in its impact, within a Ricardian context, if forward-looking individuals are afraid that private savings will be pre-empted or debt will be monetised by the authority (Bertola and Drazen 1993).

Ricardian behaviour generates smoothing of consumption to counterbalance the lifetime and intergenerational distribution suggested by a policy of public debt. Consumption smoothing is correspondingly produced by overlapping generations'

models. With no inheritance motive, this occurs throughout an individual's life. Nevertheless, the models of either overlapping generations or infinitely-lived families can be criticised because the more realistic case of partial consumption smoothing cannot be explained satisfactorily. Hence, a savers-spenders model was developed by Mankiw (2000), in which individuals do not have much net worth, inheritances become influential factors for the accumulation of wealth and consumption smoothing is less than perfect. There is a better model that admits the enormous heterogeneity in consumer behaviour. Either long or short-time perspectives are held by some people. The evidences for personal long-term perspectives are that wealth concentration is great and aggregate capital accumulations of bequests are important. By contrast, from a short-term perspective, people may fail to engage in consumption smoothing and close to zero net worth occurs.

A critical channel by which accumulation of debt might impact fiscal multipliers is the risk premium that applies to interest rate policy. Miller, Skidelsky, and Weller (1990) point out that a risk premium, which represents the increase in interest rates due to the rising risk of default or escalating risk of inflation, will strengthen crowding out effects. When governments pursue expansionary fiscal policy, public debt can accumulate and, to the extent that market participants view this debt as problematic, it can raise risk premiums in the economy. In an open economy with substantially mobile capital, fiscal expansions could increase fears of balance of payments problems in the future and this may cause a decline in capital outflows and foreign investment, with negative implications for output (Calvo 2014). It can be argued that credibility is crucial in this context. Interest rates will most likely incorporate a risk premium when agents have low levels of trust in the ability of government to reverse what they argue will be only temporary expenditure growth or tax cuts. Such perceptions may arise as a result of the way in which the government manages its fiscal policy, a lack of prudence and the expectation that the temporary fiscal expansion that have been announced will become permanent. Most likely, the strong reason why fiscal multipliers might become negative is a sizeable risk premium. The reason is that private expenditure responds positively to a credible commitment to debt reduction and a diminishing of risk premium. Giavazzi and Pagano (1990) and Alesina and Perotti (1997) explain this is as an example of expansionary fiscal contractions. Another example of credibility is the evidence from both Ireland, in 1987, and

Denmark, in 1983, where contractions of expansionary fiscal policy had existed and their sovereign debt rating deteriorated rapidly.

Another factor that affects the fiscal multipliers is uncertainty. Fiscal multipliers could decrease and possibly turn negative if an expansion of fiscal policy is related to increased uncertainty, evidenced by a protective attitude on the part of firms and households. Irreversible investments might be delayed by firms, and precautionary savings might be accumulated by households (Caballero and Pindyck 1996). The main concept is that investment or consumption depends on firms' or households' behaviours within the economic environment in general. Government policies can influence current confidence in this regard, such as having a negative effect on confidence due to anticipated future deficits.

Finally, institutional aspects of fiscal policy also need to be considered. One of the key drawbacks of fiscal policy is often believed to be the length of time it takes to be implemented. The argument being that, by the time a fiscal stimulus/contraction is actually put in place, the position of the economy can have changed and, thus, the fiscal policy runs the risk of exacerbating cyclical fluctuations. Inside lags are the result of the effectiveness of fiscal management and functions of the political process. They represent the duration required to identify that a fiscal policy should be modified and, after that, to set fiscal measures in place appropriately. Outside lags represent the duration required for measures of fiscal policy to actually impact on aggregate demand. The higher the dependence on discretionary measures, the inside lags are more likely to be longer. Automatic stabilisers that create countercyclical impulses to the economy, with no need for discretionary measures, have short inside lags.

The second aspect is considerations of political economy. There are several political factors for which persistent and high deficits might indicate a deficit bias exists (Alesina and Perotti 1995). Policy makers and voters may be subject to fiscal illusion. They are not totally concerned with the intertemporal budget constraints of government. As a result, deficits are favoured over surpluses, shifting the fiscal adjustment's burden onto generations in the future. Accumulation of debt might be used as a strategic tool to restrain the fiscal room for manoeuvre of governments in the future. Then, consolidations of fiscal policy might also be delayed conflicts of politics in regard to the distribution of adjustment costs among different groups,

causing permanent deficits. An example is the government of Australia at the present time. The fiscal spending on education implemented by an earlier government significantly impacted upon the current government's ability to manipulate its fiscal position. With the existence of a bias of deficit, the positive effect of a fiscal expansion has to be considered, in contradiction to the negative effect of permanently higher deficits that occur when the fiscal expansion is not totally reversed. Fiscal multipliers might not be effective multipliers if firms and households are completely biased. However, fiscal multipliers will reduce if financial markets, firms and households are partially forward-looking, because a fiscal expansion that is revealed to be not permanent might still cause a rise in private savings or risk premiums.

The final institutional aspect is the level of development (Agenor, McDermott and Prasad 2000). The size of fiscal multipliers will be affected by the institutional features specific to developing countries. For example, the availability and cost of external and domestic financing is often a primary constraint. The size of fiscal deficit is often determined by access to loan financing, which in highly indebted developing countries may be very limited. Meanwhile, the size of the multiplier may tend to increase in some developing countries because of their relatively high marginal propensities to consume. In addition, fiscal policy is more likely to be harder to implement in developing countries because of bad expenditure management and tax administration, problems of governance, the volatile basis of revenue due to heavy dependence on trade taxes, long lags impacting fiscal policy, and a greater deficit bias.

Concisely, there are many aspects that determine the size of multiplier effects on the demand side of fiscal policy. Certainty of policies, credibility of government, risk premiums, Ricardian equivalence, expectations, price rigidity, openness, exchange rate regimes, demand for money, and existence of private investment channels are the components that influence the level of fiscal policy multipliers.

#### **2.4.2 Empirical Studies on Fiscal Multipliers**

This section looks at a range of studies in the literature that have attempted to estimate the size of fiscal multipliers.

The fiscal multiplier of an economy can be described as the proportional adjustment in GDP following on from a 1% of GDP adjustment in government taxes or

government spending. Batini et al. (2014) summarise some main findings in the literature on the size of multipliers for advanced economies. Table 2.2 and Table 2.3 below show that these narrative studies do not support the traditional view that revenue multipliers are smaller than spending multipliers.

Table 2.2 Narrative Approach: First Year Tax Multipliers

<b>Author</b>	<b>Country</b>	<b>Tax Multipliers</b>	<b>Comments</b>
Guajardo, Leigh and Pescatori (2014)	OECD countries (panel)	1	Multiplier is around 3 after 3 years.
Hayo and Uhl (2014)	Germany	1	After 8 quarters, the highest multiplier is around 2.4.
Cloyne (2013)	United Kingdom	0.6	After 10 quarters, the highest multiplier is around 2.5.
Mertens and Ravn (2013)	United States	1	After 8 quarters, the highest multiplier is about 2.
Favero and Giavazzi (2012)	United States	0.7	After 9 quarters, the highest multiplier is just under 1.
Romer and Romer (2010)	United States	1.2	After 10 quarters, the highest multiplier is about 3.

Batini et al. (2014) also investigated the narrative approach of first-year spending multipliers, as shown below.

Table 2.3 First-Year Spending Multipliers by Narrative Approach

<b>Author</b>	<b>Spending Multipliers</b>	<b>Comments</b>
Guajardo, Leigh and Pescatori (2014)	0.3	Multiplier is around 1 for overall spending shock.
Owyang, Ramey and Zubairy (2013)	Canada: 0.4 - 1.6 United States: 0.8	In Canada, range of multipliers implies low multiplier (low unemployment), high multiplier (high unemployment). In the United States, multipliers do not differ substantially among regimes; two-year multipliers. From US defence spending news for Canada (1921-2011) and the United States (1890-2010).

Cont.

<b>Author</b>	<b>Spending Multipliers</b>	<b>Comments</b>
Barro and Redlick (2011)	0.4 - 0.6	End of range for permanent changes is higher; multiplier for temporary spending changes is lower. From US defence spending news: 1972-2006.
Ramey (2011)	1.1 - 1.2	In response to military events, changes in the expected present value of government spending; multipliers reach a peak after 6 quarters. From US defence spending news: 1939-2008.
Hall (2009)	0.6	From US defence spending news: 1930-2008.

Source: Batini et al. (2014)

It can be seen from the two tables above that both spending and tax multipliers have approximately similar sizes. Those findings are different from the literature using other methods, such as Dynamic Stochastic General Equilibrium (DSGE) or linear VAR models, which have usually supported the basic Keynesian point of view in which revenue multipliers have a tendency to be smaller than expenditure multipliers. The argument is that, because tax cuts are weaker than increasing expenditure to stimulate the economy, a significant proportion of the additional income after tax might be saved by households.

There are many factors affecting the value of the fiscal multipliers found in empirical studies: for instance, the underlying economic structure assumed in the modelling process, the choice of econometric model, the composition or level of revenue and expenditure adjustments of the fiscal policy, the nature and the duration of the fiscal changes (either expansion or contraction), the propensity towards consumption and import within the economy, the level of public debt, any confidence effects, and other monetary and financial backgrounds, including exchange rates. In other words, there is no valid standard value for the fiscal multiplier for any model, any period or any economy.

A continuing discussion over the magnitude of a fiscal multiplier reflects the current interest in how the economy is affected by fiscal policy. The multiplier cannot be observed but can be estimated. The fiscal multiplier's estimators will vary according to their definitions; these values may be more than one or less than zero. In order to

determine the economic impacts of fiscal policy changes, it is not enough to observe the outcomes of an economy. This is because an understanding of the economic path is required to isolate the impacts if there is no change in policy (Van Brusselen 2009).

Economists' usage of numerous varieties of models cannot clarify the differences among estimates of the fiscal multiplier, and a variety of multipliers can be estimated within each type of model. For instance, estimates for the USA on a cumulative basis after eight quarters range from 0.3 to 3.5 in time-series models, 0.5 to 2.25 in DSGE models, and 0.75 to 2.25 in macroeconomic forecasting models (Reichling and Whalen 2012). The ways in which fiscal policy could influence the confidence of the people in future output, the economic background, fiscal policy implementation details and analytical measurement problems must be taken into consideration to gain a better understanding of the variety of multiplier estimates found in the literature (Whalen and Reichling 2015).

The estimates can vary with the technique employed to address the problem of identification and with the method used to determine a given variable. Riera-Crichton, Vegh, and Vuletin (2015) highlight the significance of such methodological options. They found a tax multiplier of 1.32 after the third quarter, using the SVAR methodology, and a multiplier of 2.76 using the narrative method, which includes anticipation of policy, meaning that fiscal shocks are often anticipated that might impact the validity of SVAR impulse-response analysis. They, correspondingly, investigated tax increases in 14 developed countries. Different estimates also arose when using different techniques. Krugman (2015) believes that the multiplier is not much bigger than "1", partly, not only because of the econometrics, but also because taxes and transfers act as automatic stabilisers. It can be said that the number of variants in multiplier estimates is due to variations in underlying behavioural assumptions, methodological choices and data sets.

However, studies can also vary in regard to the time over which the multiplier is measured. Auerbach, Gale and Harris (2010) argue that, even though it is crucial to measure the cumulative impact due to the effects of a multiplier on economic activity, which could reverse direction over time, efforts to compare numerous estimates are often complicated because researchers occasionally cannot specify the precise multiplier concept used. Sometimes, multipliers are peak multipliers that correspond

to the highest impact on output growth in any quarter next to a policy alteration. On the other hand, others are instantaneous multipliers that look at the impact directly after a policy change and others are impact multipliers that allow a lagged response. Meanwhile, others are cumulative multipliers that correspond to the cumulative impact on economic activity of a policy change over a certain period.

Leeper, Richter, and Walker (2012) believe that fiscal foresight, which is how businesses and households behave in anticipation of government expenditure and tax changes, can impact significantly upon the multiplier estimates. However, it is difficult to measure foresight. Time elapses between the recognition point of the need for policy action and the time at which the spending or tax program takes place. Sometimes it requires a period of four or more quarters, but there is no certainty. Foresight intensity is not unambiguously measured, meaning that news might impact upon the predictions of standard theories in relation to time-series data. The confidence of people about pending changes could be another variable dimension. Also, the ways in which the public acts in anticipation of a fiscal policy change can rely on economic conditions and details of the policy (Whalen and Reichling 2015).

The literature generally supports the notion that tax multipliers are smaller than spending multipliers (Chahrour et al. 2012). For example, aggregate demand increases by a dollar as an immediate consequence of an increase by a dollar in government spending. However, aggregate demand might increase less than a dollar because of a dollar cut in taxes because households tend to save a considerable amount of their extra after-tax income. As a result, the ability of revenues to stimulate the economy is less than that of spending (Van Brusselen 2009) and (Whalen and Reichling 2015).

Theoretically and empirically, multiplier distinctions also exist between public consumption and public investment. Auerbach and Gorodnichenko (2012) suggest that multipliers for public consumption are smaller than multipliers for infrastructure expenditure and other categories of government investment in the USA. Gonzalez-Garcia, Lemus, and Mrkaic (2013) and Tuladhar and Bruckner (2010) found similar results for government investment outside of the USA. Nevertheless, previous research by Perotti (2004) claimed that there is no evidence of higher multipliers for government investment relative to government consumption in five nations, including the USA.

Zandi (2011) points out that those multipliers can differ among different fiscal policy provisions due to different reactions. For instance, tax cuts are expected to increase trading more for lower-income individuals than for higher-income individuals. The reason is due to higher-income households usually consuming a lower fraction of their income.

The multiplier size can also be affected by the timing and duration of fiscal policy actions. For example, multipliers are higher if the whole of the government expenditure in a stimulus of fiscal spending is scheduled to correspond with a zero-bound constraint on interest rates [(Christiano, Eichenbaum, and Rebelo 2011) and (Cogan et al. 2010)]. Regarding the duration, the stimulus of fiscal spending has a higher impact if it is of reasonable persistence, having the duration of two or three years. A change of policy of short duration increases consumer expenditure more than a one-time action. Some expansionary impacts of an even more permanent policy initiative can be offset by increasing taxes in the future, as suggested by Coenen et al. (2012).

The expectations of people regarding the path of government expenditure and revenue in the future also influence the multiplier of fiscal spending. In the case of a stimulus fiscal package, the way people predict that the fiscal stimulus will be funded in the future (either through taxes, transfers, government expenditure or a specific combination of these options), details of an important set of fiscal policies, several postulations about such aspects, and the speed of policy correction will all affect the multiplier estimates (Leeper, Plante, and Traum 2010). According to Capet (2004), the effectiveness of fiscal policy is often examined within the context of discretionary fiscal policy, and the multiplier associated with the fiscal expansion is large and positive.

In the case of emerging or developing countries, Ilzetki, Mendoza, and Vegh (2013) believe that the size of fiscal multipliers depends on the characteristic of each country. For developing countries, the uncertainty is even greater due to the scarcity and dubious nature of data available, the history of spotted debt repayments and fiscal profligacy, financial fragility, exchange regime and openness.

They elaborate five findings. First of all, the degree of development is the most important factor influencing the size of the fiscal multiplier. There is a negative impact on the response of output to increase in government consumption. There is also a negative (and significantly different from zero) cumulative response of output. Fiscal policy in emerging economies die out after about six quarters and this difference is not only in its execution but also on its effect.

The second important factor is the degree of exchange rate flexibility. If the economies operate under fixed exchange rate regimes, the long-run multipliers are larger than one, while a negative multiplier on the long run and its impact occur if the economies operate flexible exchange regime. The response of central banks to fiscal shocks also becomes important in measuring the size of fiscal multipliers.

The third element is openness to trade. Economies that are relatively open have negative multipliers. On the other hand, relatively closed economies, either because of larger internal market or trade barriers, have positive long-run multipliers of around 1. The differences are significant statistically for the first five years. The multiplier is statistically different from zero in either the short or long run in countries with small percentage of trade to GDP. Meanwhile, Guy and Belgrave (2012) found that even though four Caribbean countries have similar level of openness the fiscal multipliers are relatively low because the economic structure and the debt burdens are different.

The next critical determinant is the level of outstanding debt. In examples where the outstanding debt of the central government is more than 60%, the fiscal multiplier is not statistically different from zero on impact and negative in the long run. It can be concluded that in the long run, if the level of outstanding debt is above 60% of GDP threshold, the fiscal stimulus will have a negative impact on output.

Finally, Ilzetzki, Mendoza, and Vegh (2013) found that the multiplier on government investment in developing economies is positive and larger than one in the long run. There is also indication that the proportion of expenditure might play a critical role in examining the impact of fiscal stimulus in emerging countries. The fiscal multiplier on government consumption is lower than that on government investment, even though the different is not statistically significant. Hayat and Qadeer (2016) who analyse the size and impact of fiscal multipliers in selected South Asian countries

(Bangladesh, India, Pakistan and Sri Lanka) also argue that government expenditure on public investment should be more emphasised by government due to the fact that government consumption has a lower multiplier than that of government investment expenditures on all time horizons.

Broadly speaking, the magnitude of fiscal multipliers depends on the following factors: monetary and financial setting, confidence level, public debt level, propensity to import and consume, duration of the fiscal adjustment, expenditure and revenue composition, econometric model and economic structure. Instead of being observed, the multipliers can only be estimated with widely varying models and techniques. The timing or duration, expectations and types of fiscal instrument used often influence the results. For developing countries, they have specific characteristic with the critical determinant consists of the degree of development, the degree of exchange rate flexibility, openness of trade, the outstanding of debt, and government investment over the government consumption.

## **2.5 Sustainable Public Debt Theory and Fiscal Stabilisation**

The sustainability of public debt is another important issues in any survey of fiscal policy stabilisation. The Keynesian approach that government must play an active role in stabilising market economies has largely dominated the politico-economic debate, especially during 1970's. Public expenditures that are being financed by public deficits can raise aggregate demand to achieve the goal. In the case of high unemployment and low aggregate demand, the government must be more active so that the full employment equilibrium can be restored which hopefully outstanding public debt can be reduced. According to this point of view, if the government runs into debt in the home country it does not pose a problem since no resources are lost. This view argues that public deficits just imply a reallocation of sources from taxpayers to bondholders.

Inter-generational redistribution is another reason to resort to debt-financing. The golden rule of public finance is that public investments which yield long-term benefits by public deficits in order to make future generations contribute to the financing should be financed by government. Future generation's contribution to the financing is justified because they will benefit from today's investment.

As a result of the predominant Keynesian view, in the fourth quarter of the last century, public debt increased considerably. The growth rate of public debt was even higher than that of the gross domestic product (GDP) so that the ratio of public debt to GDP grew too. The European Economic and Monetary Union have signed the Maastricht treaty stating that the public deficit and the public debt relative to GDP must not exceed 3% and 60% respectively. However, quite a many economies have difficulties with their debt service and some even had to be bailed out by European Stability Mechanism to avoid bankruptcy. The impact of this condition to the future generation is considered as unfair as they would have to bear all the costs but benefit only to a certain degree Hamilton and Flavin (1986).

The government must increase future primary surplus so that its intertemporal budget constraint is fulfilled when public debt rises in an economy. Unless it accepts the possibility of a default which is clearly not a good option as a government default is usually accompanied by social riots that can endanger the political system as a whole. Raising taxes, reducing public spending, or a rise in GDP that leads to more tax revenues or combination of all three measure can achieve higher primary surpluses. The money supply is raised and a higher inflation rate is accepted by central bank in order to decline the real value of public debt is another possibility. If the inflation rate exceeds the interest rate on public debt, the real interest rate becomes negative cause a decline in the public debt to GDP ratio.

Rao Aiyagari and Gertler (1985) indicate that in contrast to the budget constraint of private agent, the intertemporal budget constraint of the government must hold for some paths of the price level but not for all. The government pursues a Ricardian fiscal policy if the intertemporal budget constraint holds for any price path and not only for the equilibrium price path. Hence, the government would not commit itself in the future to completely match new public debt with future primary surpluses in a non-Ricardian regime. The reason is because some part of the additional debt is to be financed through money creation. The opposite holds true and future fiscal revenues are expected to be equal to current public debt. Woodford (1994), Sims (1994), and Leeper (1991) contribute to the fiscal theory of the price level. Nevertheless, McCallum (2003) and Buiters (2002) criticised the fiscal theory of the price level as it is controversial and further studies conducted by (McCallum and Nelson 2006).

Hamilton and Flavin (1986) become the first authors in modern research on debt policies sustainability that analysed the possibility of a bubble term in the series of public debt in USA by using statistical tests. Many papers then followed to investigate the sustainability of debt policies. The answers of the questions are very important not only for academic interest, but also for policy makers. Therefore, corrective action should be undertaken if the conclusions of the tests suggest that sustainable governments cannot be guaranteed through the given debt policies.

Some studies such as Wilcox (1989) pointed out that interest rates play a significant role on sustainability. As we know that the present value of public debt asymptotically converges to zero is required by the intertemporal budget constraint of the government. Therefore, it is clear that the role of the interest rate is as a way out to discount the stream of public debt. Trehan and Walsh (1991) analyse the possibility of public deficits inclusive of interest payments grow at most lineary and are independent of the interest rate. Trehan and Walsh (1991) also proposed another analysis of a quasi-difference public debt,  $B_t - \vartheta B_{t-1}$  with  $0 \leq \vartheta < 1 + r$ , denoting by  $B$  public debt and  $r$  interest rates, whether it is stationary and also answer the question about the co-integration of public debt and primary surplus. Public debt is sustainable if government debt is quasi-difference stationary and primary surpluses and public debts are co-integrated. An alternative where the outcome is independent of the exact numerical value of the interest rate is presented by these two tests. Bohn (2008), Necker and Sturm (2008), and Afonso (2005) are the survey of analyses that tested on sustainability of debt policies.

One of the economic literatures that received a great attention is a proposal of Bohn (1995). He suggested to test whether the primary surplus relative to GDP is a positive function of the debt to GDP ratio. A given public debt policy is sustainable if that property holds. As it has a nice economic intuition, this test is very plausible. Corrective actions have to be taken in the future by increasing the primary surplus if governments run into debt today. Public debt will not be sustainable if otherwise. Fincke and Greiner (2011), Fincke and Greiner (2012), Greiner (2007), Ballabriga and Martinez-Mongay (2005), and Bohn (1998) for instance, tested the real world debt policies for that property.

The implication of a rise in primary surpluses as a response to higher government debt is that the series of public debt relative to GDP should become a mean-reverting process. The reason is that higher debt ratios lead to a rise in the primary surplus relative to GDP. This makes the debt ratio decrease and return to its mean. Nonetheless, the requirement of mean-reversion is only if the reaction coefficient, determining how strongly the primary surplus reacts as public debt rises is large sufficiently.

Therefore, the behaviour of the debt to GDP ratio when governments pursue sustainable debt policy is interested to discuss. For instance, the question about the compatibility of a sustainable debt policy with a rising debt to GDP ratio can be analysed. If the government does not react to rising debt ratios what is the impact to sustainability. This includes the existence of a critical debt ratio that makes a sustainable of debt policy is impossible.

## **2.6 Concluding Comments**

This chapter has reviewed some key ideas about the use of fiscal policy, along with a number of relevant empirical studies. While classical economists have argued for non-intervention by the government, preferring to allow the self-adjustment mechanism in the economy to keep it close to equilibrium, from the classical point of view, economic stabilisation is a natural process that does not require any action of government, because there is an “invisible hand” that leads the economy towards the most efficient outcome. Keynesian economists argue that governments must play active roles in stabilising their economies so governments need to use fiscal policy, especially in a recession. The effectiveness of fiscal policy in stabilising the economy can be seen from the results of the fiscal multiplier, as presented in the second part of this chapter. The higher the fiscal multiplier, the more effective is the fiscal policy. Even though Keynes believed that the fiscal multiplier was greater than one, the size of fiscal multiplier depends on many factors. Crowding out, debt sustainability issues and interest rates are likely to make the fiscal multiplier smaller, or even negative. The different characteristic between developed and developing economies might have different impact and size of multipliers. While Keynesians generally believe that government spending affects economic growth, Wagner’s Law argues that output

growth would be followed by relative growth in the government's expenditure within the economy. Hence, there are differing views of the causal link. Moreover, it can be concluded that the debt sustainability in analysing fiscal stabilisation is important. When government spending increases and it is financed by government deficits, it raises the possibility of growing problems of public debt. The increase in public debt might jeopardise the economy if the public debt is not sustainable. Therefore, there are some aspects, such as the ratio of public debt to GDP and the ratio of primary surplus to GDP, which should be taken into consideration when public debt increases, to ensure the existence of public debt sustainability.

# **CHAPTER 3**

## **OVERVIEW OF THE INDONESIAN ECONOMY**

### **3.1 Introduction**

This chapter provides a comprehensive overview of the Indonesia's economy. It is divided into four sections. In Section 3.2, a concise historical review of the evolution of the economy over the past few decades is offered, covering the country's governance framework, timeline milestones, economic activity, external sector influences and monetary policy. Because fiscal activities are especially important to this dissertation, they are covered in more depth in Section 3.3, including the institutional framework, the role of state-owned companies and the evolution of government expenditures and revenues. This chapter does not speculate on plausible short-run and long-run effects of fiscal policy on macroeconomic aggregates; those aspects are thoroughly investigated, using appropriate methodology, in other chapters. Section 3.4 addresses the question of public debt sustainability. More specifically, it assesses whether or not budget deficits have affected Indonesia's debt repayment. Section 3.5 concludes with final comments.

### **3.2 A Historical Overview of Indonesia's Economy**

After a multi-party democracy replaced military-led authoritarianism and the Indonesian economy was transformed from a state-led economy to a market based one, Indonesia faced a most economic challenging era. The government of Indonesia, after the fall of President Suharto in 1998, undertook significant institutional reform. Furthermore, economic decentralisation has been implemented since 2001. In the new Indonesia, there are significant challenges both in policy making and sustaining much-needed reforms. The process of making decision is significantly more complex nowadays compare to the previous regime under President Suharto. As a result, economic policies becomes entangled in a constant political bargaining process as there is no mutual relationship between a single-party majority and the government.

Moreover, local governments have more power due to decentralisation. Local governments have been allowed to manage their own economic strategies in achieving prosperity and better growth for their population since 2010. However, the technical capacity within local governments strive to identify the reforms and to understand the economic challenges are not sufficient. The good news is that there are also many achievements made in some reforms such as the monetary and financial sectors, fiscal reforms, trade, manufacturing, democracy and decentralisation (Nasution 2015).

The global economic crisis caused a significant economic collapse in Indonesia, which especially impacted on its export growth sector which declined dramatically. However, compared to other ASEAN countries, the effect of the crisis on the Indonesia economy is relatively limited. Indonesia's performance was relatively good because of two reasons: the appropriate fiscal and monetary policy of Indonesian government and relatively small export share to GDP (Basri and Rahardja 2010).

According to Ramayandi (2014), Indonesia needs to design economic policy that creates the right incentive structures for promoting sustainable and balanced growth. It is also important to avoid protectionist policies that might reduce Indonesia's international competitiveness. He argues that the country needs to investment, especially in infrastructure and governance, higher levels of productivity, research-development and better quality education.

Below are listed the most important defining events in Indonesia's recent economic history and selected macroeconomic aggregates for the Indonesian economy:

- 1966: Indonesia experiences hyperinflation.
- 1967: President Soeharto starts his mandate. He will remain in office until 1998.
- 1967: Indonesia, Malaysia, the Philippines, Singapore and Thailand form the Association of South Eastern Asian Nations (ASEAN). In the context of the Cold War, ASEAN countries provide mutual protection against the threats of communism and strengthen economic collaboration.
- 1974: Organisation of the Petroleum Exporting Countries (OPEC) announces an oil embargo on the US, Canada, Japan, Holland and the UK, and introduces quotas. A reduction in supply of 4.4 million barrels per day increases the international oil price to an unprecedented value (around 50 USD/barrel).

Indonesian oil reserves become very valuable and high oil export revenues follow.

- 1978-1980: The Iranian Revolution takes place in 1978 and Iraq declares war upon Iran in 1980. Supply disruptions push the oil price to nearly 110 USD/barrel, and Indonesian oil revenues substantially increase again.
- 1985: A period of low international oil prices (at around 30-40 USD/barrel) commences. It will continue until 2001, depressing Indonesia's oil export revenues.
- 1992: ASEAN formally agrees to a free trade area for countries within its block and establishes a plan to phase out tariffs. It also sets ambitious economic integration goals for the future, including a common market for skilled labour, free movement of capital and a possible common currency. In the latter part of this decade, Brunei, Cambodia, Laos, Myanmar (Burma) and Vietnam join ASEAN.
- 1997: ASEAN pursues further trade liberalisation and economic integration with China, Japan and South Korea under the ASEAN Plus Three framework.
- 1997: The Asian Financial Crisis commences. The Thai baht comes under intense speculation and Thai authorities are forced to devalue it. Other currencies in South East Asia, including Indonesia's, come under pressure as well. To avoid depletion of international reserves and to maintain bilateral exchange rates within ASEAN fixed currencies, Indonesian authorities have to devalue the rupiah and let it float. (Prior to that, Indonesia had been using a nearly fixed exchange rate arrangement.)
- 1998: The effects of the crisis are felt. There is a capital flow reversal, lack of investment, lack of consumers' confidence and the financial system collapses. Firms that had borrowed in US dollars find themselves unable to repay their loans. Real GDP declines by 13.13% in 1998<sup>3</sup>. It is the worst economic recession in Indonesia's modern history.
- 1998: President Habibie remains in office for only one year.
- 1998-2003: The International Monetary Fund (IMF) negotiates a USD43 billion rescue package with Indonesian authorities. This provides liquidity but it demands reforms in the financial sector and fiscal discipline.

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<sup>3</sup> <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=ID>

- 1999: President Sukarnoputri assumes office.
- 1999: A new law granting further independence to Indonesia's central bank is enacted.
- 1999: Law 25/1999 redefines fiscal relationships between different levels of government, formalising established practices while also allowing for increased decentralisation.
- 2003: Act No. 17/2003 is enacted to establish limits upon fiscal policy and to secure long-run fiscal discipline. Under the new law, fiscal deficits cannot exceed 3% of GDP and public debt cannot exceed 60% of GDP.
- 2004: President Yudhoyono comes to power.
- 2004: The independence of Indonesia's central bank is reaffirmed by strengthening the law and clarifying the central bank's goals and responsibilities in relation to financial regulation.
- 2004: Law No. 40/2004 redefines social expenditure priorities.
- 2004: For the first time in its history, Indonesia becomes a net oil importer.
- 2007: ASEAN develops a new platform for further trade liberalisation under the ASEAN Plus Six framework (which adds Australia, New Zealand and India to the ASEAN Plus Three countries).
- 2008-2009: Oil prices hit a historical high, followed by a trough, and remain high until 2015.
- 2014: The current president, Widodo, begins his mandate.

Table 3.1 Selected Macroeconomic Aggregates for the Indonesian Economy

Period	1971	1976	1981	1986	1991	1996	2001	2006	2011
	- 1975	- 1980	- 1985	- 1990	- 1995	- 2000	- 2005	- 2010	- 2015
Real GDP Annual Growth Rate	7.2	7.9	5.7	7.2	7.9	1.0	4.7	5.7	4.6
Population Annual Growth Rate	2.6	2.4	2.2	2.0	1.6	1.4	1.3	1.3	1.3
Real GDP -Average Level (Trillion)	n/a	1418	1663	2298	3384	4078	4631	6122	8143
Private Consumption (% GDP)	n/a	n/a	49	48.2	47.5	56	61.8	57.8	56.6
Gross Capital Formation (% GDP)	20.8	24.1	28.1	30.4	30.9	22.6	23.7	28.4	34.2
Government Consumption (% GDP)	8.5	10	10.9	9.3	8.4	6.6	7.7	8.8	9.4

Period	1971 - 1975	1976 - 1980	1981 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 - 2015
Investment (% GDP)*	n/a	31.9	37.3	40.52	35.64	24.36	26.71	30.95	34.2
Budget Balance (% GDP)	n/a	-0.63	-0.19	-1.50	0.74	-0.04	-1.16	-1.0	-1.91
General Government Debt (% GDP)	n/a	14.3	21.9	40.5	30.1	44.7	50	26.6	25.6
Standard & Poor's Credit Rating(+)	n/a	n/a	n/a	n/a	BBB	BB+	B+	BB	BB+
Moody's Credit Rating(+)	n/a	n/a	n/a	n/a	Baa3	B3	B2	Ba2	Baa3
Unemployment Rate	n/a	2.36	2.08	2.42	3.59	5.02	8.69	8.24	6.19
CPI Inflation	20.3	14.7	9.75	7.48	8.92	19.4	9.33	7.85	4.49
Short-run Interest Rate	n/a	n/a	23.3	25.4	25.1	23.7	12.2	9.15	32.5
Long-run Interest Rate	14.4	7.8	9.2	17.2	17.3	20.4	11.2	8.84	6.97
M1/GDP	n/a	0.072	0.079	0.080	0.086	0.089	0.090	0.083	0.083
M2/GDP	n/a	0.13	0.16	0.26	0.37	0.48	0.43	0.36	0.37
Central Bank's Reserves (USD)	n/a	n/a	5,317	6,709	12,397	23,344	33,471	62,697	108,019
Market Exchange Rate (rupiahs/USD)	410.4	505	867.8	1,645	2,095	6,308	9,358	9,496	10,775
Exports (%GDP)	21.47	27.41	25.69	23.36	26.65	36.63	33.70	27.75	23.91
Imports (% GDP)	18.46	20.64	23.69	21.82	25.17	31.14	27.55	24.70	24.52
Trade Balance (% GDP)	3.01	6.77	2.0	1.54	1.48	5.49	6.15	3.05	-0.61
Balance of Payments (% GDP)	n/a	10.01	3.94	4.39	3.58	9.74	9.29	5.58	1.55
Net Capital Inflows (% GDP)	n/a	n/a	0.26	0.62	1.41	0.11	0.32	1.54	2.38
Net Capital Outflows (% GDP)	n/a	0.01	n/a	n/a	0.29	0.17	1.2	0.79	0.99

Source: Thompson Reuters Data Stream Oxford and Bank of Indonesia.

Those related historical overview and issues will be elaborated in the next sections.

### 3.2.1 Governance and Political System

Indonesia is a constitutional democracy. The Constitution of Indonesia was established in 1945, following the end of the Japanese invasion that had supplanted its Dutch colony status. Amendments to the Constitution were made in 1999, 2000, 2001 and 2002. The most significant change affected presidential re-eligibility. At present,

a president is not allowed to serve for more than two consecutive periods. Prior to this change, long mandates were common, e.g. president Soekarno (1945-1967) and president Soeharto (1967-1998).

The Indonesian Constitution lays down five basic principles (*Pancasila*<sup>4</sup>) and establishes specific rules for governance. The government is divided according to three independent powers: executive, legislative and judicial. Both the president and the legislators are directly elected by Indonesian citizens. The mandates of presidents and members of parliament overlap, and there is no guarantee that the president's party will hold majority in parliament.

The Indonesian legislative body is formed by The People's Representative Council [Dewan Perwakilan Rakyat (DPR)] and the Regional Representative Council [Dewan Perwakilan Daerah (DPD)]. Only the DPR has the power to make a law. The DPD has responsibility for regional government and can only give advice on national bills to the DPR. At present, there are 560 DPR members (3 to 8 per district) and 136 DPD members (4 per province). It is a duty of the DPR to pass a central government budget bill each year.

Unlike many bipartisan Western countries, Indonesia has a variety of political parties, and the president often needs to negotiate bill proposals to obtain majority support in the parliament. The presidents that have served since 1945 have belonged to the following four parties: the National Awakening Party [Partai Kebangkitan Bangsa (PKB)], the Democratic Party [Partai Demokrat (PD)], the Party of the Service Society [Golongan Karya (Golkar)], and the Indonesian Democratic Party of Struggle [Partai Demokrasi Indonesia Perjuangan (PDIP)]. The PKB is a nationalist-religious, rural-based party; it promotes moderation and social inclusiveness in a greater civil society. The PD is also nationalist-religious, but more conservative, with more emphasis on economic liberalisation, political and cultural pluralism, and an internationalist outlook. Golkar is to the right of center and moderately supports neoliberal economic theories with an emphasis on quality economic growth. The PDIP adheres to nationalism, collectivism and anti-capitalism, and promotes democratic rights. The list of Indonesia's presidents from 1945 to the present is as follows: Sukarno (1945-1967,

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<sup>4</sup> The five philosophical principles of the Pancasila are: (i) Belief in God, (ii) Just and civilised humanity, (iii) Unity of Indonesia, accepting the diversity of its peoples, (iv) Sovereignty of its people, and (v) social justice.

non-partisan), Soeharto (1967-1998, Golkar with military support), Habibie (1998-1999, Golkar), Wahid (1999-2001, PKB), Sukarnoputri (2001-2004, PDIP), Yudhoyono (2004-2014, PD) and Widodo (2014-present, PDIP).

### **3.2.2 Economic Activity**

Real output growth in Indonesia has been generally very strong. Its growth averaged 7.6% in 1970-1980, 6.9% in 1980-1995, and about 5% in 2001-2015, as shown in Table 3.1. The greatest decline in real output was observed in the aftermath of the Asian Financial Crisis (-13.13% in 1998). Despite the crisis, there has been substantial economic development in Indonesia since then, and policies have promoted equity and reduced poverty levels. Output growth has been accomplished via exports, increased capital flows, liberalisation of some sectors of the economy, and strong government support in the form of infrastructure developments and household equity.

Between 1968 and 2015, the economy has shifted its activity in rural areas to services and, in urban areas, to the production of manufactured goods. According to official data, in 2013 the sectoral composition of Indonesian GDP was as follows: manufacturing industry, 26%; trade hotel and restaurants, 18%; agriculture, livestock and fishery, 12%; finance, real estate and business services, 10%; transport and communication, 10%; other services, 9%; mining and quarrying, 7%; construction, 7%; and electricity, gas and water supply, 1%.

Private consumption has grown as a percentage of GDP up to the low 2000s, and has remained stable at around 55% thereafter (see Table 3.1). This has generally contributed to economic growth by lessening the need to apply expansionary monetary and fiscal policies. The Asian crisis has been the exception, but consumers responded well in the aftermath, facilitating a quick recovery. The growth in consumption has been driven by welfare policies that have redistributed income towards the less-favoured sectors of the economy. The headcount below the poverty line drastically decreased from about 48 million in 1998, to 33 million in 1999 and 28 million in 2015. As households with relatively low incomes have a higher propensity to consume than high earners, equity policies have resulted in increased consumption as a percentage of GDP. In terms of composition of consumption, the most remarkable trend has been

increased expenditure on services and manufactured goods and a decreased share of agricultural goods, which is in line with domestic product growth and trade patterns.

Private investment grew strongly up to 1997, and has since been more erratic due to the volatility of foreign investment. It declined sharply in 1997-1998, followed by an upwards trend in 1999-2001, and has been falling since 2012. According to balance-of-payment statistics, the sectors that have been most favoured by foreign investment during the 1999-2011 recovery period were manufacturing (USD3,096m), financial and insurance services (USD1,318m), electricity, gas and water (USD1,497m), and real estate (USD1,002m). Therefore, overall, the post-1997 recovery period replaced lost capital in some sectors, with capital formation in other sectors, causing a transformation of the structure of Indonesia's economy. As the economy became more contemporary and better aligned with the relative prices of traded commodities, the recovery accelerated. This phenomenon also has been observed in economies that have been subject to severe exchange-rate realignment, both in South East Asia and South America.

Despite the high output growth rates, the level of unemployment has remained relatively high. The rapid changes occurring in the 1990s have provoked profound mismatches between supply and demand in some labour markets, causing long-term structural unemployment. Urban unemployment (7.3% in 2015) is higher than rural unemployment (4.9% in 2015), and youth unemployment is remarkably high; it was 19.3% for males and 21.0% for females aged 15-24 in 2015. Generally speaking, it could be said that income growth has led to an increased participation in tertiary education that has provided skills different to those that are in demand. On the other hand, it is easier to find work in rural areas where informal jobs can be offered to less skilled workers; although this type of unemployment is lower, working conditions in the informal sector are generally poor. Between 55% and 65% of workers in Indonesia can be classified as informal employees, and 80% of this occurs in rural areas.

### **3.2.3 The External Sector**

Generally speaking, Indonesia's external sector accounts have followed developments in trade liberalisation, exchange rates and policies that have attracted foreign investment. This evolution contrasts with what some other developing Asian

economies have been doing, i.e. supporting exports with artificially weakened exchange rates. From 1998, the exchange rate in Indonesia has risen strongly with little intervention, and wealth generated through exports has been used to support higher standards of living through increased imports and high real income.

The openness of the Indonesian economy has been achieved through trade agreements, most of which have been led by ASEAN as a block. Indonesia, currently, has eight free trade agreements in effect: six regional and two bilateral. Specifically, these are: ASEAN and AFTA (regional); and ASEAN-Australia and New Zealand, ASEAN-China, ASEAN-India, ASEAN-Japan and ASEAN-Korea FTAs, Indonesia-Japan EPA and Indonesia-Pakistan FTA (bilateral). In addition, Indonesia signed the Preferential Tariff Arrangement with the Group of Eight Developing Countries and the Trade Preferential System of the Organisation of the Islamic Conference (not yet in effect). Currently, Indonesian authorities are discussing trade agreements with the European Union and Chile, and interesting prospects await for ASEAN. The agreements are too many to be covered in detail here, but it should be noted that ASEAN-led trade liberalisation has not generally been implemented in the form of a full elimination of trade barriers with immediate effect, but rather as a schedule for the smooth easing of tariffs. Considering the time-overlapping agreements above, the effects on Indonesia's trade balance have been smooth rather than abrupt.

In Indonesia, the exchange rate has been influenced by policy approaches. It was managed in the 1970s and 1980s, whereas, as trade increased, it became practically fixed during the 1990s in the lead up to the 1997 crisis. Then, it was devalued from being approximately fixed at 2,200 rupiah/USD, prior to the crisis, to around 10,400 rupiah/USD in 1998. Devaluing the rupiah was the only available option at the time. As other South East Asian countries that competed for the same export markets had devalued their currencies, Indonesian authorities were forced to do the same in order to maintain export shares in destination countries and the balance of trade. It was also necessary to avoid immediate depletion of international reserves. Although the nominal exchange rate shows an overall upwards trend in Table 3.1, the inflation rate in Indonesia has been generally higher than the change in international prices, so the nominal exchange rate trend is not indicative of the real exchange rate trend. The real effective exchange rate (REER), defined as 1997=100, remained in the 95-110 bracket

during 1990-1997, sharply decreased (depreciated) below 40 in late 1997, and strengthened from mid-1999, stabilising around 80-102 from 2005. During the 2008-9 global financial crisis it depreciated from 95 to 80, then quickly recovered to surpass 100 in 2010. The REER was about 95 in 2016.

Indonesia's trade balance was positive in 1970-2012, negative in 2012-2014, and approximately balanced recently. A major contributing factor for the deterioration in the balance of trade has been the oil trade. Indonesia is an oil-rich country and has been an oil exporter up to 2004 and Indonesia is still exporting oil even as of today. The oil sector is dominated by a state-owned company, and policies have not favoured new developments for oil. As a result of oil disinvestment, the rate of production has been outpaced by the rate of consumption, leading to a negative oil trade balance that has been widening since 2004. Interestingly, the exact opposite has happened within the gas sector, where investment has been favoured and demand growth has been moderate. Gas trade was practically non-existent up to the early 1990s but, from that point forward, net gas exports have been growing each year.

The poor performance of the oil-and-gas trade has been generally correlated with a low exchange rate and the elimination of trade barriers, and it has been increasingly overshadowed by the trading of services and manufactured goods. Current major export destinations for Indonesia include Japan (24%), China (22%) and the USA (7%), and the rest is diversified across a relatively large number of countries. It is worth noting that the current account result has been generally positive (except for 2013) thanks to net inflows of labour and transport payments.

As for the capital account, over the 1970-2015 period it has, on average, compensated for the current account to give a positive balance-of-payment result (see Table 3.1). However, data from the balance-of-payment accounts reveals that capital movements have been rather erratic. As a result, the balance-of-payment result has been volatile, reaching a low of minus USD9,835 million in Q4:1997 and a peak of USD5,753 million in Q1:2006. The major reversal of foreign direct investment and short-term investment occurred in 1997-8, and the overall trend in net private investment has been positive since 2000.

As for external indebtedness, there has been growth in private external debt resulting from the accumulation of positive net foreign private investment. Up until 1985, nearly all external debt was public, which is explained by the closed nature of the Indonesian economy. According to World Bank data, Indonesia's external debt as a percentage of Gross National Income (GNI) experienced an overall decline between 1970 and 1981, and was within the 25-51% margin of GNI. From 1981 to 1987 it increased from about 25% to 73% of GNI. It remained stable, to then peak at 168% of GNI in 1998. The next stage involved a smooth decline until it reached 25% of GNI in 2011. From 2011 to date, both private and public external debts have been growing as a percentage of GNI. In 2015, the level of external debt was 37% of GNI. Since 1987, the private component of external debt has been growing as a result of increased capital flows; official authorities in Indonesia have estimated that, in April 2016, roughly 52% of total external debt was private and 48% was public. Between 1970 and 2016, the only period in which private external debt did not grow as a percentage of GNI was 1998-2002.

A significant contribution to public external indebtedness was the USD43 billion rescue package provided by the IMF to stabilise Indonesia's external accounts. The use of IMF credit was practically negligible between 1970 and 1997 (between 0 and USD623 million). The Asian crisis rescue package given by the IMF annually injected USD8-11.150 billion during 1998-2003. Between 2006 and 2008, line credit accounted for less than USD400 million, and USD2.7-3.1 billion between 2009 and 2015.

### **3.2.4 Monetary Policy**

The Central Bank of Indonesia [Bank Indonesia (BI)] is responsible for managing monetary policy in Indonesia, and has incrementally gained its independence. Act No. 13/1968 stipulated that the board of governors had to be appointed by the president, upon approval of the parliament. A major change occurred in 1999 (under Act No. 23/1999), when the power to choose BI governors was transferred to the parliament and goals were more clearly defined. At present, the BI governance framework is laid out in Act No. 3/2004, which contains minor amendments to the 1999 Act and highlights that BI decisions are to be made free from any government or other party's influence. Article 7 states that "The goal of the Central Bank of Indonesia is to

maintain a stable value of the rupiah”, and that to achieve this goal the Bank “shall conduct monetary policy on (a) sustained, consistent, and transparent basis, taking into account the general economic policies of the government”.

It is important to understand that the mission of the Indonesian central bank is flexible. According to article 7 of Act No. 3/2004, its goal is to achieve stability of the rupiah. Its current interpretation is that this should be done through inflation targeting, but there are provisions allowing for exchange rate intervention in extreme situations, and for other possible objectives that align with Sharia Principles (which may relate to economic activity and financial regulation). The central bank’s official website states: “Rupiah stability is defined, among others, as stability of prices for goods and services reflected in inflation. To achieve this goal, Bank Indonesia decided in 2005 to adopt the inflation targeting framework, in which inflation is the primary monetary policy objective, while adhering to the free floating exchange rate system. Exchange rate stability plays a crucial role in achieving price and financial system stability. For this reason, Bank Indonesia also operates an exchange rate policy designed to minimise excessive rate volatility, rather than to peg the exchange rate to a particular level.” It also states: “Bank Indonesia may also apply monetary controls based on Sharia Principles.”<sup>5</sup>

Although the central bank has reserved the right to consider almost any type of monetary policy objective, in practice it is currently focusing on inflation targeting. It is worth remarking here that independent monetary policy targets that apply to inflation, exchange rate and unemployment are not simultaneously achievable. Essentially, central banks have one main policy instrument, i.e. open market operations by which the central bank buys or sells government securities in order to inject money into the economy or withdraw it. Other policy instruments, such as setting minimum requirements and regulating financial activities, can complement policy objectives but are not generally effective by themselves in achieving macroeconomic targets. To put it in a nutshell, with one main policy tool, only one macroeconomic policy objective is achievable at a time. This is because inflation, exchange rate and unemployment are not independent from one another, as macroeconomic models suggest. Central banks around the world have focused on

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<sup>5</sup> <http://www.bi.go.id/en/moneter/tujuan-kebijakan/Contents/Default.aspx>.

different policy objectives. For instance, the European Central Bank and the Reserve Bank of Australia have clearly defined their inflation targets, and let exchange rate and unemployment freely adjust. The current US Federal Reserve Bank objective is a hybrid: it minimises large deviations of inflation or unemployment (a mechanism known as the Taylor rule). Prior to 1997, many South East Asian central banks adopted fixed exchange rate objectives, which is still the most prevalent technique in many developing countries.

In Indonesia, the monetary policy objectives have changed over time. In the late 1960s and 1970s, the emphasis was on reducing inflation. This was because there was a period of hyperinflation in the 1960s. In 1966, the annual inflation rate was 1,195%. At that time, the central bank was not fully independent from the central government, and pressure on the government's budget deficit was often cleared by printing money. In the 1970s and 1980s, there was no hyperinflation. However, the average inflation rate continued to be high (Table 3.1). In the 1990s, Indonesian monetary authorities pursued exchange rate stability, up to 1997, imitating what other South Asian economies were doing at the time. In 1997-8, there was no clearly defined monetary policy objective in Indonesia but, in practice, authorities sought minimisation of output losses. To enhance that, monetary authorities introduced a sharp devaluation, letting the exchange rate float afterwards. Following this development, a currency board proposal was announced and that restored market confidence, leading to a temporary appreciation in the exchange rate. The proposal was rejected and then the currency depreciated to reach about 14,800 rupiah/USD in June 1998. Towards the end of 1998, and in 1999, with financial management under control and an IMF rescue package announced, financial chaos eased up and the exchange rate stabilised at around 8,000 rupiah/USD. Towards the end of 1999, Indonesian policy makers decided it was time to grant formal independence to the central bank within a framework that would avoid the mistakes of the past, namely, by maintaining a fixed exchange rate arrangement and monetisation of government budgets leading to high inflation. That led to the 2004 Act, which sets out the current monetary policy.

The inflation targets adopted since 2004 have been neither aggressive nor strict. The best way to explain it would be the following. The Indonesian central bank seeks to reduce inflation rates, but tries to achieve it smoothly over a long-run time horizon.

This approach leads to annual inflation reduction targets that are relaxed according to the evolution of economic activity. Therefore, while fiscal policy is the main instrument for achieving stabilisation of the business cycle, the inflation targets are decided by taking into account how to enhance fiscal policy with small adjustments. To put it in technical terms, if one was to empirically model the monetary policy rule for setting the cash rate in Indonesia, an adequate approach would involve two right-hand-side explanatory components. The first one would be a long-run downwards trend for inflation, and the second would explain reactions to deviations in the level of economic activity from acceptable levels (after fiscal policy has been factored in). Overall, the current monetary policy approach leads to a predictable long-run time horizon and some short-run uncertainty, and these translate into low long-run real interest rates and high short-run real interest rates (see Table 3.1). It is not within the scope of this thesis to model interest rates, and those will be considered as exogenous variables for empirical purposes.

### **3.3 Government Expenditure, Revenue, Deficit and Debt**

#### **3.3.1 Institutional Framework for Participation of the Public Sector**

There are four important regulatory items that delimit the decisions on public expenditure and revenue in Indonesia.

The first one comprises laws defining competencies, transfers and revenue sharing for different government levels. In Indonesia, government activities are conducted at central, provincial and district/municipal levels, and the laws have favoured decentralisation in recent years. The current attributes of the different government levels are set in Acts No. 22/1999, No. 25/1999 and No. 25/2000. The central government is responsible for the judicial system, religion affairs, national defence and security, fiscal and monetary affairs, and international diplomatic relationships. Local government responsibilities include public works, health, education, trade and industry, investment, environment, agriculture, cooperatives, and labour policies. Since Act No. 25/2000 lists in detail, and by sectors, the responsibilities of both central government and provincial governments, so it should be assumed that all other activities are within the province of district/municipal governments. Higher education is a central government responsibility and, to some extent, the provincial governments

have an influence on it. Elementary and secondary schools fall under district/municipal management. As for road management, there are national, provincial and district/municipal roads.

Three methods of intergovernmental transfers are stated in Act No. 25/1999: (i) revenue sharing, (ii) use of the general allocation fund [Dana Alokasi Umum (DAU)], and (iii) use of the specific allocation fund [Dana Alokasi Khusus (DAK)]. Revenue sharing is classified into natural resources revenue sharing (for oil, gas, mining, forestry and fishery) and tax revenue sharing (that applies to property taxes, land transfers and personal income taxes). The general allocation fund (DAU) is the most important form of transfer and is a general purpose grant that can be freely used by local authorities. About 10% of it is allocated to provincial governments, and the remaining 90% goes to district/municipal governments. The DAU allocation across territories is decided with a formula that takes into account each territory's needs (based on population, area, geographical location and poverty condition) and capacity (endowment of natural resources, human resources, income and industry). The DAK fund is relatively minor and is available for issues of national importance that are not covered under other schemes (mainly emergencies). In theory, local governments can borrow money but, in practice, local government debt is negligible. All intergovernmental transfers are captured in the consolidated budget bill that is passed each year.

Secondly, there is a law establishing limits to public deficits and public debt. Law No. 17/2003 established: (i) the limitation of a maximum deficit of 3% of Gross Domestic Product for the actual government budget balance; (ii) that gross government debt should not go over 60% of Gross Domestic Product; and (iii) set a recommendation for a surplus or balanced position for a medium-term budget.

Such fiscal rules are desirable to ensure that public finances are sustainable in the long-run. They were inspired both by the European Union Euro zone fiscal rules, which appear in the Maastricht Treaty provisions on the procedures to combat excessive deficit (Article 104.3), and by the Stability and Growth Pact (which is expressed in two regulations of the Ecofin Council and resolutions of the European Council).

However, fiscal rules could have potential drawbacks. Blondal, Hawkesworth, and Choi (2009) believe that fiscal rules entail a long-lasting restraint on fiscal policy by means of numerical limits. In recessions, they might lead to a pro-cyclical multiplier. In addition, the quality of fiscal policy may suffer as policy makers concentrate on aggregate numbers rather than budget composition. The rules may also distract from other priorities and could reduce transparency and encourage “creative accounting”.

A third type of budgetary restriction invokes the fourth amendment to Indonesia’s Constitution, which requires both central and regional governments to allocate at least 20% of their budgetary spending to education. This rule became effective in 2003 when the Law on National Education (No. 20/2003) was enacted. This law provides the right to basic education for all Indonesian citizens.

The fourth and final type of budgetary restriction can be associated with the National Social Security System (SJSN). This scheme is regulated by Acts No. 40/2004 and No. 24/2011. The system offers five national types of benefit: work accident compensation payments, elderly allowances, pensions, death benefits and a health programme for both formal and informal workers. To pay for them, contributions from workers, employers and government are placed in separate social insurance funds for each program, and this money cannot be used for any other purpose. Contributions are made either by formal workers and their employers, or by informal workers who are supported by a matching contribution from the government. Under the Indonesian retirement scheme, all current retirees receive a pension from the government that is paid for using contributions from current workers. (Indonesia does not use a pay-as-you-go system.)

### **3.3.2 State-Owned Companies and Privatisation Experiences**

For Indonesia as a whole, there has been general de-regulation and liberalisation of economic activity within the last few decades. The decreased participation rate of the Indonesian government since 1990 is reflected in the government-expenditure-to-GDP ratio of Table 3.1. However, the state still owns companies in key sectors of the economy, and that has implications for the government’s budget. In this section, some key sectors will be reviewed, including: banking, energy (oil, gas, coal), utilities (electricity, water, telecommunications), and airline transportation. In general, state-

owned companies are meant to finance themselves but, in times of financial struggle, government subsidisation often occurs. This is especially true for fuels and electricity. On the whole, this overview suggests that the outcomes of privatisation and competition policies have been mixed.

Deregulation of the banking sector commenced in the 1980s and it led to the 1992 Banking Law, which replaced old standards of the 1966 Act and is still in use. The Banking Law facilitated the increased participation of private banks in the industry by introducing a comprehensive framework for firms to operate within and to enter the market. The number of banks increased from 63 in 1988 to 160 in 1997, and the number of branches increased from 574 in 1988 to 4,267 in 1997. The Law regulates all aspects of Indonesian banking, including the classification and listing of permitted activities, licensing, ownership, supervision and management of the bank. Only two kinds of bank are permitted by the Law namely: general commercial banks and rural credit banks. The latter are confined to a more limited range of activities than the general commercial banks; they are restricted to receiving deposits and extending loans. In contrast, the general commercial banks are authorised to engage in securities transactions, custodial activities, the hiring of agents, trust services and credit cards issuance. Each bank is required to be organised in the form of a state-owned limited liability company, a privately owned limited liability company, a provincial government company or a cooperative. Naturally, all banks were severely affected by the 1997 Asian Financial Crisis and many had to shut down in its aftermath. Currently, the market is dominated by four state-owned banks, namely, Bank Mandiri, Bank Negara Indonesia (BNI), Bank Rakyat Indonesia (BRI), Bank Tabungan Negara (BTN), but a number of small private banks still participate in it. It is worth remarking that both BNI and BTN have been partially privatised and are traded in the Indonesian Stock Exchange, with the government still owning the majority of shares.

In the energy sector, private market participation has been encouraged. Act No. 8/1971 established Pertamina as the only state-owned corporation tasked with managing the whole oil and gas business in Indonesia. In an effort to introduce competition, Indonesian authorities passed the Oil and Gas Law (Act No. 22/2001), which stated that Pertamina had to be treated as any other oil/gas company. This reform introduced competition in the upstream segment, but was not so successful in the downstream

segment. As of 2014, upstream oil activities, including exploration, drilling and extraction, were dominated by Chevron (with a 29% share in domestic crude oil production), followed by Pertamina, which had a 17% share. In the gas upstream sector, Total and ConocoPhillips had a combined 50% share in domestic production, with a minor role for Pertamina Gas taking just a 13% share. In the downstream sector, Pertamina runs nearly all of Indonesia's nine refineries and distributes all subsidised fuels. Overall, the interactions of the upstream and downstream sectors in the oil industry led to a decline in the oil production rate, which, in combination with demand growth, led to Indonesia becoming a net importer in 2004 and having its OPEC membership cancelled in 2009. The natural gas sector has become more successful thanks to long-term policies for the development of pipelines and Liquefied Natural Gas (LNG) terminals that have facilitated exports and agreements with electricity generators owned by the state electricity company [Perusahaan Listrik Negara (PLN)]. Coal production is concentrated in the hands of a small group of companies. In 2011, the top six producers were PT Adaro Indonesia, PT Kaltim Prima Coal (KPC), PT Kideco Jaya Agung, PT Arutmin Indonesia and PT Berau Coal, and they had a combined market share of 75% of total coal production. Two thirds of this production originates in the East Kalimantan region.

The sale of electricity has always been practically monopolised by PLN or its predecessors, through various subsidiaries. It generates 85% of power and controls the distribution networks. The privatisation of PLN has been discussed on many occasions, but general public opposition to that has prevented it so far.

Supply of water in Jakarta was privatised in 1997, and 25-year contracts were given to the private multi-nationals Thames Water and PAM Lyonaise Jaya (Palyja). There was a market regulator in place between 2001 and 2004, and a later policy that put a freeze on water tariffs until 2009. As a result, firms exited the market and the state regained control of water supply. The privatisation of Jakarta's water supply was also ruled to be illegal by the Central Jakarta District Court in 2015.

Telecommunications have been deregulated, with relative success in mobile and internet services but less success in the line telephony market. In the 1970s and 1980s, state-owned Perumtel had a national monopoly. In 1991, Perumtel was renamed Telkom and it became a majority state-owned company. Telkom introduced the

subsidiary Telkomsel to operate within the mobile phone market. Telkomsel is currently the largest Indonesian mobile operator. Private operators of mobile and internet services and include XL Axiata, Indosat, 3 Indonesia and a number of other smaller operators. Despite the introduction of competition, regulation standards in Indonesia seem to be below those of comparable countries. *Learning Initiatives on Reforms for Network Economies Asia* - an ICT policy and regulation think tank - found that industry regulations in Indonesia were below average in a study that covered Indonesia, Sri Lanka, the Maldives, Pakistan, Thailand and the Philippines<sup>6</sup>.

In the air transportation sector, there has been increased competition from new private entrants. Traditionally, the sector was dominated by the state-owned flag-carrier Garuda, which was the only firm allowed to operate passenger jet aircrafts in Indonesia until the early 1990s. From this point forward, a new policy allowed for increased competition. Sempati - a small airline previously owned by the military - quickly established a high profile that was fuelled by private investment, and other small firms entered the market too. Sempati went bankrupt in 1998, but it did not take long to attract new private investment. In 1999, private low-cost airline Lion Air was set up, and in 2000 it started operating flights between Jakarta and Denpasar. It has since gained the greatest market share. Today, Lion Air has a domestic market share of 41%, followed by Garuda (21%), Sriwijaya Air (11%), Batavia Air (10%), Wings Air (4%), Merpati (4%, state-owned), Indonesia AirAsia (3%), Citilink (2%) and others (4%). Garuda started trading in the Indonesian Stock Exchange in February 2011, but the government still owns the majority of its shares.

Other government-owned corporations that still operate in Indonesia include: Angkasa Pura I and II (management of airports), PT Kereta Api Indonesia (national railway), Perum Perumnas (construction sector), Pelni (shipping), Pos Indonesia (postal services), TVRI (national television station), PT Dirgantara (aircraft manufacturing), PT Industri Kereta Api (train manufacturing), PT Barata and PT Boma Bisma Indra (general manufacturing), PT Krakatau Steel (steel production) and Antara (news agency).

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<sup>6</sup> [http://irneasia.net/wp-content/uploads/2009/07/TRE\\_Indonesia\\_2009Mar18.pdf](http://irneasia.net/wp-content/uploads/2009/07/TRE_Indonesia_2009Mar18.pdf).

### 3.3.3 Government Expenditures

Government expenditures in Indonesia can be divided into two primary classifications: central government expenditures and local transfer expenditures. Central government expenditures consist of personnel, goods and services, capital, interest payments, subsidies, grants, social and other expenditures. Local transfer expenditures comprise of revenue sharing funds, the general allocation fund (DAU), the specific allocation fund (DAK) and the special autonomy fund.

Figure 3.1 shows government expenditure as a proportion of GDP in Indonesia from 1990 to 2015. Overall, government expenditure in Indonesia increased from 39,754 billion rupiah in 1990 to 1,806,515 billion rupiah in 2015. The most obvious observation is that interest repayments increased in the aftermath of the Asian Financial Crisis, which is logical considering that government borrowing increased substantially in 1997-9. It can be seen that the share of expenditure on personnel remained stable after 2000, while capital expenditure increased significantly. It is in line with the zero growth policy for civil servants that was introduced in 1995, and the government's commitment to improving the nation's infrastructure in order to offer a more attractive investment opportunity for businesses. It also reflects the push to apply the constitutional amendment dictating that 20% of the budget must be allocated to the education system, a rule laid down in the Law on National Education (No. 20/2003) and strictly applied.

Subsidies seem to be applying fiscal pressure due to their high proportion. However, the subsidies decrease from about 15% of GDP in 1999 to 8% of GDP in 2015. This might be due to the decision of President Joko Widodo to abolish the fuel subsidy on January 1st, 2015, as a signal to international investors and the money markets that the Indonesian government embraced pro-market reforms. Another most significant expenditure is the transfers to local government, especially the general allocation fund, as a consequence of the fiscal decentralisation policy enacted by Law 32/2004 on Regional Government, and the block grants to villages that align with Government Regulation 72/2005 on Villages, and the Home Ministry 2005 on Village Allocation Funds.

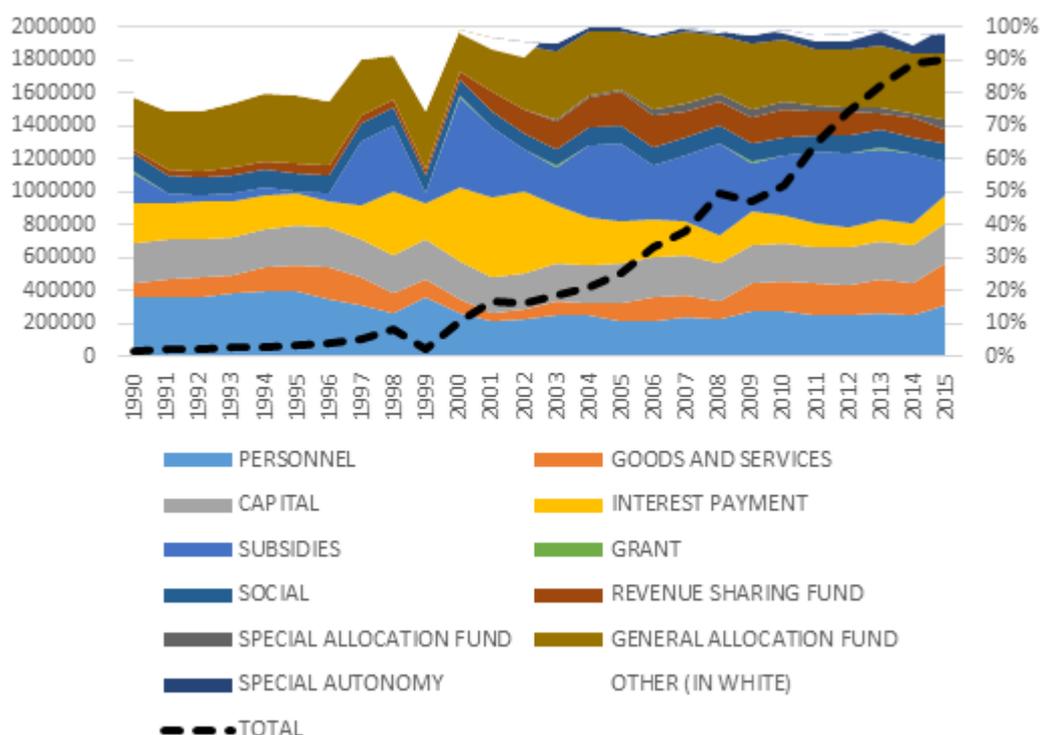


Figure 3.1 Government Expenditures in Indonesia 1990-2015

Indonesia's government expenditure in million rupiah (left axis) and proportion (right axis) from 1990 to 2015. Source: Ministry of Finance of Indonesia sourced from Thomson Reuters DataStream.

### 3.3.4 Government Revenues

Government revenues in Indonesia can be divided into three main categories: tax revenues, non-tax revenues and grants. Tax revenues consist of domestic taxes (income tax, value added tax, luxury-goods sales tax, land and property tax, duties on land and building transfers, excise duties and other taxes) and international trade taxes (import duties and export taxes). Non-tax revenues are comprised of natural resources revenues (both oil and gas and non-oil and gas), profit transfers from state-owned enterprises, and other non-tax revenues.

Figure 3.2 shows the evolution of government revenue. Overall, it shows a smooth increase in tax revenues relative to non-tax revenues. The increase in Other Expenditures in Figure 3.2 occurring in 1998-2000 is linked to external borrowing during the Asian Financial Crisis. Tax revenue as a proportion of GDP decreased slightly from around 10% in 1991 to about 2% in 1999. After that, tax revenue increased significantly and reached a peak of 11% of GDP in 2008, before going down to 9% in 2009 and stabilising at 10% in 2015. On the other hand, non-tax revenues

have fluctuated but, overall, decreased steadily from just above 16% in 1990 to about 13% in 2015.

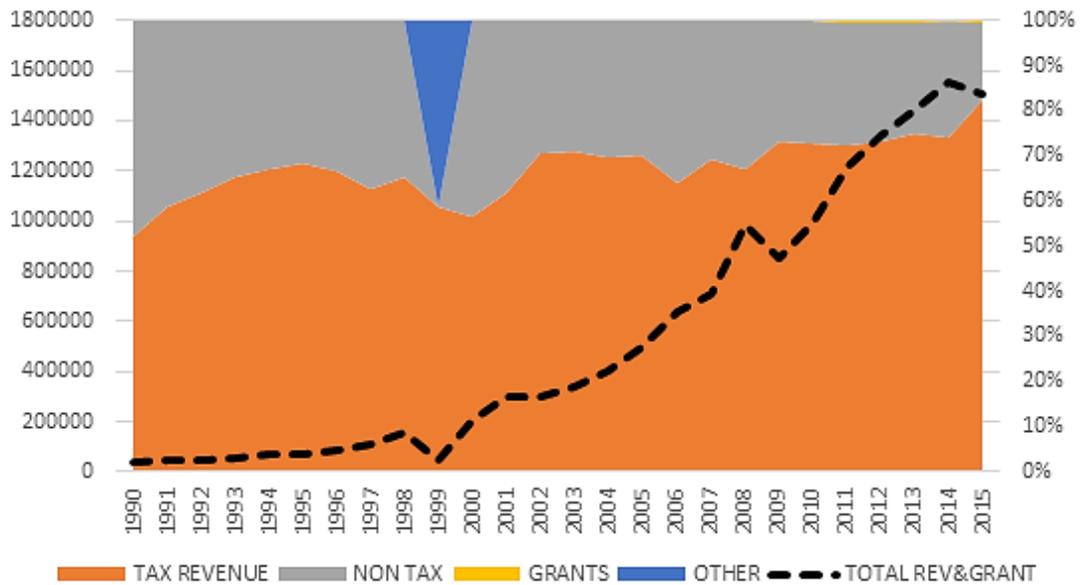


Figure 3.2 Government Revenues (% of GDP) in Indonesia 1990-2015

Indonesia's government revenue in million rupiah (left axis) and as a proportion (right axis) from 1990 to 2015. Source: Ministry of Finance of Indonesia sourced from Thomson Reuters DataStream.

### 3.4 Budget Deficits: Have They been Maintained within Sustainable Levels?

Applying the dynamic analysis framework in Gartner (2009), the sustainability of public debt will be analysed. It is argued that the public debt stock is not relevant *per se*, but the debt-to-GDP (defining re-payment capacity) is. Going one step further, the dynamics driving the debt-to-GDP ratio are subject to mutual feedback between budget deficits and debt stock. The increase in real debt (i.e. the real budget deficit) depends on the absolute real debt stock at the beginning of the period because the latter affects the monetary value of interest to be paid. Then, the accumulation of fiscal deficits may increase the public debt stock to a higher level and, if its growth is higher than the output growth rate, the repayment capacity would be affected. To better assess these dynamics, some equations and statistics will be employed.

Let us assume a budget deficit that is wholly financed by issuance of new government debt. (We are assuming that monetisation of it is not possible, an assumption that is

line with the Indonesian central bank's mission.) This budget deficit is defined as the difference between expenses (including interest repayment) and government revenue:

$$Deficit = \Delta B = G + iB - T \quad (3.1)$$

where  $G$  represents government expenditure,  $iB$  represents the government interest expense on the government debt level,  $B$ , and  $T$  is government revenue. All variables are real measures. Sometimes economists find it useful to assess the primary budget deficit, defined as:

$$Primary\ Deficit = G_t - T_t \quad (3.2)$$

The primary deficit will be assessed later, but now we shall refocus on equation (3.1). Rearranging (3.1) to leave government sources of financing on the l.h.s. and expenditures on the r.h.s. leads to the following budget constraint:

$$\Delta B + T = G + iB \quad (3.3)$$

To introduce ratios, we divide (3.3) by real GDP ( $Y$ ) and obtain:

$$\frac{\Delta B}{Y} + t = g + ib \quad (3.4)$$

Lower case letters represent the values of the variables as percentage of GDP.

Now, the ratio public-debt-to-GDP may change because of two reasons: changes in government debt or changes in GDP. We can put it in formal terms by calculating the differential of  $B = bY$ , and then dividing by  $Y$  in a second step:

$$B = \Delta bY + b\Delta Y \quad (3.5)$$

or

$$\frac{B}{Y} = \Delta b + by \quad (3.6)$$

where  $y$  is real GDP growth. Rearranging the last equation and substituting (3.4) into it leads to the following difference equation:

$$\Delta b = (g - t) + (r - y)b \quad (3.7)$$

This equation is very important and provides the basis for dynamic analysis of debt sustainability. The stationary level of debt-to-GDP,  $b^*$ , can be found by substituting the stationarity condition  $\Delta b = 0$  into (3.7):

$$b^* = \frac{(g - t)}{(y - r)} \quad (3.8)$$

The dynamic adjustment towards or away from  $b^*$  can be conducted with the aid of phase diagrams. That is carried out in Figure 3.3. There are four possible cases. In each case, dynamics are defined by the value of  $\Delta b$  and are indicated with arrows. Whenever  $\Delta b > 0$ ,  $b$  increases, and *vice versa*. Case A is associated with a stable debt-to-GDP level. Case B suggests that positive debt-to-GDP levels will decrease over time and stabilise around a negative value, meaning that the country becomes a creditor. In both cases, A and B, there is no risk of explosive growth. In Case C, unless the country is a creditor, the debt-to-GDP will grow uncontrollably. Case D is associated with a sustainable debt-to-GDP level, but this solution is unstable, and a small perturbation can destabilise public finances. In Cases B and C, sustainable debt-to-GDP levels are negative, meaning that the country has to be a creditor to sustain its finances.

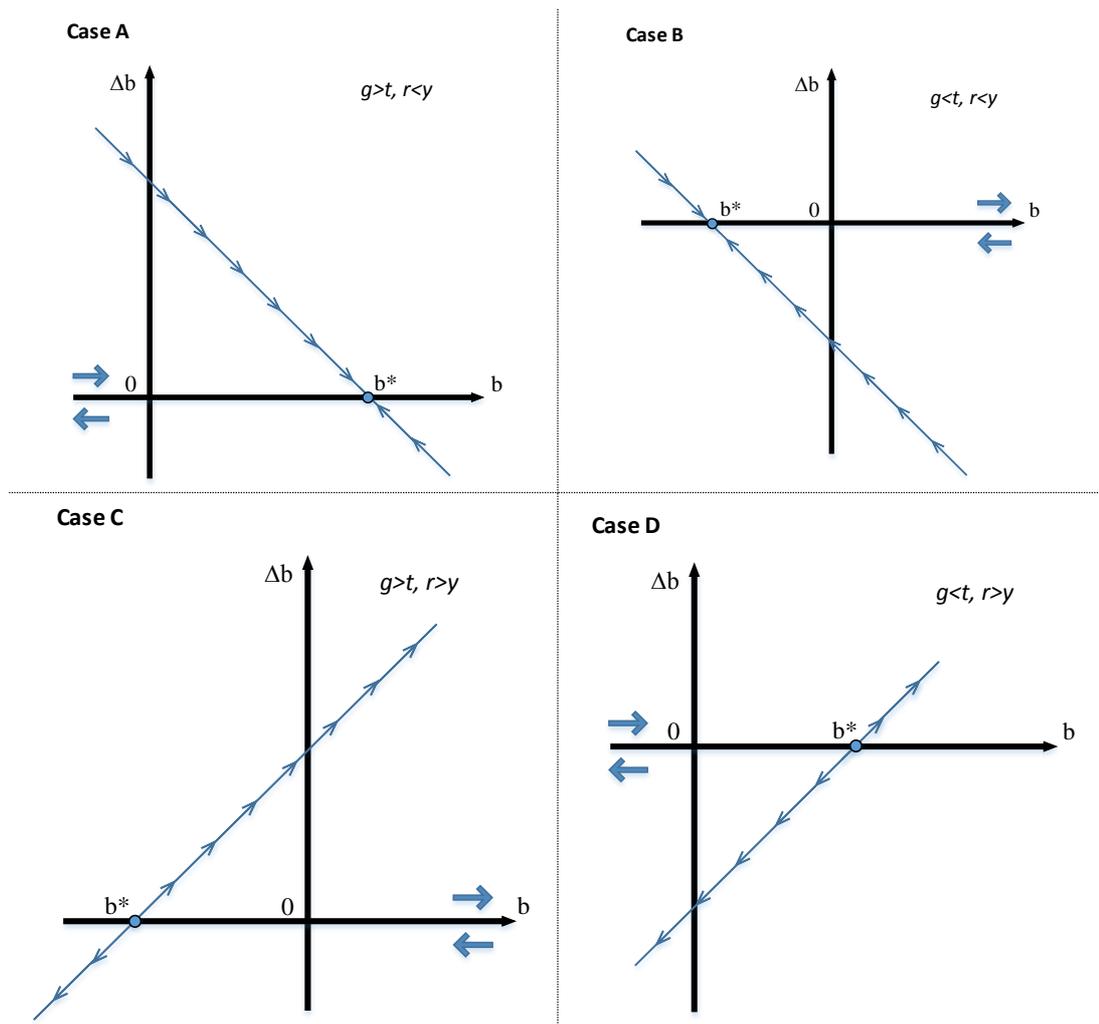


Figure 3.3 Dynamic Phase Analysis of Debt-to-GDP ( $b$ ) Sustainability

Given data for  $g$ ,  $t$ ,  $r$  and  $y$ , it is possible to calculate the sustainable debt level  $b^*$  that is consistent with them. Then, by comparing it with the actual public-debt-to-GDP level, it is possible to arrive at conclusions. Table 3.2 provides an account of the evolution of  $g$ ,  $t$ ,  $r$  and  $y$ . In Table 3.2, a dynamic classification of Indonesia's primary surpluses is provided, based on the model outlined. Cases A and B are sustainable, in the sense that the consistent growth of the variables  $g$ ,  $t$ ,  $r$  and  $y$  at the same rate would cause the amount of public debt relative to GDP to converge to a stable value, which could be either positive (Case A) or negative (Case B). In Case C, if the initial level of public-debt-to-GDP is positive and  $t$ ,  $r$  and  $y$  keep growing at the same rate, public-debt-to-GDP will never stop growing. In Case D, public-debt-to-GDP will never stop growing if the current level is higher than the implied sustainable level,  $b^*$ . All cases in which the primary deficit was unsustainable are highlighted in grey. A criticism of the approach that is employed here would be that it is unlikely that all variables will keep growing at current rates forever. For instance, if there is low output growth, a positive primary surplus is likely to boost it in the future. However, if, following this methodology, prolonged consecutive periods in which primary deficits were classified as unsustainable can be identified, there are good reasons to believe that these fiscal policies are time-inconsistent. This is exactly what occurs in the period 1986-2004 when it is considered as a block. In only 6 out of 19 periods was the primary result sustainable. Consequently, overwhelming evidence is found that Financial Law No. 17/2003, which established limits upon fiscal deficits and public debt relative to GDP, was well-suited for Indonesia. Figures 3.6 and 3.7 demonstrate how fiscal policy makers have changed their attitudes towards public spending, favouring a decrease in the public-debt-to-GDP ratio.

Table 3.2 Primary Surpluses/Minuses as a Share of Aggregate Income ( $t-g$ ) and Real Income Growth Minus Real Interest Rates ( $y-r$ ), Implied Sustainable Debt-to-GDP Ratio ( $b^*$ ) and Dynamic Classification in Indonesia, 1980-2014

Year	$t-g$	$y-r$	$b^*$	Case	Year	$t-g$	$y-r$	$b^*$	Case
1980	-0.63	n/a	n/a	n/a	1998	-1.06	11.47	9.2%	A
1981	-0.65	n/a	n/a	n/a	1999	-0.18	-11.0	-1.6%	C
1982	-0.92	n/a	n/a	n/a	2000	-1.7	6.63	25.6%	A
1983	-1.1	n/a	n/a	n/a	2001	-1.27	-0.08	-1,588%	C
1984	1.42	n/a	n/a	n/a	2002	-1.36	-7.82	-17.4%	C
1985	0.28	n/a	n/a	n/a	2003	-1.74	-6.07	-28.7%	C
1986	-2.39	-14.42	-16.6%	C	2004	-1.13	-0.1	-1,130%	C

Cont.

Year	<i>t-g</i>	<i>y-r</i>	<i>b</i> *	Case
1987	-1.01	1.17	86.3%	A
1988	-2.19	-1.31	-167.2%	C
1989	-1.88	-1.56	-120.5%	C
1990	-0.02	-3.16	-0.6%	C
1991	0.44	-6.42	6.9%	D
1992	-0.35	-11.2	-3.1%	C
1993	0.06	-2.79	2.2%	D
1994	1.26	-1.72	73.3%	D
1995	2.3	-0.12	1,916%	D
1996	2.12	-1.7	124.7%	D
1997	0.62	-3.51	17.7%	D

Year	<i>t-g</i>	<i>y-r</i>	<i>b</i> *	Case
2005	-0.32	5.94	5.38%	A
2006	-0.86	3.84	22.4%	A
2007	-1.05	4.01	26.2%	A
2008	0.21	11.29	-1.9%	B
2009	-1.39	-1.05	-132.3%	C
2010	-0.52	1.77	29.4%	A
2011	-1.06	2.16	49.1%	A
2012	-1.68	-1.07	-157.0%	C
2013	-2.16	-1.42	-152.1%	C
2014	-2.11	n/a	n/a	n/a

Unsustainable situations are identified in grey. Source: Thomson Reuters Datastream and own calculations.

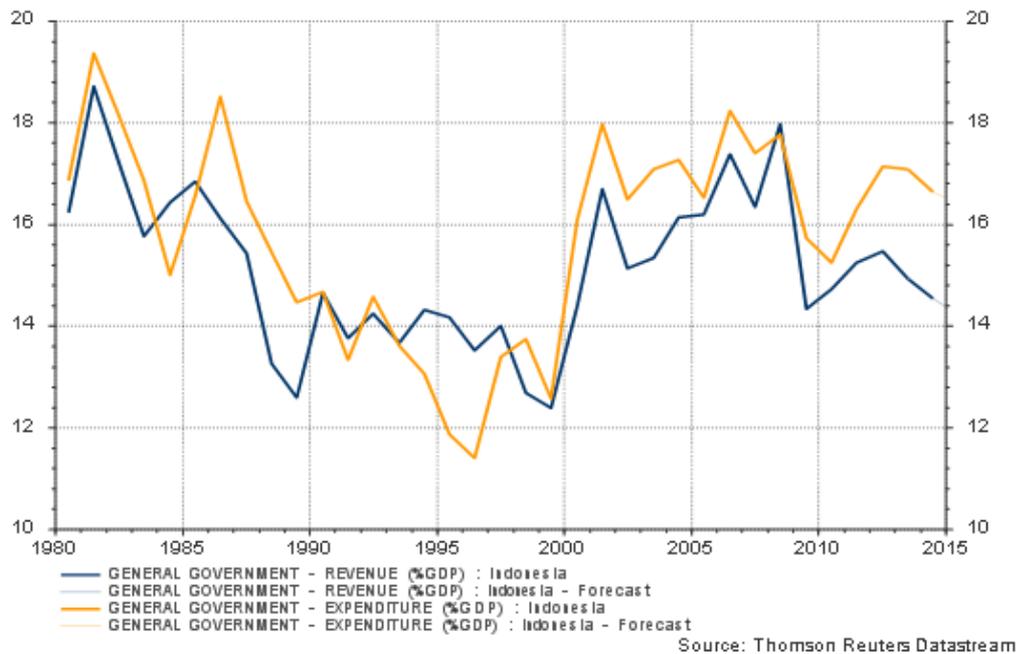


Figure 3.4 General Government Revenue and Expenditure in Indonesia 1980-2014

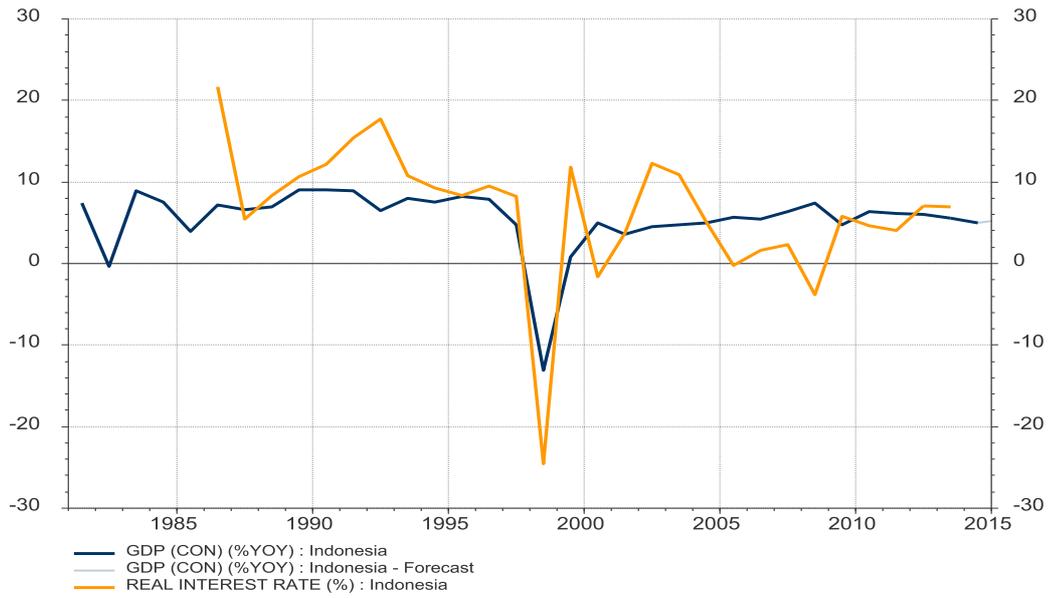


Figure 3.5 Real Income Growth and Real Interest Rates in Indonesia 1980-2014

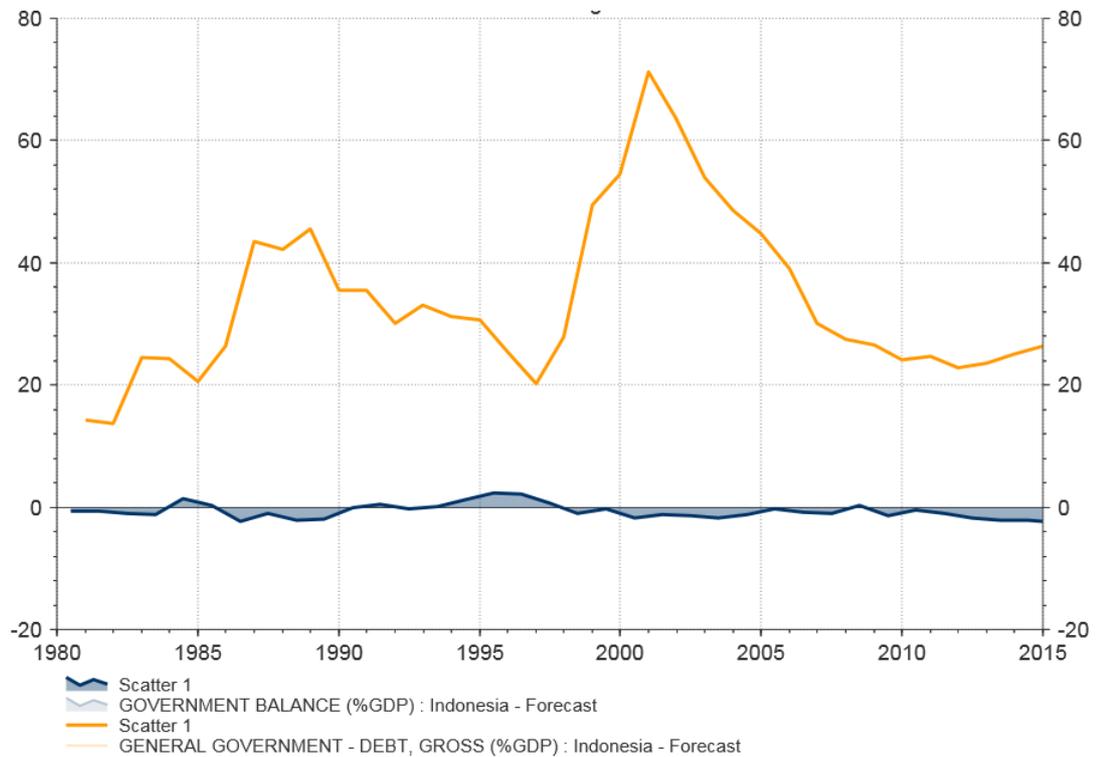


Figure 3.6 The History of Debt Ratios and Budget Balances in Indonesia

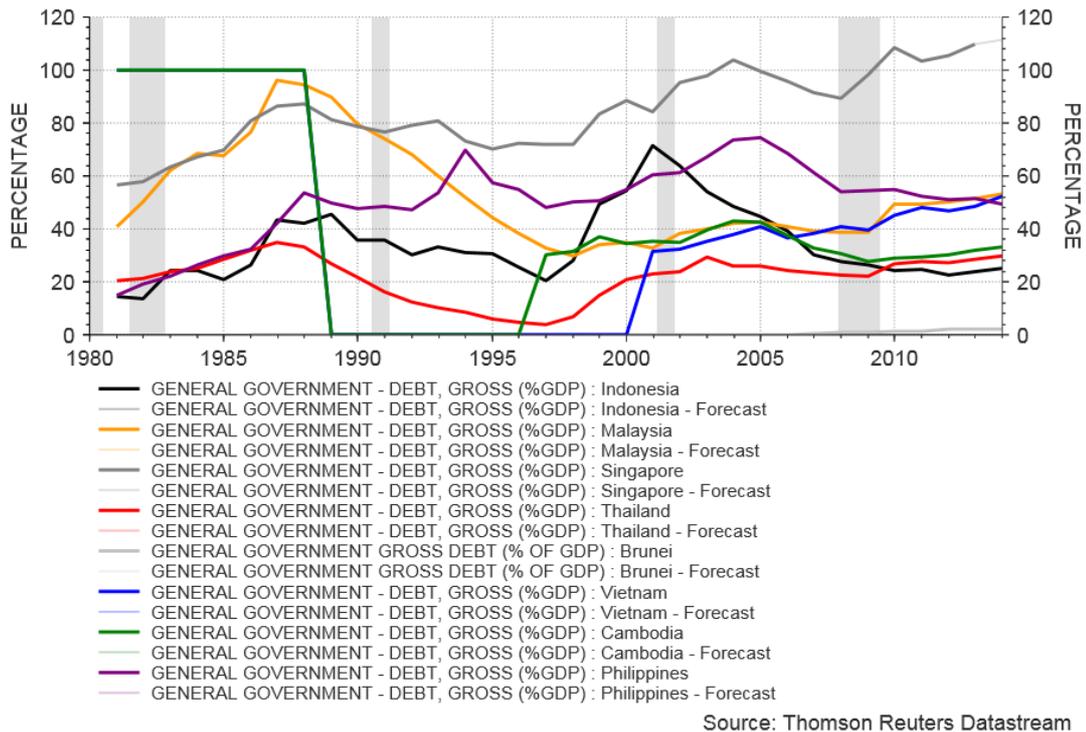


Figure 3.7 The Indonesia's History of Debt Ratios Compared to ASEAN Countries

### 3.5 Concluding Comments

This chapter has provided a 'helicopter ride' view over the Indonesian's economy. It has been demonstrated that, through market-oriented reforms including trade liberalisation, improvement of institutions, de-regulation of economic activity and policies targeting inefficiencies arising from state-owned companies, enough investment was secured to sustain a high level of output growth (except for the 1997-8 crisis episode). In this examination, external indebtedness and total public debt were not found to be a problem, with the Financial Law in place. Interestingly, it was found that the government budget is subject to a number of rules that allow for restricted flexibility and an expenditure composition that has been very consistent with Indonesian policy makers' growth strategies and policies to enable it to react to both domestic and international shocks. How the fiscal stance contributes to smoothing of the business cycle is still not known. Importantly, neither is it clear whether the peculiar combination of different expenditure items in Indonesia's government budget, as a package, may have had some sizeable impact on long-run output growth. These questions will be addressed from a macro-policy perspective in the coming chapters.

# **CHAPTER 4**

## **WAGNER'S LAW AND DYNAMIC GOVERNMENT EXPENDITURE IN INDONESIA**

### **4.1 Introduction**

The nature of the empirical relationship between government expenditure and economic growth is open to alternative interpretations. One view, associated with Keynes, would be that discretionary changes in government expenditure are used by governments to stabilise cyclical fluctuations and to develop capital infrastructure. This view implies that, if causality exists between government expenditure and economic activity, it would flow from the former to the latter. Although relevant, this Keynesian view does not explain why the level of government expenditure as a proportion of GDP would need to grow over time.

A complementary theory explaining why government expenditure increases faster than output as an economy develops has been associated with Wagner (1911). More specifically, the long-run relationship between the two variables, under the assumption that government expenditure and consumption are endogenous, with causality running from economic activity to government expenditure in the long run, has been dubbed Wagner's Law. In the case of Indonesia, the role of Wagner's Law is not so much about inducing government expenditure that leads to the development of technology (as described in the previous chapters), as it is about limiting unproductive government expenditure/bureaucracy. Furthermore, it is important to keep in mind that Indonesia's fiscal policy has been applied with the intention of attaining output stability, acceleration of economic growth through income re-distribution and sustainability of government finances. This has led to considerable debate among policy makers and economists about whether fiscal policy can be used to simultaneously achieve such multiple goals. The results should shed some light on the overall attainment of that over-arching policy. Therefore, the aim of this chapter is to test the validity or otherwise of Wagner's Law in Indonesia.

Having outlined the motivation for this study and reviewed relevant literature, the balance of this paper is organised as follows. Section 4.2 considers the time series properties of the data in order to provide a guide to the correct economic methods and models to be applied through the tests of Augmented Dickey Fuller (ADF) [Dickey and Fuller (1979)], Dickey Fuller-Generalised Least Square (DF-GLS) [Elliott, Rothenberg, and Stock (1996)] and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) [Kwiatkowski et al. (1992)], both in the absence of a structural break and with one break (Perron 1997). Section 4.3 presents the concept of co-integration, together with causality and its empirical tests, while estimated co-integrated Vector Auto Regression (VAR), Vector Error Correction Model (VECM) and cyclicalities are discussed in Section 4.4. Finally, Section 4.5 provides a conclusion.

## **4.2 Time Series Properties of the Data**

This section deals with the basic characteristics of the individual time series that is carried out in the empirical modelling of this chapter. The objective of this section is to investigate the statistical properties of the data, in order to provide a guide to the correct econometric methods and models to be applied in later sections. This section also examines the basic interrelationships among the data and highlights key features. As is well known, testing for the stationarity or otherwise of the data is a vital prerequisite to co-integration modelling, which will be carried out in subsequent sections. As most of these techniques are standard, only a very brief discussion of the unit root tests is included. However, since one issue that is expected, *a priori*, to be of importance is the possible presence of breaks in the data; a brief discussion of the matter of allowing for a break in the unit root tests will be included. This section focuses on the four basic unit root tests used: namely, the ADF, the DF-GLS, the KPSS and breaking trend tests based on the ADF test.

A time series is stationary when its mean and its variance are not functions of time. The stationarity properties of the data used in this thesis affect the modelling techniques applied to them. For instance, variables that are non-stationary yet are found to be co-integrated may be modelled through an error correction or Vector Error Correction Model (VECM). That is, a stationary error-correction term may be obtained from a linear combination of non-stationary variables. This error-correction term represents a long-run relationship between the variables. In addition, to identify

this sort of long-term macroeconomic relationship, the models in this thesis also consider short-run dynamics emerging from stationary variables that are exogenous, through Vector Auto Regressive (VAR) modelling techniques. To identify meaningful relationships among the variables, it is crucially important to identify the stationarity and other dynamic properties of the data. This section is fully dedicated to this endeavour.

Econometric models for time series analysis require stability and a well-behaved stochastic component. In regression analysis, error terms are often assumed to be normal and independently distributed (both with respect to other variables and over time). The presence of non-stationarity may cause the problem of *spurious regression*. This means that, if each of a pair of variables contains a unit root, then a standard Ordinary Least Squares (OLS) regression involving these variables will be generally misleading. Typically, the coefficient of determination will be high, and *t*-statistics will appear to be significant. However, these results are not viable because major assumptions about the distribution of the error term are violated. The main reason why relationships estimated through spurious regressions appear to be strong is that non-stationary variables will typically share a trend. The first person who identified this problem of spurious regressions was Yule (1926). He suggested that, if a regression equation uses trending data, the coefficients' estimates might well appear to be statistically significant even though there is no true relationship between the dependent and explanatory variables. This idea was later supported by the study of Granger and Newbold (1974), which concluded that regression equations that contained non-stationary time series data frequently resulted in a high coefficient of determination and very low Durbin-Watson statistics. This issue of non-stationarity in macroeconomic time series data is now often referred to as the "unit root" problem and has resulted in a vast amount of literature, applied and theoretical, looking at the issue of testing data for the presence of a unit root.

This thesis uses four standard unit root tests (ADF, DF-GLS, KPSS and breaking trend) in attempting to draw conclusions about the stationarity or otherwise of the data. This section provides a brief overview of these tests, without going into technical detail, since most are accepted to be standard within the literature.

Probably the most famous and popular test for detecting unit roots in univariate time series data was developed by Dickey and Fuller (1979). This basic form of the Dickey Fuller (DF) test can be augmented in two ways. Firstly, the inclusion of deterministic variables such as a constant and trend is important within the context of this thesis since it allows for the alternative hypothesis of trend stationarity. The second method is the inclusion of lagged dependant variables on the right hand side to ensure non-auto correlated residuals, in which case the test is referred to as an ADF test. In the case of autocorrelation in the observed series, the most general form of the ADF model formula is:

$$\Delta y_t = \alpha + \beta t + \pi y_{t-1} + \sum_{i=1}^k \gamma_i \Delta y_{t-i} + \varepsilon_t \quad (4.1)$$

where  $y_t$  is the time series in question,  $t$  is a time trend, the error term  $\varepsilon_t \sim NID(0, \sigma^2)$  and the null hypothesis of a unit root is carried out by testing the null that  $\pi = 0$ . The inclusion of “nuisance parameters”, such as the constant and trend, allow for generalisations of the alternative hypothesis to include the possibility of trend stationarity. In the case of most of the data in this thesis, there is visual evidence of trends in the data. Therefore, a constant and trend in the unit root tests of the log levels data is typically included.

While the test of the null hypothesis of a unit root is carried out using a standard  $t$ -test on the relevant parameter ( $\pi$ ), the test statistics do not have a standard  $t$ -distribution and critical values and, as is common in this field of literature, they have to be obtained via simulation methods. There now exists a wide range of sources for these critical values, so this thesis draws on these<sup>7</sup>; see, for example, MacKinnon (1991). Finally, in the ADF test, an appropriate lag length,  $k$ , has to be selected. According to the study of Campbell and Perron (1991), the ADF test is very sensitive to the lag length number in an estimated equation. If the number of lags is too small, it might cause the over-rejection of a null hypothesis of a unit root at any significance level. On the other hand, too many lag lengths may reduce the power of the test due to more parameters being estimated and there being less numbers of effective observations. This can lead to falsely rejecting a null hypothesis of a unit root.

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<sup>7</sup> Indeed, most standard computer packages include these response surfaces and derive appropriate critical values from them as standard.

In order to choose the appropriate lag length for the ADF tests of the unit root hypothesis, the Akaike Information Criterion (AIC) was used and a maximum lag length of 5 was allowed. Critical values are from the response surface equation of MacKinnon (1991).

The DF and ADF tests were the original and most popular tests of the unit root hypothesis; however, the literature displays a vast array of alternative tests that were developed in a search for greater statistical power and the ability to test the basic hypothesis of a unit root against a wider range of alternative hypotheses. In the rest of this section, some tests of interest are briefly outlined, paying particular attention to how they vary from the standard ADF test.

An important assumption of the standard DF test is that the error terms are independent and identically distributed, and the ADF test includes adjustment of the DF test by adding the lagged different terms of regression. However, when using the ADF test method, it is necessary to make sure that the error terms are uncorrelated and have constant variance; if not, the test may be biased.

The ADF test has been criticised for its lack of efficiency and power, in spite of its broad usage. An alternative procedure for testing a unit root has been developed by Elliott, Rothenberg, and Stock (1996); namely, DF-GLS. DF-GLS increases the power of standard ADF tests by a prior de-trending of the data based on a specific local alternative to the unit root hypothesis. It is believed that this methodology yields more efficient estimates of the constant and trend terms in ADF-type regression. With a time series,  $y_t$ , the unit root is performed within a standard ADF framework using the regression equation:

$$\Delta y_t^\tau = a_0 y_{t-1}^\tau + \sum_{j=1}^k \Delta y_{t-j}^\tau + u_t \quad (4.2)$$

for the  $DF - GLS^\tau$  test for which critical values, under the assumption that  $k=0$ , are provided in Elliott, Rothenberg, and Stock (1996) Table 1,

and

$$\Delta y_t^\mu = a_0 y_{t-1}^\mu + \sum_{j=1}^k \Delta y_{t-j}^\mu + u_t \quad (4.3)$$

for the  $DF - GLS^u$  test for which critical values are given in the first panel of Table 8.5.2 of Fuller (1976).

The forms of  $y_t^r$  and  $y_t^u$  are generated using the equations  $y_t^r = y_t - \hat{\beta}_0 = \hat{\beta}_1 t$  and  $y_t^u = y_t - \hat{\beta}_0$  where the  $\hat{\beta}$  values are estimated coefficients from regression. This involves, firstly, constructing the variables  $\tilde{y} = (y_1, (1 - \bar{\alpha}L)y_2, \dots, (1 - \bar{\alpha}L)y_t)$  and  $\tilde{z} = (z_1, (1 - \bar{\alpha}L)z_2, \dots, (1 - \bar{\alpha}L)z_t)$  where  $z$  is both a constant and trend  $(1, t)$  for the  $DF - GLS^r$  test, and simply a constant  $(1)$  for the  $DF - GLS^u$  test, and  $L$  is the lag operator. Then  $\bar{\alpha}$  is determined by the constant  $\bar{c}$  and is given by  $\bar{\alpha} = 1 + \bar{c} / T$ , and the coefficients in a regression of  $\tilde{y}$  on  $\tilde{z}$  give the values of  $\hat{\beta}$ . Finally, the problem of determining the lag order used in equation (4.2) is carried out using the same method as described before, that is AIC.

Kwiatkowski et al. (1992) propose an alternative model in testing a unit root, known as the KPSS model. Essentially the trick here is to flip the null hypothesis: in the ADF, the null hypothesis is that the series contains a unit root, whereas the KPSS tests the null of (trend) stationarity against a unit root alternative. The KPSS should be used to complement the ADF and DF-GLS tests.

The tests discussed above are all applied to the data set used in this thesis and the results are then used to attempt to draw some conclusions about the stationarity/non-stationarity of the data. However, all use the alternative (or in the KPSS test, the null) hypothesis that the series is (at most) trend stationary, where the trend is a simple linear trend in the data. In an important paper, Perron (1989) argued that the presence of structural breaks in the underlying trends in the data would significantly bias the tests in favour of non-rejection of the unit root hypothesis. Since there is a clear possibility (based on visual observation) that the data from the Indonesian economy might well have undergone structural change, it is important to allow for this possibility within the unit root-testing framework.

There are at least two procedures that allow for the detection of endogenous trend breaks. They are the Perron (1989, 1997) approach and the Zivot and Andrews (1992) approach. Once again, the basic ideas behind the tests are briefly reviewed.

In general, the assumption of an ADF test standard is that there is no structural break and that the estimated parameters are stable during the sample period. If there is a structural change in the time series, the assumption may not appropriately illustrate the properties of the data. In many cases, when there is a structural break in the intercept and/or trend functions, a stationary time series may appear non-stationary – a result demonstrated in the paper by Perron (1989). Hence, stationarity occurs in macroeconomic fluctuations if structural changes are allowed to affect the time trend. Perron (1989) extended the ADF model to allow for a single break in the underlying trend function at some point in time. Essentially, this involved augmenting the range of dummy variables in the regression model used to test the unit root null.

In the presence of a potential structural break, this thesis carries out further testing of the unit root null hypothesis against an alternative that allows the series to be stationary around a breaking, deterministic trend. A number of papers, such as Zivot and Andrews (1992), Banerjee, Lumsdaine, and Stock (1992), Pierre and Vogelsang (1992), Perron (1989) and Rappoport and Reichlin (1989), have considered this type of test. Essentially, what Perron (1989) demonstrated was that, if a data set is generated using a simple data generating process such as:

$$y_t = \mu_1 DU_t + e_t \quad (t = 1, \dots, T) \quad (4.4)$$

where  $DU=1$  if  $t > T_b$  and 0 otherwise, and  $e_t \sim$  independent and identically distributed (*iid*),  $N(0, 1)$ , then, clearly, this series is stationary because  $e_t$  is assumed to be *iid* and it will have a mean of 0 up to  $T_b$ . If the researcher was to carry out standard Dickey-Fuller tests on the data, using a standard ADF test as in (4.1), then the estimated value of  $\pi$  would be biased toward 0 because the size of the crash ( $\mu_1$ ) is increased and, therefore, the power of the Dickey-Fuller test is reduced. Perron (1994a), through carrying out a large number of replications of this experiment, found that the power of the Dickey-Fuller tests drops to zero when  $k=0$  and  $\mu_1=25$ , even in the basic example. Perron notes that, even though these seem to be extreme values, the series under question has an *iid* noise component and, for much smaller shifts in the mean, when the error term is auto-correlated the power of these tests will fall more rapidly.

Perron (1989) recommended that three models be used to allow for slight variants of the structural break. The first model is the simplest and is often referred to as the “crash model”. This model is based on the traditional ADF model, augmented by the addition

of a dummy variable that provides shift, but only in the intercept. A second model is known as the “growth change” model and it allows for changes in the slope of the trend function with no sudden change in the level at the time break. The third model combines both of these effects and allows for a change of both intercept and slope. The researcher, based on observation of the series in question, must decide which model is most appropriate. Shrestha and Chowdhury (2005) provide an example of the procedures for choosing the right model. The point mentioned above is not complex; however, the wide range of tests and test procedures necessary for this work complicated the testing framework. In the first Perron (1989) paper, the times of crashes were selected as being the great crash in 1929 and the oil price shock in 1973. A set of critical values for the tests, based on the assumption of an assumed time for  $T_b$ , was generated and this led a number of economists, such as Christiano (1992), Zivot and Andrews (1992), and Banerjee, Lumsdaine, and Stock (1992), to criticise this assumption. Essentially, they argued that Perron (1989) had biased his findings by “peeking” at the data and picking dates that were most likely to be in favour of the hypothesis of his thesis. As a result, the null (of a unit root) would be excessively rejected because the use of Perron’s critical value would be too small or incorrect. Therefore, it has been suggested that recursive methods should be utilised so that the break point of the data can be determined and critical values of the test appropriate to this technique can be simulated.

Hence, there are some problems testing for a unit root in the presence of a structural break. The first problem is selecting the most applicable model. The second problem is selecting the break point in the data, using data-based searches. The third problem is on the assumption that the break occurs instantaneously. Using the terminology of Box and Tiao (1975), this is often termed as the Additive Outlier (AO) model. Nevertheless, practically, it would be more realistic to assume that the change in the trend occurs gradually. Another case is termed the Innovational Outlier (IO) model. Again, different testing procedure and set of test statistics, with regard to which model is chosen, apply and the choice depends largely upon observation of the series in question.

To deal with the break dates issue, the unit root tests carried out in this thesis both allow for a break for each of variables by allowing the data to fix the break date and

by fixing the break at the date of the passing of the Financial Law No.17/2003 (2003Q4).

The models and the regression formulae to test the breaking trend model can be seen in Table 4.1, below. For the AO model, two equations are estimated. Firstly, the data is de-trended and, secondly, the unit root null in an auto-regression of the residuals (the noise component) is tested. In the case of the IO models, only one regression is needed. The unit root using the  $t$  statistic on  $\alpha$  is tested. Once more, critical values for the test statistics must be derived, for which Monte Carlo simulations are used. Such test statistics for wide-ranging models, each based on the method of selecting lag orders in the auto-regression and the time of the break, are provided by Perron (1994b), Zivot and Andrews (1992), and Banerjee, Lumsdaine, and Stock (1992).

Two variables, that is  $T_b$  (the break point) and  $k$  (the order of the auto-regressive parameter), need to be determined and utilised within the context of the models. There are various times of the break, ranging from  $0.15T$  to  $0.85T$ , where  $T$  is the observation's number in the series. Hence, taking values at the beginning or end of the sample is not allowed.

Table 4.1 Steps of AO and IO Models

<b>AO</b>		
Model	Step 1. Original series de-trended	Step 2. Auto-regression estimated
(a)	$y_t = \mu + \beta t + \gamma DU_t + \hat{y}_t$	$\hat{y}_t = \alpha \hat{y}_{t-1} + \sum_{i=0}^k d_i D(T_b)_{t-i} + \sum_{j=1}^k a_j \Delta \hat{y}_{t-j} + e_t$
(b)	$y_t = \mu + \beta t + \theta DU_t + \gamma DT_t^* + \hat{y}_t$	$\hat{y}_t = \alpha \hat{y}_{t-1} + \sum_{i=0}^k d_i D(T_b)_{t-i} + \sum_{j=1}^k a_j \Delta \hat{y}_{t-j} + e_t$
(c)	$y_t = \mu + \beta t + \gamma DT_t^* + \hat{y}_t$	$\hat{y}_t = \alpha \hat{y}_{t-1} + \sum_{j=1}^k a_1 \Delta \hat{y}_{t-j} + e_t$

Cont.

<b>IO</b>	
(a)	$y_t = \mu + \beta t + \gamma DU_t + \delta D(T_b) + \alpha y_{t-1} + \sum_{i=1}^k a_i \Delta \hat{y}_{t-i} + e_t$
(b)	$y_t = \mu + \beta t + \theta DU_t + \gamma DT_t^* + \delta D(T_b) + \alpha y_{t-1} + \sum_{i=1}^k a_i \Delta \hat{y}_{t-i} + e_t$

where:  $T_b$ =the break date,  $DU_t=1$  and  $DT_t^*=(t-T_b)$  if  $t > T_b$  and 0 otherwise,  $D(T_b)_t = 1$  if  $t=T_b+1$  and 0 otherwise.

The regression was estimated with lags from 0 to  $k$  (maximum 8) and the lag order was determined using a  $t$ -test on the last included lag for each  $T_b$ . The coefficient of the last included lag was significant and determined by  $k$ , but it was not significant for higher order lags.

The various tests discussed above are now applied to the quarterly data from the Indonesian economy (all of the data used in this chapter are plotted in Appendix X and as can be seen, a number of the series do show visual evidence that trend breaks may be of some importance). Table 4.2 reports the results of a range of standard unit root tests on the five (seasonally adjusted) variables considered. They suggest that nominal Government Expenditure, nominal GDP, real GDP and the GDP Deflator are all I (1) as might have been expected. Interestingly, real Government Expenditure appears stationary, while Population appears to be I (2). It is, however, interesting that the real Government Expenditure variable (that has been deflated using the GDP deflator) rejects the unit root null for both the ADF and the DF-GLS tests, but rejects stationarity using the KPSS test. Further testing of the unit root null using the heteroskedasticity-robust Phillips and Perron (1988) test reports a  $t$ -statistic of -9.31 with  $p$ -value of [0.00], strongly confirming the result that the real variable can reject a unit root. The implication of this, if the rejection of the unit root null is accepted, would be that nominal Government Expenditure and GDP are co-integrated with a co-integrating vector (1, -1).

Table 4.2 Unit Root Tests

Variable						
	Nominal Govt. Exp.	Nominal GDP	GDP Deflator	Real Govt. Exp.	Real GDP	Pop.
ADF (level)	-2.87 [0.18]	-1.63 [0.77]	-2.49 [0.33]	-5.62** [0.00]	-1.65 [0.77]	-0.09 [0.99]
ADF (1 <sup>st</sup> diff.)	-19.74** [0.00]	-6.62** [0.00]	-5.97** [0.00]	-9.53** [0.00]	-10.49** [0.00]	-2.72 [0.23]
DF-GLS (level)	-2.79 (-2.99)	-1.80 (-2.99)	-2.20 (-2.99)	-5.43** (-2.99)	-1.15 (-2.99)	-0.05 (-2.99)
DF-GLS (1 <sup>st</sup> diff.)	-16.39** (-1.94)	-2.12** (-1.94)	-3.25** (-1.94)	-20.1** (-1.94)	-5.6** (-1.94)	-1.15 (-2.99)
KPSS (level)	0.23** (0.15)	0.13 (0.15)	0.18** (0.15)	0.22** (0.15)	0.23** (0.15)	0.35** (0.15)
KPSS (1 <sup>st</sup> diff.)	0.50** (0.46)	0.10 (0.46)	0.11 (0.46)	0.22 (0.46)	0.17 (0.46)	0.33** (0.15)

Figures in [ ] are p-values for the test statistic, figures in ( ) are 5% critical values, \* indicates significance at the 10% level and \*\* at the 5% level. For all variables, a constant and trend were included in the level tests but only a constant in the 1st difference test, with the exception of POP, which showed evidence of a trend in 1st differences.

The next unit root tests allow for a break for each of the variables in the table above by allowing the data to choose the break date and also fixing the break. One obvious choice for the fixing of the break date would be the Asian Financial Crisis of 1997 (see Appendix X). However, since the focus of this chapter is to test whether the passing of Financial Law No.17/2003 has had any significant effect on the relationships between government expenditure and the other key macroeconomic variables, it was decided to set the data at 2003Q4.

There are two approaches taken to the issue of the dates of the break points in the testing. Firstly, the break points were selected by allowing the data to select the data in one part of the chapter. This is standard practice and avoids the bias created by “peeking” at the data and selecting a point most likely to lead to a significant test statistic. This is essentially the point raised by Christiano (1992) in his criticism of the original Perron paper.

Secondly, 2003 is selected as a testable break point as this would have been the date that might have been expected a break if the change in the financial law had made

significant changes in the behaviour of the key variable. Even though some of the break points are potentially consistent with other exogenous events in the Indonesian macro economy, they were not a core concern of the analysis of the thesis though we note their presence below.

It will be of some interest to see whether the test that allows the date of the break to be chosen at the minimum of the relevant *t*-statistic selects 1997 or some other date, since the primary goal of this test is to estimate the breakpoint that gives the most weight to the trend stationary alternative. Based on these minimum *t*-values, the break values for each series are shown in Table 4.3.

Table 4.3 Unit Root Tests Allowing for Breaks

Variables	Allow Data to Pick a Break		Setting Break at 2003Q4	
	DF IO (levels)	DF IO (1 <sup>st</sup> diff)	DF IO (levels)	DF IO (1 <sup>st</sup> diff)
Nominal Govt. Exp.	-3.97 [0.19] 1991Q2 k=1	-19.64** [<0.01] 2005Q3 k=0	-2.77 [NA] k=1	-9.13** [<0.01] k=3
Nominal GDP	-2.39 [0.94] 2010Q1 k=0	-6.92** [<0.01] 1998Q2 k=1	-1.95 [≥0.50] k=0	-6.76** [<0.01] k=1
Price Deflator	-2.73 [0.83] 2010Q2 k=2	-6.40** [<0.01] 1998Q2 k=2	-2.43 ≥ [0.50] k=2	-6.18** [<0.01] k=2
Real Govt. Exp.	-10.21** [<0.01] 1999Q3 k=0	-9.48** [<0.01] 2010Q1 k=3	-9.77** [<0.01] k=0	-9.46** [<0.01] k=3
Real GDP	-2.12 [0.98] 1990Q2 k=0	-10.72** [<0.01] 1998Q3 k=0	-1.34 [≥0.50] k=0	-10.6** [<0.01] k=0
Population	-3.76 [0.27] 2006Q3 k=8	-2.95 [0.73] 1995Q1 k=10	-2.61 [NA] k=8	-0.27 [≥0.50] k=7

Figures in [ ] are *p*-values for the test statistic, \* indicates significance at the 10% level and \*\* at the 5% level.

The results in Table 4.3 show the unit root tests, both allowing for a break and setting the break at 2003 quarter 4. In all cases, lag length was selected using the Schwarz Information criteria with a maximum lag length of 13. Interestingly, the set of tests both without (Table 4.2) and with a break (Table 4.3) tell essentially the same story; that the nominal variables and the Price Deflator are  $I(1)$ , that real GDP is  $I(1)$ , but that real Government Expenditure appears to be stationary, while Population is  $I(2)$ .

When a break in the trend is introduced and the data is allowed to select the date, the dates selected do not seem to fit with the introduction of Financial Law No.17/2003. Equally, none of the results select 1997, the year when the Asian crisis swept rapidly throughout the South East Asian Economies, including Indonesia's. Indeed, there seems to be no intuitive interpretation for the range of break dates chosen. It is also important to note that the results of both sets of tests (with and without a break) yield consistent results regarding the orders of integration of the variables.

It should be noted that the finding that Population is  $I(2)$  suggests that it might be omitted from further analysis since there should be no relationship between the  $I(1)$  and  $I(2)$  variables. Furthermore, this is similar to what Oxley (1994) found. Converting the basic series to a per capita basis also makes little impact since the Indonesian population statistics are very smooth, as can be seen in Figure 4.1, below:

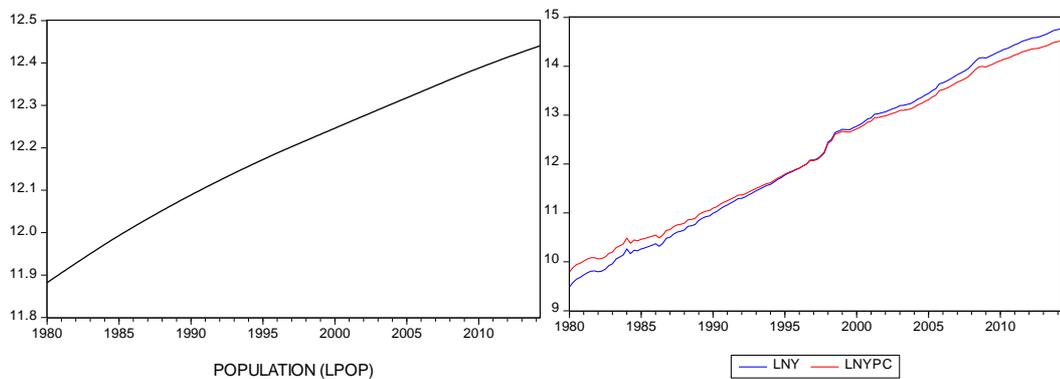


Figure 4.1 Log Population and Comparison between Nominal GDP and Nominal GDP Per Capita in Indonesia, 1980-2014

It can be seen that both real GDP and real GDP per capita look very similar. (Note that the scale has been altered so that they have the same means.) In addition, the calculation of a correlation coefficient shows that there is little to be gained from analysis in per capita terms. As a result, the population variable is omitted from the analysis carried out in the next section.

Oxley (1994) also utilised nominal government spending and output data. Other contentious issues relevant to the specific formulation of the law relate to whether the variables could be measured in real or nominal terms, can be seen for example, Beck (1979), Heller (1981) and Diba (1982). Another reason is because the result of the unit root tests in the chapter shows that even though the real GDP is  $I(1)$ , the real Government Expenditure appears to be stationary. Therefore, for the simplicity of the approach, as both the nominal government spending and output data are  $I(1)$ , this chapter uses nominal data.

In this section of the chapter, a range of unit root tests on the variables under consideration were carried out. Three conclusions can be drawn from this set of results:

1. The inferences drawn on the orders of integration of the variables are consistent both across a range of standard tests and tests that allow for breaks in the data.
2. Allowing trend breaks in the unit root tests not only does not change the inferences drawn, but also provides no clear consistency regarding the dating of breaks, either around the dates of the Asian Financial Crisis or the introduction of Financial Law No.17/2003.
3. Finally, the finding that real Government Expenditure is  $I(0)$  does suggest that there is co-integration between nominal Government Expenditure and the Price level, and that is something that will be tested for in the next section, in addition to causality.

### **4.3 The Concept of Co-integration, Causality and its Empirical Tests**

The findings of the previous section suggest that many of the variables (nominal Government Expenditure, nominal GDP, Price Deflator and real GDP) are  $I(1)$ . Therefore, this section proceeds, where applicable, to test for co-integration among those variables. This section also examines causality, since the establishment of causal relations is important [as noted by Oxley (1994)] in the testing of Wagner's Law. As with the unit root tests in the previous section, both co-integration and causality tests are fairly standard in the current literature, so this section only provides a brief overview of the concepts.

One of the simplest co-integration tests is the Engle and Granger (1987) approach, which consists of two steps. The first step is testing for unit roots for the variables. If the results of unit root tests show that all variables are integrated of the same order,  $I(1)$ , then the second step is to run a “co-integrating regression” involving a simple OLS regression, using one of the variables as the dependent and the other(s) as the explanatory variable<sup>8</sup>. Once the co-integrating regression has been run, the residuals are retrieved and tested for a unit root using the ADF test discussed above. Once again, critical values have to be obtained from simulation methods because these critical values are different to the standard unit root critical values (MacKinnon 1991). The variables are not co-integrated if the test fails to reject the unit root, while the variables are co-integrated if the unit root null can be rejected.

The Engle-Granger co-integration approach has a number of disadvantages despite its ease of implementation and the fact that this approach is useful for testing the long-run equilibrium relationship between two variables. Firstly, when there are more than two variables, the Engle-Granger technique cannot be used to test for the possibility of more than one co-integrating relationship. Another reason is that straightforward testing of a hypothesis regarding a co-integrating vector is not allowed by this method. Johansen (1988), Johansen (1991), and Johansen and Juselius (1990) built an alternative model for testing co-integration to avoid the problems of the Engle-Granger approach. The Johansen method allows testing for multiple co-integrating vectors as well as allowing various restrictions on the co-integration vector. The test is based on the error correction representation of the VAR, as below:

$$A_k(L)x_t = \mu_0 + \Psi D_t + \varepsilon_t \quad (4.5)$$

where  $\mu_0$  is an unrestricted constant term, and  $D_t$  represents vector impulse dummies and/or seasonal dummies.

Assuming the variables in the vector  $x$  are  $I(1)$  and that the error term is *iid* then (4.5) can be re-written as (4.6), the Vector Error Correction Model (VECM):

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<sup>8</sup> Two other cases are possible:

- a) If all of the variables are stationary ( $I(0)$ ), standard regression techniques can be applied.
- b) If the results show that the variables appear to be integrated of different orders, alternative estimation techniques, such as Autoregressive Distributed-Lag (ARDL) as in Pesaran, Shin, and Smith (2001), could be considered because this allows for potentially mixed orders of  $I(1)$  and  $I(0)$  variables.

$$\Delta x_t = \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \Pi x_{t-1} + \mu_0 + \Psi D_t + \varepsilon_t \quad (4.6)$$

The test for co-integration hinges on the characteristics of the  $\Pi$  -matrix and relies on the number of independent rows in the matrix that are non-zero – clearly all being zero would imply no co-integration and a model in first differences, while a matrix of full rank would imply that all of the variables were stationary. The issue raised here can be resolved by a standard mathematical method: the number of independent rows in  $\Pi$  (and hence, the number of co-integrating vectors) is determined by the rank of the  $\Pi$  matrix, and the number of significant eigenvalues found in  $\hat{\Pi}$  gives the rank of  $\Pi$ . A stationary relation is represented by each significant eigenvalue. Note also that  $\Pi = \alpha\beta'$ , where  $\beta'$  contains the estimates of the co-integrating relationship and  $\alpha$  their weighting, or loading, in the VECM.

The three cases that may occur are, therefore:

- 1) the rank ( $\Pi$ )=0 implies that there are no co-integrating vectors among the variables and, subsequently, the modelling should be undertaken in the first differences;
- 2) the rank ( $\Pi$ ) is of full rank, so all variables in  $x_t$  must be stationary; and, finally, the most interesting case is when
- 3) the rank ( $\Pi$ ) is  $r$ , such that  $0 < r < n$ , where  $n$ =the number of variables, then the variables are co-integrated and there exist  $r$  co-integrating vectors. The rank order of the matrix  $\Pi$  can be found by analysis of its characteristic roots. Hence, for a square ( $n \times n$ ) matrix  $\Pi$  its determinant is equal to the product of its characteristic roots:

$$|\Pi| = \prod_{i=1}^n \lambda_i$$

where the  $\lambda_i$  values are the roots of the characteristic equation.

Two test statistics that essentially will test whether the estimated characteristics or eigenvalues of the matrix  $\Pi$  are significantly different from zero are identified by Johansen as the “trace” test and the “maximum eigenvalue test”:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (4.7)$$

$$\lambda_{max}(r, r + 1) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_{r+1})$$

where the  $\lambda_i$  values are the  $n$  distinct eigenvalues ordered by size, so  $\lambda_1$  is the largest eigenvalue and  $\lambda_n$  is the smallest. The  $\lambda_{trace}$  equation tests the null of at least  $r$  co-integrating vectors against the general alternative that there are more co-integrating vectors. Meanwhile,  $\lambda_{max}$  tests the null of at least  $r$  co-integrating vectors against the alternative of  $r+1$  co-integrating vectors.

It should be noted that only the number of co-integrating vectors ( $r$ ) and the number of common trends ( $p-r$ ) are determined by the reduced rank test of  $\Pi$ . In order to represent meaningful economic relationships, normalisation and tests of the  $\alpha$  and  $\beta$  matrices to identify the co-integrating vector(s) must be conducted. Fortunately, Johansen (1995) showed that it is possible to construct likelihood ratio tests (with an asymptotic  $\chi^2$  distribution) that allow testing of hypotheses on both the  $\alpha$  and  $\beta$  vectors.

In essence, then, the Johansen test comprises the four following steps:

1. Estimate the VAR(q) model for  $X_t$  in levels.
2. Construct likelihood ratio tests, as above, for the rank of  $\Pi$  in order to determine the number of co-integrating vectors.
3. If necessary, impose normalisations and identify restrictions on the co-integrating vectors.
4. Estimate the resultant co-integrated VECM.

Finally, the possibility of causal relationships between the variables is examined. Granger's (1969) definition of causality is based on the idea that  $x$  is causal for  $y$  if lagged values of  $x$  improve the prediction of  $y$  over and above the lagged values of  $y$  itself. Naturally, such tests can be simply carried out in a VAR model by testing zero restrictions on the appropriate lag coefficients in the VAR. Therefore, for example, to test if  $y_2$  is Granger non-causal for  $y_1$  in the simple VAR in Equation (4.8), the null hypothesis that  $\delta_{12,i} = 0 (i = 1 \dots k)$  would be tested, and only if the hypothesis is rejected could it be concluded that  $y_2$  is causal for  $y_1$ .

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \end{bmatrix} = \sum_{i=1}^k \begin{bmatrix} \delta_{11,i} & \delta_{12,i} \\ \delta_{21,i} & \delta_{22,i} \end{bmatrix} \begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \end{bmatrix} + \varepsilon_t \quad (4.8)$$

Such a procedure is valid in the context of stationary variables, but if the system contains  $I(1)$  (and possibly co-integrated) variables, the usual Wald statistics do not have their standard distribution, as demonstrated in Toda and Phillips (1993). Fortunately, a simple solution to this problem is provided by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) that simply involves adding extra lags to the VAR. Hence, for instance, if the two variables in (4.8) were found to be  $I(1)$ , a VAR of the order  $k+1$  should be simply estimated and used to test the zero restriction on the first  $k$  lags. The approach of this method is as follows. Firstly, the appropriate lag order in the VAR is tested and the VAR with one lag is augmented [since all of the variables considered here are at most  $I(1)$ ]. Then, an F-test of the appropriate restriction is carried out. It should also be noted that the co-integration tests, carried out later, provide a “backup” for the causality tests since, if a set of variables is co-integrated, there must exist some causal relationship among the variables.<sup>9</sup>

In the light of the results in Table 4.1 and Table 4.2, simple bivariate VAR models of the three variables must be examined. Firstly, the possibility that Government Expenditure and the Price Deflator are co-integrated must be considered. As a precursor to this, the lag order in the bivariate VAR is tested. Table 4.4 reports a variety of tests on the levels of VAR. Since there is a reasonably long sample of data, this begins with estimating a VAR of the order 10 and sequentially reducing the lag order to 1. The first 3 columns of Table 4.4 report standard Information Criteria: the Akaike Information Criterion (AIC), the Schwarz Criterion (SC) and the Hannan-Quinn (HQ) statistics. As can be seen, there are conflicts, with HQ and SC selecting lag 2 but the AIC selecting lag 4. Row 3 of the table shows an F-test for the implied restriction of the levels VAR: it can be seen that the restriction from 10 lags to 4 lags is not rejected at the 5% level, suggesting that lag 4 would be the better choice. This is confirmed by tests for autocorrelation in the VAR at the chosen lags, which suggests that there are significant problems in the individual equations at lag 2. As a result, a level VAR with 4 lags was selected.

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<sup>9</sup> By testing within the augmented VAR framework, the problem of “pre-testing” the system for co-integration and then testing for causality in the VECM can be avoided. A number of studies have suggested that such pre-testing can lead to significant over-rejection of the non-causal null. Furthermore, since a reasonably large sample of data is available, the issues of overfitting are likely to be less important. See Toda and Phillips (1993), Dolado and Lütkepohl (1996), Zapata and Rambaldi (1997) and Clarke and Mirza (2006).

Since the maximum order of integration in the VAR was 1, in order to carry out the non-causality tests suggested by Toda and Yamamoto (1995), it was re-estimated with 5 lags. The results of the Wald tests of zero restrictions on the first 4 lags of the Price Deflator in the nominal Government Expenditure equation ( $\chi^2(4) = 19.02$ ,  $p$ -value 0.00) and on the first 4 lags of the nominal Government Expenditure variable in the Prices equation ( $\chi^2(4) = 3.77$ ,  $p$ -value 0.43) suggest, perhaps not too surprisingly, that causality runs from Prices to the nominal Government Expenditure variable.

Table 4.4 Tests on Levels VAR

Lag Order Selected	AIC	HC	HQ
	4	2	2
F-test for restriction from 10 lags	$X^2(24)=35.00$ [0.0683]	$X^2(32)=55.78$ [0.0057]**	$X^2(32)=55.8$ [0.0057]**
Test for autocorrelation at selected lag in:			
a) Govt. Exp. Eqn.	$F(5, 114) = 1.89$ [0.1022]	$F(5, 118) = 3.28$ [0.0082]**	$F(5, 118) = 3.28$ [0.0082]**
b) Price Deflator Eqn.	$F(5, 114) = 0.42$ [0.8314]	$F(5, 118) = 2.90$ [0.0165]*	$F(5, 118) = 2.90$ [0.0165]*

Figures in [ ] are  $p$ -values and \* indicates significance at the 10% level.

Table 4.5 shows the results of the Johansen trace test for co-integration between the two variables. It can be seen that it confirms the expectation that they do, in fact, co-integrate, with a co-integrating vector  $\beta$  of (1, -1.47), suggesting that (log) nominal Government Expenditure and the Price Deflator level do move together in the long run and that Government Expenditure increases more than proportionately with the Price Deflator.

Table 4.5 Bi-Variate Co-integration Test: Government Expenditure and Price Deflator

	Trace Test
Null: At most, zero co-integrating vectors	15.719** [0.0463]
Null: At most, one co-integrating	0.003 [0.952]

Figures in [ ] are  $p$ -values, \* indicates significance at the 10% level and \*\* at the 5% level.

A Likelihood Ratio (LR) test of the restriction that  $\beta$ , the co-integrating vector, was in fact (1, -1) produces a test statistic of 15.55 which, with one degree of freedom, results in rejection at less than 1%. This seems to contradict the unit root tests in the previous

section in that, when real Government Expenditure is constructed as  $\log(\text{Government Expenditure}) - \log(\text{Prices})$ , the (1, -1) restriction is implicitly imposed so that the LR strongly rejects the relationship. However, the co-integration results presented in Table 4.5 above, use the standard assumption of allowing only a constant that is restricted to the co-integrating vector and an orthogonal (unrestricted) constant in the VAR (to allow for trends in the data). If the co-integration test is re-estimated allowing both a constant and trend that are restricted to the co-integrating vector, there is, once again, strong evidence of a single co-integrating vector (as shown in the first column of Table 4.6). Now, the normalised  $\beta$  vector is (1, -1.056, -0.0116) and a test of the restriction that the vector  $\alpha$  is (1, -1,  $\alpha_3$ ) yields an LR test (0.48 with  $p$ -value 0.49) that does not reject the restriction. This fits well with the finding of the unit root tests in Section 4.2 that real Government Expenditure is stationary around a linear trend.

Table 4.6 also shows the results of the co-integration test that allowed for a fixed break in 2003Q4 in order to ascertain whether the adoption of Financial Law No.17/2003 had any impact on the results. As can be seen, the result is not affected: both tests support the notion of co-integration between the two variables.<sup>10</sup>

Table 4.6 Bi-Variate Co-integration Test: Government Expenditure and Price

	<b>Trace Test</b>	<b>Trace Test</b>	<b>Trace Test</b>
	<b>Orthogonal constant</b>	<b>Constant and trend in CV – no break</b>	<b>Constant and trend in CV – break in 2003 Q4</b>
At most zero CVs	15.72** [0.046]	27.02** [0.036]	37.42** [0.037]
At most one CV	0.003 [0.95]	3.89 [0.76]	6.75 [0.79]

Figures in [ ] are  $p$ -values, \* indicates significance at the 10% level and \*\* at the 5% level.

It can be seen from the results of the estimated restricted model in

Table 4.7 that the co-integrating vector can be written as a simple equation:

$$\text{LNE} = 1 * \text{LP} + 0.013181 * \text{trend} \quad (4.9)$$

<sup>10</sup> The standard Johansen estimation framework can still be applied, allowing dummy variables to model the trend breaks (both restricted to the co-integration space and unrestrictedly), but new sets of critical values are required for the trace and maximal eigenvalue tests. Johansen, Mosconi, and Nielsen (2000), p.216, provide the appropriate critical values, and the test is implemented in J-multi (Lutkepohl and Kratzig 2007). Also see Joyeux (2007) as a source.

Table 4.7 Co-integration Restrictions for Nominal Government Expenditure and Price Deflator

Co-integration Restrictions:	
B(1, 1)=-1, B(1, 2)=1 Convergence achieved after two iterations Restrictions identify all co-integrating vectors	
LR test for binding restrictions (rank = 1):	
Chi-square (1)	0.48
Probability	0.49
Co-integration Eq.	
LNE (-1)	-1
LP (-1)	1
@TREND(80Q1)	0.013 (0.000) 30.23
C	10.92

Therefore, the coefficient of the trend implies that real Government Expenditure would rise at around 1.3% per quarter, or approximately 5.4% per annum. Table 4.8 compares these VECM results to the actual data and indicates that, for the actual quarterly data, the average change in real Government Expenditure was growing at 1.4% and the average of the annual change was growing at 5.5%. The co-integration between nominal Government Expenditure and Prices suggests that the predicted underlying growth rate of real Government Expenditure fits with the actual growth of real Government Expenditure.

Table 4.8 Comparison of VECM and Actual Government Expenditure Data

Quarterly		Annually	
VECM Prediction	Average Change of Actual Data	VECM Prediction	Average Change of Actual Data
1.3%	1.4%	5.4%	5.5%

The plot of log of real Government Expenditure in Figure 4.2 also shows that the underlying trend in growth rate does not seem to have increased, although there has been greater volatility in the post 2000 period.

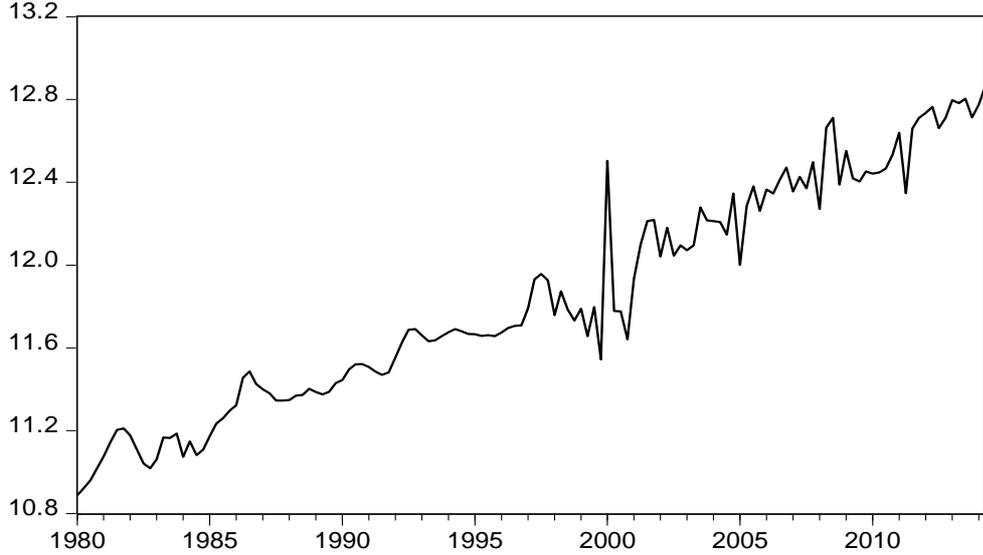


Figure 4.2 Plot of Real Government Expenditure

Finally, since simple bi-variate systems have been estimated here, this implies that, given the acceptance of the unit root tests that suggest both Prices and nominal Government Expenditure are  $I(1)$ , then there are either no co-integrating vectors or a single co-integrating vector. Finding two co-integrating vectors would invalidate the unit root tests because the only way to have two co-integrating vectors with two variables is for the result to become  $I(0)$ . Therefore, in the case of zero or one co-integrating vector, the Johansen test for co-integration will hinge upon the single largest eigenvector. One way to examine the stability or instability of the co-integrating result is to estimate this eigenvalue recursively. Two options are available. The first is to look at the recursively estimated eigenvalue to see whether it shows signs of instability. The second is to carry out a test for instability. Hansen and Johansen (1999) provide such a test, based on the difference between the full sample eigenvalue and the one estimated from the recursive sample. Intuitively, if these differ “substantially”, this suggests instability of the co-integrating vector. If  $\lambda_i^{(\tau)}$  is denoted as the eigenvalue that is estimated over a sample of data of size  $\tau$ , then the test statistic is defined as:

$$\Gamma(\xi_i^{(\tau)}) = \frac{\tau}{T} |(\xi_i^{(\tau)} - \xi_i^{(T)}) / \hat{\sigma}_{ii}| \quad (4.10)$$

where

$$\xi_i^{(\tau)} = \log\left(\frac{\lambda_i^{(\tau)}}{1 - \lambda_i^{(\tau)}}\right)$$

Ploberger, Krämer, and Kontrus (1989) tabulates critical values for the limit distribution of the test. These tests are implemented in J-multi, an interactive software designed for univariate and multivariate time series analysis [see Lutkepohl and Kratzig (2007)] and the two graphs below show, respectively, the estimated test statistic and the eigenvalue, both being estimated recursively. While there do seem to be some fluctuations in the eigenvalue around 2000, there is no formal evidence of instability.

It can be concluded that the estimated co-integrating vector is reasonably stable (since, here, the method is focused on the stability of the long-run relationship, and these results were obtained using the concentrated likelihood function and full sample standard errors).

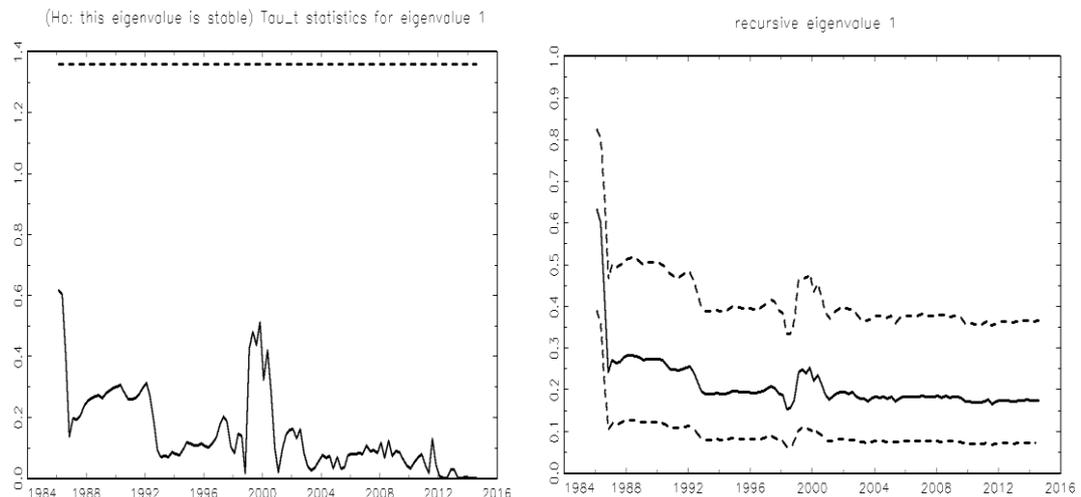


Figure 4.3 Stability Tests for Price and Nominal Government Expenditure

In summary, then:

1. There is evidence that Government Expenditure and Prices do co-integrate and that, if allowance is made for a trend in the co-integrating vector, the restriction that the co-integrating vector is  $(1, -1)$  cannot be rejected, as implied by the unit root tests that show real Government Expenditure is  $I(0)$  when allowance is made for a trend.
2. The results of tests suggest co-integration without the need to consider a break in the co-integrating vector, although allowing for one still yields the result that the variables co-integrate.

- Examination of the recursively estimated eigenvalue suggests the co-integration result is robust, showing no sign of a significant break either around the time of the Asian Financial crisis or at the introduction of Financial Law No.17/2003.

Turning now to the other possible bivariate relationships among the data, the bi-variate VAR that includes nominal Government Expenditure and nominal GDP is considered first. The same procedure as above is used to establish lag length, this time finding that a lower order VAR with 3 lags produced acceptable diagnostics. Estimating a VAR (4) and testing zero restrictions on the first lag showed evidence of causality running from GDP to Government Expenditure ( $\chi^2(3) = 8.2612 [0.0409]^*$ ), but not from Government Expenditure to GDP ( $\chi^2(3) = 0.89374 [0.8269]$ ). Table 4.9 shows the results of the Johansen trace tests of Government Expenditure and GDP when allowing an orthogonal constant in the VAR, when restricting the constant and trend to the co-integrating vector with no break and when allowing a break in 2003Q4. All three tests suggest no evidence of co-integration between the variables.

Table 4.9 Bi-Variate Co-integration Test: Government Expenditure and GDP

	Trace Test		
	Orthogonal constant	Constant and trend in CV – no break	Constant and trend in CV – break in 2003 Q4
At most zero CVs	11.452 [0.185]	18.25 [0.3343]	28.36 [0.2681]
At most one CV	0.206 [0.650]	6.62 [0.3963]	10.99 [0.3904]

Next, the bivariate VAR that includes GDP and the Price Deflator, where a VAR (4) was found to be acceptable, is considered. Estimating the VAR (5) and testing the zero restrictions on the first 4 lags showed clear bi-directional causality with the zero restrictions on the lags of Prices in the GDP equation, rejecting at better than 1% ( $\chi^2(4) = 18.564 [0.0010]**$ ), and the zero restrictions on GDP also rejecting at better than 1% ( $\chi^2(4) = 16.492 [0.0024]**$ ). The co-integration test showed no evidence of co-integration between the two variables, as can be seen from Table 4.10. As before, Table 4.10 shows the results of the Johansen co-integration test of GDP and Price Deflator with an orthogonal constant in the VAR, when restricting the constant and trend to the co-integrating vector with no break and when testing for co-integration that allows a fixed break in 2003Q4 to check whether the adoption of Financial Law

No.17/2003 had any impact on the results. All three tests also suggest no evidence of co-integration between the variables.

Table 4.10 Bi-Variate Co-integration Test: GDP and Price Deflator

	Trace Test		
	Orthogonal constant	Constant and trend in CV – no break	Constant and trend in CV – break in 2003 Q4
At most zero CVs	5.045 [0.804]	15.02 [0.5799]	22.40 [0.6149]
At most one CV	0.9156 [0.339]	4.11 [0.7262]	6.56 [0.8133]

In summation, the simple bi-variate models tell us the following. There seems to be unidirectional causality running from GDP to Government Expenditure and from Prices to Government Expenditure. In the case of Prices and Government Expenditure, there is also evidence of a long-run co-integrating relationship, which appears to be stable and supports the suggestion that the causality runs from Prices to Government Expenditure. The estimated co-integrating vector also seems to be stable and suggests that Government Expenditure increases more than one-for-one with Prices. There is no evidence of co-integration between the other two pairs of variables.

Next, in this section, the three-variable VAR (nominal government expenditure, prices and nominal GDP) is considered. It seemed appropriate to re-test lag orders and, so, the same procedure as above was followed, with very similar results. HQ and SC selected lag order 2, while AIC selected lag order 5. However, once again, the VAR(2) was poorly specified, with only the Government Expenditure equation failing to reject the null of no autocorrelation, while the VAR(5) was clean and, so, was preferred. For the causality tests, the VAR(6) was estimated and tested, with zero restrictions on the first 5 lags. The results of Granger causality testing<sup>11</sup> in the three variables of the VAR in Table 4.11 (below) indicate that all null hypotheses can be rejected, except the null hypothesis that Government Expenditure does not Granger-cause GDP and Prices; this cannot be rejected because the *p*-value is 0.6451, i.e. is above 5%. This means that there is no evidence to suggest that Government Expenditure is causal for GDP and Prices. However, there is support for the hypotheses that:

1. GDP and Prices affects Government Expenditure;

<sup>11</sup> In this chapter, we interpret the results of the Granger causality tests using the (common) terminology ‘*X* is causal for *Y*’. However, we note here that these tests do not necessarily imply causal links, rather that *X* contains predictive information on *Y*.

2. Government Expenditure and GDP affects Prices;
3. Government Expenditure and Prices affects GDP;
4. GDP affects Government Expenditure and Prices; and
5. Prices affect Government Expenditure and GDP.

Table 4.11 Causality in the Three Variables VAR

Null Hypothesis	F-Statistic	Probability
LNY, LP do not Granger-cause LNE	2.4905	0.0068*
LNE, LNY do not Granger-cause LP	2.7160	0.0032*
LNE, LP do not Granger-cause LNY	2.5457	0.0057*
LNE does not Granger-cause LNY, LP	0.7831	0.6451
LNY does not Granger-cause LNE, LP	2.7719	0.0026*
LP does not Granger-cause LNE, LNY	2.8614	0.0019*

Finally, the possibility of co-integration among the three variables is considered in this section. The results of the three-variables Johansen co-integration in relation to Government Expenditure, Prices and GDP in Table 4.12 show that the trace testing for the Johansen co-integration with orthogonal constant in VAR indicates that there is no co-integration at the 0.05 level.

Table 4.12 Three-Variate Co-integration Test: Government Expenditure, Prices and GDP

	Trace Test		
	Orthogonal constant	Constant and trend in CV – no break	Constant and trend in CV – break in 2003 Q4
At most zero CVs	25.122 [0.157]	47.915 [0.015]	57.46 [0.052]
At most one CV	5.905 [0.707]	15.813 [0.508]	23.57 [0.541]
At most two CVs	0.710 [0.399]	5.170 [0.572]	6.93 [0.778]

However, the results using a constant and trend restricted to the co-integrating vector do suggest co-integration. Finally, in the fourth column, a break in both the co-integrating vector trend and intercept was included and carried out with J-multi. The *p*-values are very close to being significant but, technically, were not significant at the 5% level. It can be concluded that the strongest evidence of co-integration occurs when simply allowing both constant and trend in the co-integrating vector and, therefore, the VECM needs to be estimated using the second set of results – allowing constant and trend to be restricted to the co-integrating vector.

The first thing to note is that, from the results of the VECM of LNE, LP and LNY with a constant and trend allowed (Table 4.13<sup>12</sup>), the co-integrating vector does not seem to make sense. If the co-integrating vector on LNE is normalised, it can be written as:

$$LNE = 27.44394 + 1.766945LP - 1.477801LNY + 0.051447TREND \quad (4.11)$$

These results are difficult to rationalise; firstly, it's hard to understand why government expenditure would be negatively related to economic activity in the long run over this span of data and, secondly, the coefficient of the trend term is now considerably higher than in the simple bivariate case, suggesting a trend increase in government expenditure (over and above that implied by the coefficient of 1.766 on the price variable) in excess of 5% per quarter. If this is compared to the earlier result, when strong evidence of co-integration between LNE and LP are existed, the co-integrating vector then suggested was:

$$LNE = 10.92 + 1.056LP + 0.0116TREND \quad (4.12)$$

It can be seen that the coefficient of prices was close to one. This simply implies that government expenditure, in nominal terms, rose one-for-one with prices, an intuitively attractive result.

Table 4.13 VECM of LNE, LP and LNY with a Constant and Trend Allowed

Sample (adjusted): 1981:2 2014:2			
Standard errors in ( ) & t-statistics in [ ]			
Co-integration Equation			
LNE (-1)		1	
LP (-1)		-1.766945 (0.15579) [-11.3422]	
LNY(-1)		1.477801 (0.30300) [ 4.87725]	
@TREND(80Q1)		-0.051447 (0.00858) [-5.99872]	
C		-27.44394	
Error Correction:	D(LNE)	D(LP)	D(LNY)
ECM term	-0.710577 (0.17468) [-4.06790]	0.098763 (0.04826) [ 2.04642]	0.014404 (0.04542) [ 0.31711]

<sup>12</sup> To save space, only the estimated co-integrating vector and the estimates of the coefficient of the error correction terms ( $\hat{\alpha}$ ) in each of the three equations are presented—lagged dynamics are omitted, but available upon request.

If the VECM is re-estimated using the more standard formulation, which permits a constant only in the co-integrating vector and an orthogonal constant to allow for trends in the data, the results are as in Table 4.14 below.

Table 4.14 VECM of LNE, LP and LNY with a Constant Only

Sample (adjusted): 1981:2 2014:2			
Standard errors in ( ) & t-statistics in [ ]			
Co-integration Equation			
LNE (-1)		1	
LNY (-1)		-0.224373 (0.12969) [-1.73007]	
LNP(-1)		-1.156483 (0.18863) [-6.13093]	
C		-9.335545	
Error Correction:	D(LNE)	D(LNY)	D(LNP)
ECM term	-0.434878 (0.12225) [-3.55740]	0.049240 (0.03102) [ 1.58757]	0.054233 (0.03350) [ 1.61890]

Now, the co-integrating vector seems more sensible ( $t$ -statistics are in parentheses):

$$LNE = 9.3355 + \frac{1.15648LP}{(6.13)} + \frac{0.2243LNY}{(1.73)} \quad (4.13)$$

However, the coefficient of LNY is insignificantly different from 0 ( $t$ -stat is 1.73) and, if the loading vector of the VECM is examined, neither LNY nor LP are significant, whereas the coefficient of LNE is significant. The earlier result in the bivariate VAR (which showed strong evidence of co-integration) suggested that the coefficient of LP was -1.47 (if the VECM imposing that restriction is re-estimated).

It can be seen in

Table 4.15 that, when the VECM with restrictions for LNY, LNE and LP is carried out, the coefficient of LNY is -0.011486 with a  $t$ -stat of -0.75 and, therefore, statistically insignificantly different to zero. Importantly, also note that the restriction is not rejected by the data, with a Likelihood Ratio test with a  $\chi^2(1)$  test statistic of 1.478 and a  $p$ -value of 0.224. Indeed, a further test restricting the coefficient of Price to -1.47 and that of LNY to zero gives a  $\chi^2(2)$  test statistic of 2.09 and a  $p$ -value of 0.353, suggesting no significant role for GDP in the co-integrating space.

Table 4.15 VECM with Restrictions for LNY, LNE and LP

Sample (adjusted): 1981:2 2014:2			
Standard errors in ( ) & t-statistics in [ ]			
Co-integration Restrictions: B(1, 1)=1, B(1, 3)=-1.47 Convergence achieved after two iterations Restrictions identify all co-integrating vectors			
LR test for binding restrictions (rank = 1):			
Chi-square(1)		1.478209	
Probability		0.224055	
Co-integration Equation			
LNE (-1)		1	
LNY (-1)		-0.011486 (0.01522) [-0.75449]	
LP (-1)		-1.470000	
C		-12.40406	
Error Correction:	D(LNE)	D(LNY)	D(LP)
Coint. Eq. 1	-0.313370 (0.10582) [-2.96142]	0.053901 (0.02627) [ 2.05207]	0.061562 (0.02832) [ 2.17356]

In the light of these results, the next section will focus on the simple two-variable VECM to see what further inferences can be drawn. However, it is worth summarising the results of this section:

1. The co-integration results support the notion that, within the context of Indonesia, real Government Expenditure is trend stationary – it is simply co-integrated with the GDP Deflator.
2. There is evidence, from both the bivariate and tri-variate models, of causality from GDP and Prices to Government Expenditure, but there is no evidence whatsoever of causality running from Government Expenditure to economic activity, thus providing support for the Wagner Hypothesis in this case.
3. The fact that there is no significant role for economic activity in the co-integrating vector strengthens this conclusion.

#### 4.4 Estimated Co-integrated VAR and Cyclicity

Wagner's Law relates to a hypothesis regarding the long-run behaviour of the variables in question. Results in the previous section give support to Wagner's Law hypothesis in the context of the current data set. The previous section also found evidence that there is a long-run relationship between Government Expenditure and Prices. In this final brief section, it will be investigated whether estimation of the implied VECM model can throw any further light on the relationship.

Table 4.16 shows the estimated VECM. (It is noted that the co-integrating vector containing only a constant is assumed – this is the version most estimated in the literature, and the results above have suggested the robustness of the co-integration and its stability.) As can be seen, the parameters of the “loading vector” ( $\hat{\alpha}$ ) suggest that it is the level of Government Expenditure that does most of the correction, with its coefficient (-0.33) being clearly significant at 5%, while the coefficient of the ECM term in the  $\Delta P$  equation is relatively low (0.05) and only significant at the 10% level.

Table 4.16 Estimated Co-integrated VAR

Dependent Variable	Equation	
	$\Delta G$	$\Delta P$
$\hat{\alpha}'x_{t-1}$	-0.33 (-3.24)**	0.05 (1.80)*
$\Delta G_{t-1}$	-0.38 (-3.40)**	-0.01 (-0.26)
$\Delta G_{t-2}$	-0.10 (-0.92)	-0.00 (-0.007)
$\Delta G_{t-3}$	-0.12 (-1.41)	-0.01 (-0.39)
$\Delta P_{t-1}$	0.64 (1.99)**	0.30 (3.37)**
$\Delta P_{t-2}$	0.14 (0.43)	0.31 (3.46)**
$\Delta P_{t-3}$	-0.59 (-1.81)*	-0.17 (-1.94)**
$R^2$	0.37	0.21

Figures in ( ) are t-statistics, \* indicates significance at the 10% level and \*\* at the 5% level.

The co-integration suggests that, in this example, there is one permanent shock or common trend (Stock and Watson 1988) and one transitory shock. The frameworks,

developed by King et al. (1991), Gonzalo and Granger (1995) and Gonzalo and Ng (2001), allow us to use the estimated co-integrating vectors to decompose the innovations of the system into their permanent and transitory (P-T) components. The steps taken to achieve the P-T decomposition are clearly laid out in Gonzalo and Ng (2001) and centre around the construction of a matrix  $\hat{G} = (\hat{\alpha}'_{\perp}, \hat{\beta}')'$  where  $\hat{\alpha}$  and  $\hat{\beta}$  are the estimated loading vector and co-integrating vector respectively, and where  $\alpha_{\perp} \alpha' = 0$ . The permanent and transitory shocks can then be obtained as  $\hat{G}\hat{e}_t$ , where  $\hat{e}_t$  is the set of residuals from the estimated VECM. Intuitively, if one of the coefficients of the loading vector  $\hat{\alpha}$  is relatively small, then the  $i_{th}$  variable causes little adjustment in the face of transitory shocks. This variable would gain little weight in the transitory innovations and more weight in the permanent innovations. It is clear, therefore, that the decomposition is significantly influenced by the construction of these weights and, thus, the  $\hat{\alpha}$  vector. Indeed, Gonzalo and Ng (2001) advise the setting of statistically insignificant parameters in the vector to zero, and Chan and MacDonald (2015) show the sensitivity of results to the vector in an asymmetric setting. In this particular case, as noted above, the restriction is that  $\hat{\alpha}_2$  (the coefficient of the ECM in the  $\Delta P$  equation) could not reject the restriction that it was zero at the normal 5% significance level. Hence  $\hat{\alpha} = (0.33, 0.0)$  has been imposed.<sup>13</sup>

Table 4.17 Orthogonalised Variance Decomposition

Horizon $h$	$\Delta G_{t+h} - Et \Delta G_{t+h}$		$\Delta P_{t+h} - Et \Delta P_{t+h}$	
	P	T	P	T
1	0.019	0.981	1.000	0.000
2	0.042	0.958	0.9998	0.001
3	0.043	0.957	0.999	0.001
4	0.044	0.956	0.998	0.002
$\infty$	0.051	0.949	0.997	0.003

The table shows the proportion of the variance in the  $h$ -step-ahead forecast error that is attributable to the Permanent (P) and Transitory (T) shocks.

Table 4.17 displays the orthogonalised forecast error variance decomposition, showing what fractions of the  $h$ -step-ahead forecast error variance can be attributed to both the permanent and transitory shocks. As can be seen, and as anticipated, the

<sup>13</sup> Results are little influenced by this, given the low estimated coefficient in the VECM (0.05).

results suggest that most of the variance in the growth of Government Expenditure is due to transitory shocks, i.e. 95% at the infinite horizon, whereas for the variance of the growth in Prices the equivalent figure is under 1%. The practical implication of these results in the present case is that, for the vast majority of the deviations from the equilibrium relationship between Government Expenditure and Prices, the error correction model (ECM) can be inferred due to transitory shock to Government Expenditure. These transitory shocks will, therefore, have implications for the level of real government expenditure. Thus, for example, a positive transitory shock to Government Expenditure will raise it (and therefore real government expenditure) above the long-run equilibrium value suggested by the co-integrating vector. This raises the interesting question of the extent to which the ECM (or the deviation of nominal Government Expenditure from its long-run trend) is correlated with business cycle fluctuations; the *a priori* expectation being that, if Government Expenditure (both discretionary and through automatic stabilisers) works to stabilise fluctuations in GDP, it would be expected that the ECM will be negatively correlated with deviations of economic activity from the trend. Thus, when there is a positive deviation of output from trend, a fall in Government Expenditure might be expected to stabilise the level of activity, raising economic activity and raising income through taxes, but lowering expenditure on welfare payments. One corollary of the results above is that, if the P-T decomposition suggested in Gonzalo and Granger (1995) is used, the trend component of the Price variable will dominate, leaving very little cyclical fluctuation to be found, while the Government Expenditure variable will show significant deviations from the trend. The P-T decomposition suggested in Gonzalo and Granger (1995) decomposes the vector of series  $X$  into their Permanent and Transitory components as:

$$X_t = A_1 \hat{\alpha}'_{\perp} X_t + A_2 \hat{\beta}' X_t \quad (4.14)$$

where  $A_1 = \hat{\beta}_{\perp} (\hat{\alpha}'_{\perp} \hat{\beta}_{\perp})^{-1}$  and  $A_2 = \hat{\alpha} (\hat{\beta}' \hat{\alpha})^{-1}$ .

Figure 4.4 plots the Government Expenditure series and the trend component, while Figure 4.5 plots the cyclical component. This is in line with Lettau and Ludvigson (2004).

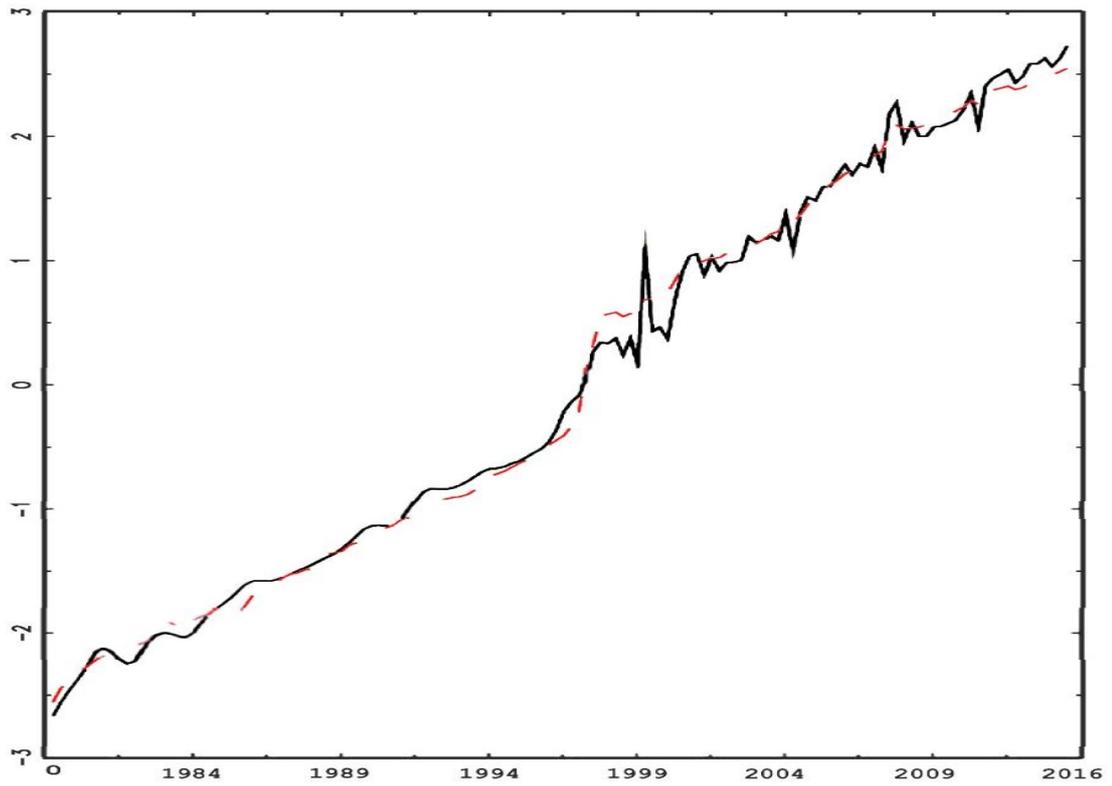


Figure 4.4 Government Expenditure and its Trend

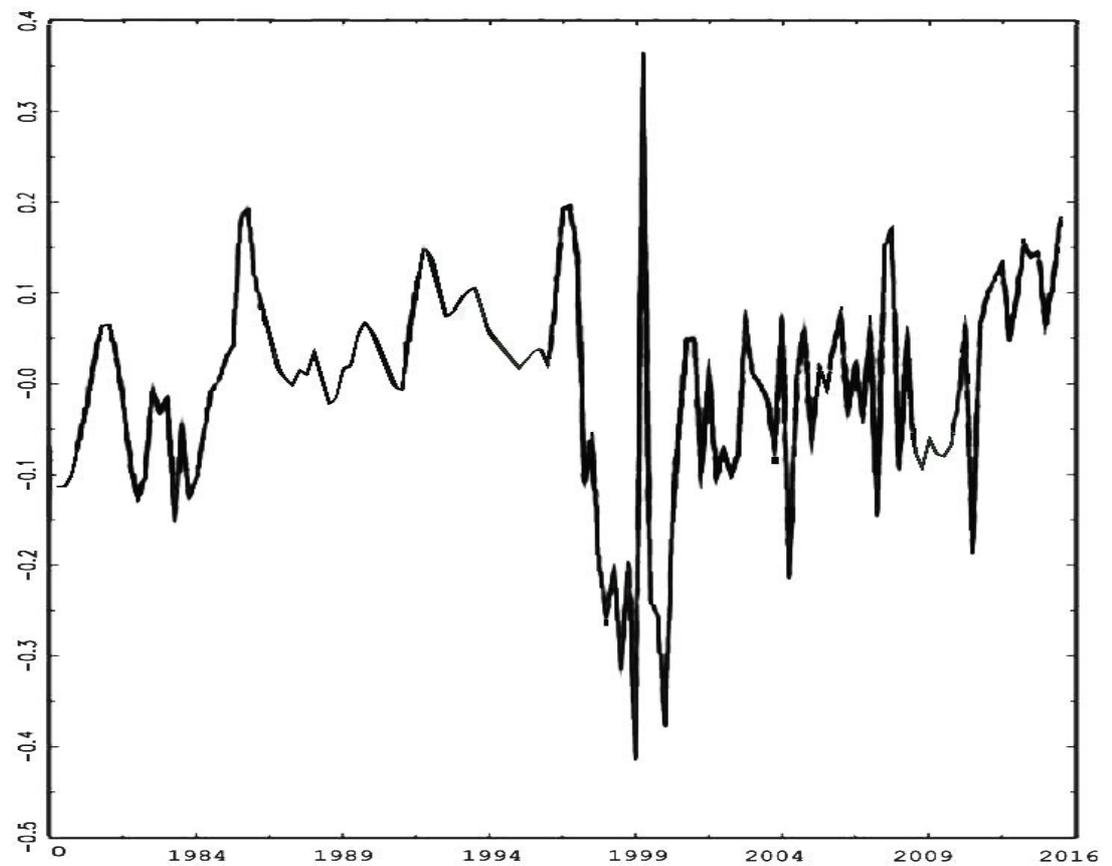


Figure 4.5 Cyclical Component of Government Expenditure

In this particular case [and indeed as in the case of Lettau and Ludvigson (2004)], when there is a single co-integrating vector among  $n$  variables (and thus  $n-1$  common trends), then the Gonzalo and Granger (1995) decomposition will, in all cases, simply show the cyclical component as the ECM term.

The above discussion raises the question of the extent to which the cyclical movements in economic activity are correlated with the cyclical component of nominal Government Expenditure (the ECM) as calculated above. To test this, the data on nominal GDP is de-trended using a standard Hodrick Prescott filter ( $\lambda = 1600$ ). What we require is a measure of the extent to which these cyclical components (in GDP and Government Expenditure) are “in- phase” with each other.

In other words, it is the case that when GDP is above trend, Government Expenditure is below trend. Harding and Pagan (2006) have suggested a number of measures for testing whether the cyclical components of time series data are synchronised with each other, using simple binary indicators that take the value of “1” when a series is in an expansionary phase and “0” when in a contractionary phase.

If these binary measures are denoted as  $S_{GE_t}$  and  $S_{GDP_t}$ , respectively, for Government Expenditure and GDP, then their concordance index is calculated as:

$$\hat{I} = \frac{1}{T} \left\{ \sum_{t=1}^T S_{GE_t} S_{GDP_t} + \sum_{t=1}^T (1 - S_{GE_t})(1 - S_{GDP_t}) \right\} \quad (4.15)$$

This concordance statistic takes the value of “1” when the two series are perfectly pro-cyclical ( $S_{ge_t} = S_{gdp_t}$ ) and “0” when the two series are perfectly counter-cyclical ( $S_{ge_t} = 1 - S_{gdp_t}$ ). Harding and Pagan (2006) suggest using  $\rho_s$ , the correlation between  $S_{ge_t}$  and  $S_{gdp_t}$ , as a test of the null of non-synchronisation between the two series. This correlation can be robustly estimated using the Generalized Method of Moments (GMM) and the moment condition:

$$E \left[ \sigma_{S_{ge_t}}^{-1} (S_{ge_t} - \mu_{S_{ge_t}}) \sigma_{S_{gdp_t}}^{-1} (S_{gdp_t} - \mu_{S_{gdp_t}}) - \rho_s \right] = 0 \quad (4.16)$$

Since both the cyclical components of nominal Government Expenditure and nominal GDP as calculated above are mean zero, it seems logical to construct the two binary indices using the simple rule that  $S_{ge_t} = 1$  whenever the cyclical component is greater

than 0, and is 0 at all other times. This means that the measure is picking up periods when it is below trend. If this is done, the simple coherence index takes the value of 0.355 and the correlation calculated from equation (4.12) is -0.2944, with a  $t$ -statistic of -2.73 and a corresponding  $p$ -value of 0.007, suggesting a significant level of coherence between the two series, with the cyclical components of nominal GDP and Government Expenditure being counter-cyclical.

## 4.5 Conclusions

This chapter contributes to a better understanding of the role played by fiscal policy in the Indonesian economy by presenting the empirical results of Wagner's Law and the dynamics of government expenditure in Indonesia. This study deals with examining the historical role of fiscal policy and the relationship between government expenditure and macroeconomic activity. This section focused on one interpretation: the validity or otherwise of Wagner's Law in the presence of price dynamics. Causality tests and an analysis of the cyclical components of economic activity (measured using GDP) and Government Expenditure were used to examine the nature of the relationship between these series. Using standard Johansen co-integration testing, Government Expenditure and the Price level were found to share a common long-run trend. The analysis was then expanded through a decomposition of the series into permanent and transitory shocks using the method suggested by Gonzalo and Ng (2001). This thesis extends previous research on developing economies by studying the Indonesian economy over the period between 1980 and 2014, a period of substantial growth and development, which makes it a likely candidate for testing of the Wagner's Law.

A key finding is that there is evidence of causality running from GDP to Government Expenditure and from Prices to Government Expenditure. In the case of Prices and Government Expenditure, there is also evidence of a long-run co-integrating relationship, which appears to be stable and supports the suggestion that causality runs from Prices to Government Expenditure. The estimated co-integrating vector also suggests that Government Expenditure increases at a rate higher than one-for-one with respect to Prices. Last but not least, it is evidence that the vast majority of the deviations from the equilibrium relationship between Government Expenditure and Prices (the ECM) are founded upon transitory shocks to Government Expenditure.

There are evidences in favour of Wagner's Law, using data from Indonesia, and there is significant evidence of a strong counter-cyclical relationship between the cyclical component of GDP and Government Expenditure, suggesting that government expenditure acts to stabilise the economy. Therefore, in conclusion, the use of fiscal policy in Indonesia that was aimed at stabilising the economy has caused long-run growth in the way the usual interpretation of Wagner's Law would suggest.

This finding is relevant to the three previous studies in Indonesia that were presented in Chapter 2; Permana and Wika (2014), Ismal (2011) and Ramayandi (2003) studied Wagner's Law using different methodologies, and they found support for Wagner's Law. In addition, the conclusion is also supportive of the discussions in Chapter 1 (Introduction) and Chapter 3 (Indonesian Fiscal Policy Literature Review Background). Even though Indonesia is a developing country, it is currently the 18th-largest economy in the world and is experiencing remarkable economic growth with a pattern that is quite similar to developed countries that usually (based on some studies that have been mentioned) also offer support for Wagner's Law.

There are evidences in favour of Wagner's Law, using data from Indonesia, and there is significant evidence of a strong counter-cyclical relationship between the cyclical component of GDP and Government Expenditure, suggesting that government expenditure acts to stabilise the economy. Therefore, in conclusion, the use of fiscal policy in Indonesia that was aimed at stabilising the economy has caused long-run growth in the way the usual interpretation of Wagner's Law would suggest. The two key points (and findings from this chapter) are:

1. There is support for Wagners law in the sense that when causality test are carried out on the (log) levels of the variables. There is evidence that GDP is causal for Government expenditure (Wagners Law), but not the other way around. In addition, as there is causality running from prices to government expenditure and these two variables do move in an equilibrium relationship, suggesting that real government expenditure is trend stationary.
2. The chapter finds that most of the fluctuations in government spending are transitory. This supports the findings of the previous paragraph in that such transitory fluctuations do not impact on the long run outcome for economic

activity. The finding that these fluctuations are counter-cyclical with the (stationary) fluctuations in GDP does suggest that they may well play a stabilising role.

The next chapter, that is Chapter 5, will measure Indonesia's fiscal policy multiplier by using of the sign restrictions Vector Auto Regression.

# **CHAPTER 5**

## **MEASURING INDONESIA'S FISCAL POLICY MULTIPLIER**

### **5.1 Introduction**

The previous chapter looked at the long-run characteristics of the data using the co-integrating framework, while the current chapter will focus on the short-run characteristics of the data and, in particular, the impact of shocks to fiscal policy on the short-run dynamics of several key macroeconomic indicators. In order to achieve this, the scope of the analysis will be broadened by extending the set of variables included in the model to incorporate both monetary and fiscal policy variables and a wider range of economic indicators.

As Keynesian economists believe that the government, through its use of fiscal policy, must play an active role in stabilising the macro economy, then the effectiveness of such policies hinges on the size the fiscal multipliers. That is, the higher the fiscal multiplier, the more effective the fiscal policy. To examine and identify the circumstances in which a fiscal expansion stimulates output effectively, or otherwise, this chapter uses a Structural Vector Auto Regressive (SVAR) model to attempt to identify the sizes of such multipliers in the case of Indonesia. Accordingly, the focus of this chapter is to answer questions with regard to the effectiveness of the process and the ability of Indonesia's authorities to use discretionary fiscal policy to smooth business cycles. The identification of the responses and the careful explanation of the measurement of shocks are involved in this short-run analysis. Hence, the evaluation, together with estimates of the dimensions and dynamic effects of important fiscal policy measures on the economy, are provided in the results of this chapter.

The balance of this chapter consists of four main sections. Section 2 describes the method by which a Vector Auto Regressive (VAR) model can be used to model and forecast the macro economy and, more importantly, how it can be used to identify the impact of structural shocks, such as fiscal policy shocks, on the short-run dynamics of the economy. Achieving this will require a brief discussion of Impulse Response

Functions (IRFs) and the methods by which structural shocks can be identified within the VAR framework. Section 3 presents the analysis and key results, including brief discussions of the unit root properties of the extended data set, Granger causality test results and, most importantly, the results of the estimation of the SVAR together with its implications for fiscal policy. Section 4 concludes the chapter.

## 5.2 Methodology

The aim of this chapter is, essentially, to establish a model that adequately captures the macroeconomic characteristics of the Indonesian economy and allows analysis of the impact of shocks to fiscal policy variables (i.e. government expenditure and revenue changes) on the macro economy. This implies that two steps must be carried out. The first is to establish a model that adequately captures the characteristics of the macro-economic data sets on the Indonesian economy from 1980Q1 to 2014Q2. The second is to adequately identify shocks to the fiscal policy variables and examine their impacts on the model.

The first step, then, can be achieved by the estimation of a Vector Auto Regression (VAR) model that includes a range of macroeconomic variables. As is well known, VAR models that impose no strict exogeneity assumptions on the set of variables have been found to be an excellent way of summarising macroeconomic data and its interrelationships as well as being used for forecasting. The VAR model can be written as in Equation (5.1):

$$y_t = B_1 y_{t-1} + u_t \quad (5.1)$$

where it is assumed that there is a set of  $K$  variables of interest so that  $B$  represents ( $K \times K$ ) coefficient matrices, and that the error terms are mean zero with constant variance and are non-auto correlated so that  $u_t \sim N(0, \Sigma_u)$ , with  $\Sigma_u$  being the variance/covariance matrix of the residuals and the VAR is assumed to be 1<sup>st</sup> order for simplicity. While, in practice, the model will be estimated with an adequate lag order of  $p$  to ensure that the error terms in the equations are “white noise”, in Equation (5.1) it is the correlations among the error terms that capture the contemporaneous correlations among the variables. The obvious advantage of Equation (5.1) is that it can be consistently estimated using standard Ordinary Least Squares (OLS). However, the key disadvantages are that Equation (5.1) cannot tell us about the structure of the

economy and the errors cannot be interpreted as structural shocks. The structural model would take into account the contemporaneous interrelationships among the variables and it might be written as Equation (5.2):

$$Ay_t = B_1y_{t-1} + e_t \quad (5.2)$$

where, now,  $e_t$  represents the structural shocks to the model. The correct choice of the  $A$  matrix will capture the contemporaneous relationships among the data and will ensure that the structural shocks are independent of each other. In other words, since the structural shocks are from diverse sources such as monetary policy, fiscal policy or oil prices, it is reasonable to assume that they are not correlated with one another and, by simple normalisation, it can be assumed that  $\Sigma_e = I$ . Put more simply, the structural shocks are  $N(0,1)$ . Pre-multiplication of (5.2) by  $A^{-1}$  gives us:

$$y_t = A^{-1}B_1y_{t-1} + A^{-1}e_t \quad (5.3)$$

or

$$y_t = Zy_{t-1} + u_t \quad (5.4)$$

that is now in the form of a standard VAR and can be estimated by OLS where:

$$\begin{aligned} Z &= A^{-1}B \\ u_t &= A^{-1}e_t \\ \Sigma_u &= A^{-1} \Sigma_e A^{-1'} = A^{-1}IA^{-1'} = A^{-1}A^{-1'} \end{aligned}$$

Hence, OLS estimation of (5.4) will yield an estimate of the coefficient matrix  $Z$  and the residuals  $u$  along with their variance covariance matrix. Knowing  $A$  will then allow us to retrieve  $B$  from the relationship  $B = AZ$  and the estimated residuals will allow us to obtain estimates of the structural shocks from  $e_t = Au_t$ . Thus, a question appears as to whether the elements of  $A$  can be obtained from the available information, that is, whether  $\Sigma_u = A^{-1}A^{-1'}$  can be identified. To illustrate the problem, let's simplify notation by setting  $A^{-1} = W$  and assuming a three variable model with three structural shocks.

$$\Sigma_u = WW' \quad (5.5)$$

$$\begin{pmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{pmatrix} = \begin{pmatrix} w_{11} & w_{12} & w_{13} \\ w_{21} & w_{22} & w_{23} \\ w_{31} & w_{32} & w_{33} \end{pmatrix} \begin{pmatrix} w_{11} & w_{21} & w_{31} \\ w_{12} & w_{22} & w_{32} \\ w_{13} & w_{23} & w_{33} \end{pmatrix} \quad (5.6)$$

The problem is that the covariance matrix is symmetric, so that  $\sigma_{21} = \sigma_{12}$ ,  $\sigma_{31} = \sigma_{13}$ ,  $\sigma_{32} = \sigma_{23}$ . Consequently, for example, if the first equality  $\sigma_{21} = \sigma_{12}$  is examined, then it is the case that:

$$\sigma_{12} = w_{11}w_{21} + w_{12}w_{22} + w_{13}w_{23} \quad (5.7)$$

$$\sigma_{21} = w_{21}w_{11} + w_{22}w_{12} + w_{23}w_{13} \quad (5.8)$$

Therefore, only six independent equations (from the estimated variance covariance matrix) and nine unknown elements of  $W$  (and  $A$ ) are obtained. As a result, to achieve identification of the  $A$  matrix, three further restrictions on its elements need to be imposed. For that reason, in terms of the notation above, three further restrictions on the  $W$  matrix need to be imposed so that, uniquely, the remaining six elements can be identified. One popular option is to assume that  $W$  is lower triangular, so that:

$$W = \begin{pmatrix} \sigma_{11} & 0 & 0 \\ \sigma_{21} & \sigma_{22} & 0 \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{pmatrix} \quad (5.9)$$

If this option is chosen, then, two further things are required: finding a way of obtaining such a lower triangular matrix and understanding what such restrictions imply for the model. Fortunately, problems are relatively straightforward to solve; firstly, the variance covariance matrix from the estimated VAR is obtained and some  $W$  such that  $\Sigma_u = WW'$  with  $W$  lower triangular is required. This can be achieved by a standard Cholesky decomposition of the matrix  $\Sigma_u$ . However, it is worth noting (before sign restrictions examined) that the Cholesky decomposition is not unique for positive semi-definite matrices such as  $\Sigma_u$ . The second issue is also relatively straightforward; by imposing the restriction that  $W$  is lower triangular, this chapter essentially imposes a causal ordering on the system.

This uses the well-known result that a “standard Cholesky decomposition” imposes an assumption about the causal ordering on the system so that the shock to the first variable in the system impacts on it contemporaneously and on all of the other variables ordered below it. On the other hand, the shock to the second variable does not impact contemporaneously on the first variable – rather, only with a lag. Another way of thinking of this is that the first variable is the “most” exogenous. It is only contemporaneously affected by a shock to itself; the second variable is contemporaneously affected by shocks to the first variable and by shocks to itself, etc. A simple example will illustrate this. Consider a three-variable VAR with a fiscal

expenditure variable ( $f$ ), an interest rate ( $r$ ) and a measure of real income ( $y$ ). The structural system might be written as:

$$Ay_t = By_{t-1} + e_t \quad (5.10)$$

$$y_t = A^{-1}By_{t-1} + A^{-1}e_t \quad (5.11)$$

If  $A$  is lower triangular, then so is  $A^{-1}$  and, if the notation and order of the three variables is  $(f, r, y)$ , then they are expanded as:

$$\begin{pmatrix} f_t \\ r_t \\ y_t \end{pmatrix} = \begin{pmatrix} z_{11} & z_{12} & z_{13} \\ z_{21} & z_{22} & z_{23} \\ z_{31} & z_{32} & z_{33} \end{pmatrix} \begin{pmatrix} f_{t-1} \\ r_{t-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} \tilde{a}_{11} & 0 & 0 \\ \tilde{a}_{21} & \tilde{a}_{22} & 0 \\ \tilde{a}_{31} & \tilde{a}_{32} & \tilde{a}_{33} \end{pmatrix} \begin{pmatrix} e_{f,t} \\ e_{r,t} \\ e_{y,t} \end{pmatrix} \quad (5.12)$$

where  $A^{-1}B = \begin{pmatrix} z_{11} & z_{12} & z_{13} \\ z_{21} & z_{22} & z_{23} \\ z_{31} & z_{32} & z_{33} \end{pmatrix}$  and  $A^{-1} = \begin{pmatrix} \tilde{a}_{11} & 0 & 0 \\ \tilde{a}_{21} & \tilde{a}_{22} & 0 \\ \tilde{a}_{31} & \tilde{a}_{32} & \tilde{a}_{33} \end{pmatrix}$  and, therefore, by

writing these out for each of the three variables, the following equations can be generated:

$$f_t = z_{11}f_{t-1} + z_{12}r_{t-1} + z_{13}y_{t-1} + \tilde{a}_{11}e_{f,t} \quad (5.13)$$

$$r_t = z_{21}f_{t-1} + z_{22}r_{t-1} + z_{23}y_{t-1} + \tilde{a}_{21}e_{f,t} + \tilde{a}_{22}e_{r,t} \quad (5.14)$$

$$y_t = z_{31}f_{t-1} + z_{32}r_{t-1} + z_{33}y_{t-1} + \tilde{a}_{31}e_{f,t} + \tilde{a}_{32}e_{r,t} + \tilde{a}_{33}e_{y,t} \quad (5.15)$$

And it can be clearly seen that the “fiscal policy” shock  $e_{f,t}$  impacts contemporaneously on all three variables, whereas the “monetary policy” shock impacts contemporaneously on interest rates and output, but not on the fiscal policy variable, etc. Clearly then, and as is well known, the ordering of the variables in the VAR has the potential to significantly impact upon the results of this type of identification scheme. This is important within the context of the VAR that is estimated in this chapter. The VAR consists of 12 variables that characterise the fiscal and monetary policy setting within the Indonesian economy. Some simple causality tests among the variables are reported below. While these are of interest, there is no clear causal ordering among the variables. Obviously, there are a very large number of possible orderings of the 12 variables and, while some general structures on the ordering could be possible, there are still a large number of possibilities, meaning that the results could be questioned. However, alternatives to identification via Cholesky decompositions also are possible, including:

1. non-recursive schemes similar to the Cholesky approach, but which allow for alternative restrictions on the contemporaneous parameters, as suggested by theory [Sims (1986), Bernanke (1986) and Amisano and Carlo (1997)];

2. restrictions on the long-run impact of shocks, such as the idea that nominal shocks (monetary shock, for example) have no long-run impact on real variables like unemployment [see, for example, Blanchard and Quah (1989), Gali (1999) and King et al. (1991)]; and
3. the use of sign restrictions on the estimated IRFs. This is the method adopted for the identification of the SVAR in the next section and it has been popularised in a number of papers [Uhlig (2005), Fry and Pagan (2011), Rafiq and Mallick (2008)] and, most importantly, in a recent paper on fiscal policy by Mountford and Uhlig (2009), who used the technique to identify fiscal policy shocks in a model that included monetary and business cycle shocks. It is their methods that are applied in this chapter.

The sign restriction method draws on the idea, noted above, that the Cholesky decomposition is not unique. Therefore, essentially, it is necessary to find as many matrices,  $W$ , as possible that will satisfy the imposed particular sign restrictions. (Recall that the Cholesky decomposition will obtain some  $W$ , such that  $\Sigma_u = WW'$ , with  $W$  lower triangular.)

For example, if the restriction is that a government expenditure shock must raise government spending for at least four quarters, then the method finds “all” matrices  $W$  that satisfy this constraint. In other words, variants of the  $W$  matrix must be tried and we must “keep” the IRFs of those that satisfy the restriction that the first four IRFs are positive, while rejecting any that does not. Indeed, such sign restrictions could take a variety of forms. An expansionary monetary policy shock could generate the restriction that interest rates must fall on impact and, perhaps, stay negative for two quarters, etc. One way of doing this is to take an orthonormal matrix. For instance, any matrix  $S$  such that  $S'S = I = SS'$  can be written as:  $\Sigma_u = WW' = WIW' = WSS'W' = \Omega\Omega'$  and this can be used to calculate a set of IRFs (noting that  $\Omega$  will not necessarily now be lower triangular). This process must be repeated by drawing as many  $S$  matrices as required. Essentially, then, the sign restriction process follows five steps:

1. The reduced form VAR is estimated;
2. The variance covariance matrix is obtained and a Cholesky decomposition to obtain  $W$  is used. This can be carried out to calculate the IRFs and ensures the

orthogonality of the shocks which, in our application, ensures that the fiscal, monetary and business cycle shocks are orthogonal to each other;

3. A random orthonormal matrix  $S$  is drawn and the IRFs are multiplied from the results of step two by it;
4. The resultant IRF is checked and will be kept only if it satisfies the required sign restrictions; and
5. Steps three and four are repeated until sufficient replications ( $N$ ) are generated, so that the mean or median of these  $N$  can be used as the IRF.

The RATS package program was used to execute all the steps mentioned above and the steps will be applied in the next section, using the code supplied by Doan (2010)<sup>14</sup> and based upon the study of Mountford and Uhlig (2009). Further, the version used to select the IRFs in this chapter is a penalty function approach from Uhlig (2005), as briefly described below. If we assume a simple penalty function of the form:

$$f(x) = \begin{cases} x & \text{if } x \leq 0 \\ 100 * x & \text{if } x \geq 0 \end{cases} \quad (5.16)$$

firstly, if  $f(x)$  is minimised, a positive response will be penalised 100 times more than a negative response. For instance, if there are two variables (such as interest rates and prices) that are required to respond to a shock (perhaps a monetary shock) in different ways (e.g. interest rates to rise and prices to fall) then using a penalty function would allow us to re-specify the above equation so that: a) if prices rose, the penalty function would penalise them 100 times more than if prices fell; while b) if interest rates fell, the penalty function would penalise them 100 times more than if interest rates rose (i.e. this would flip the sign on the penalty function compared to what is above). Following this, numerical optimisation software is used to minimise the function.

Secondly, because the restrictions carried out in the model are the same as Mountford and Uhlig (2009), in the application later in this chapter, the key identifying assumptions carried out are:

1. a business cycle shock moves output consumption, investment and government revenue in the same way for four quarters;
2. a monetary shock moves interest rates up, and reserves and prices down, for four quarters – also the shock is orthogonal to the business cycle shock;

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<sup>14</sup> The code is freely available from the Rats Procedures page: [https://estima.com/resources\\_procs.shtml](https://estima.com/resources_procs.shtml).

3. fiscal policy shocks are orthogonal to both the business cycle and monetary policy shocks; and finally,
4. there is no restriction of the government revenue behaviour when the government expenditure is identified, and vice versa.

### 5.3 Analysis

The major objective of this chapter is to employ the sign restriction method to identify an SVAR model in order to investigate the effects of fiscal policy shocks within Indonesia. To achieve this, the estimation in this chapter begins with standard unit root tests, selection of the optimal lag length and appropriate diagnostic tests of the VAR model. Then, causality tests in the 10-variable VAR are briefly reviewed, focussing on the key interrelationships. Finally, impulse response analysis is applied to show the response of the SVAR to business cycle shocks, monetary shocks, government expenditure shocks and government revenue shocks via the use of identifying restrictions, as in Mountford and Uhlig (2009).

#### 5.3.1 A Brief Discussion of the Data

The data set being used in this chapter is sourced from the Thompson Reuters Data Stream Oxford. There are ten variables to be examined in this section, some of which are the same as the data used in the previous chapter (but in real per capita terms). The data set has been chosen to replicate, as closely as possible, the data used in Mountford and Uhlig (2009).

The VAR system comprises of the ten variables at a quarterly frequency from 1980 to 2014. All variables are in natural logs<sup>15</sup>, seasonally adjusted, and are in per capita terms, except for wages, interest rates, reserve, producer price index and price deflator. The key variables analysed described in Table 5.1, while the visualisation of data can be seen in Appendix XI on page 183.

Table 5.1 Variable Identifier for Real Data Per Capita of Indonesia 1980Q1-2014Q2

Variable	Description
LRYPC	The natural log of real Gross Domestic Product per capita.
LRPCPC	The natural log of real Private Consumption per capita.

<sup>15</sup> It was to allow ease of comparison with the original article on this and it is interpretable as a semi-elasticity.

<b>Variable</b>	<b>Description</b>
LREPC	The natural log of real Government Expenditure per capita, expenditure by national and local governments – backed institutions expressed in local currency.
LRREVPC	The natural log of real Government Revenue per capita, which is central and local government revenues expressed in local currency. It includes different types of taxes and interest receipts, as well as dividends from state-owned companies.
LRW	The natural log of real Wages.
LRGFCFPC	The natural log of real Gross Fixed Capital Formation per capita.
LQIR	The natural log of quarterly Interest Rates of Bank Indonesia (Central Bank policy rates).
LRRSV	The natural log of Reserve (both central and private banks' assets).
LPPI	The natural log of Producer Price Index.
LP	The natural log of Price Deflator.

Source: The Thompson Reuters Data Stream Oxford

The data set is as close as possible to that used in the Mountford and Uhlig (2009) paper. However, due to data availability and definitions, there are a few differences that are highlighted here:

1. The definition of government expenditure used in this chapter is total expenditure by national and local government (i.e. backed institutions expressed in local currency), whereas Mountford and Uhlig (2009) used total government consumption plus total government investment.
2. While the definition of total government revenue in Mountford and Uhlig (2009) is total government tax revenues minus transfers, this chapter's definition of government revenue is central and local government revenues expressed in local currency. It includes different types of taxes and interest receipts, as well as dividends from state-owned companies, based on the definition of the Oxford source data in the Reuters data stream.
3. Also, instead of using private non-residential investment data, which was unavailable, this chapter uses private gross fixed capital formation per capita. The choice of private gross fixed capital formation was the best consistent data choice available to reflect private sector domestic investment activity.
4. In terms of interest, IRF analysis are focused on 4-5 variables: (government revenue, government expenditure, GDP, consumption and gross capital formation).

### 5.3.2 Unit Root Tests of Real Per Capita Variables

This first section presents the empirical results of the unit root tests. The results are provided in a standardised format, variable by variable. In some senses these tests are not strictly required since, as noted by a number of authors, the methodology used in SVAR modelling is "...applicable if some or all of the variables have unit roots and a levels VAR model is fitted without taking possible co-integration restrictions into account" (Lutkepohl and Kratzig (2007) pp.175). However, for completeness, the results are presented briefly. Since the inferences about unit roots were not strongly influenced by breaks as described in the previous chapter, only standard test results are presented. Table 5.2 shows a range of standard unit root tests on the considered ten variables of log real data per capita from 1980-2014, using ADF tests, DF-GLS tests and KPSS tests. The results and the inferences drawn are briefly discussed below:

1. The result of the ADF test for real GDP per capita (LRYPC) shows that the ADF statistics with constant and trend do not reject the hypothesis of a unit root since the  $p$ -value is above 5% (0.79). This implies that LRYPC is non-stationary without differencing. However, the first differencing of the ADF test of LRYPC indicates that the null hypothesis of a unit root can be rejected because the  $p$ -value is below 5% (0.00). Based on the ADF tests, it can be seen that LRYPC is I (1). Under DF-GLS testing, LRYPC is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary test shows that LRYPC appears to be significantly non-stationary in the data set, since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LRYPC appeared to be stationary, with the null hypothesis not being rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LRYPC is I (1).
2. For real private consumption per capita (LRPCPC), the ADF statistics at level with constant and trend are insignificant. This evidence clearly indicates that LRPCPC with constant and trend is non-stationary since the  $p$ -value is above 5% (0.83). After first differencing, the result shows that the null hypothesis of a unit root is rejected at 5% significance level because the  $p$ -value is below 5%, being 0.00. This supports the evidence that, according to ADF testing,

LRPCPC is  $I(1)$ . Under the DF-GLS test, the LRPCPC variable is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary test shows that LRPCPC appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LRPCPC appears to be stationary since the null hypothesis is not rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LRPCPC is  $I(1)$ .

3. The ADF statistic for the data set of real government expenditure per capita (LREPC) strongly indicates that LREPC with constant and trend is stationary when level since the ADF statistic is greater than critical value or the  $p$ -value is below 5% (0.00), so the null hypothesis that the series LREPC contains a unit root is rejected. The same is true for the first differencing of the ADF test: the series LREPC shows that the null hypothesis of a unit root is rejected at 5% significant level in which the  $p$ -value is below 5% (0.00). This confirms that the data LREPC is  $I(0)$  based on the ADF test, which is consistent with the result in the previous chapter (although here we have real government expenditure per-capita). Under DF-GLS testing, the LREPC variable is also stationary when level. Interestingly, the result of the KPSS level stationary test shows that LREPC appears to be significantly non-stationary in the data set, since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LREPC appears to be stationary with the null hypothesis not being rejected at 5% significance. It can be concluded that, based on ADF and DF-GLS results, LREPC is  $I(0)$  but, based on the KPSS test, LREPC is  $I(1)$ .
4. The ADF test at level also clearly shows that the log of real government revenue per capita (LRREVPC) is stationary because the null hypothesis of a unit root is rejected at a level with the  $p$ -value below 5% (0.00). After first differencing, LRREVPC also rejects the null hypothesis of a unit root because the  $p$ -value is 0.00, which is below 5%. As a result, the ADF tests suggest that LRREVPC is  $I(0)$ . Under DF-GLS testing, the LRREVPC variable is also stationary when level. In addition, the result of the KPSS level stationary test

shows that LRREVPC is not significantly non-stationary in the data set since the null hypothesis of stationarity is not rejected at 5% significance and, after the first differencing, LRREVPC is stationary because the null hypothesis is rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LRREVPC is  $I(0)$ .

5. The results of the ADF tests show that the log of real wages (LRW) when level is non-stationary since the null hypothesis of a unit root is not significant, with the  $p$ -value being above 5% (0.22). However, after testing at the first difference, the variable appears to be stationary, meaning that the series LRW is  $I(1)$  according to the ADF tests. Under DF-GLS testing, the LRW variable is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary test shows that LRW appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LRW appeared to be stationary because the null hypothesis is not rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LRW is  $I(1)$ .
6. The results of the ADF test on real gross fixed capital formation per capita (LRGFCFPC) in levels shows that the ADF statistics with constant and trend do not reject the hypothesis of a unit root since the ADF statistic is smaller than the critical value in its absolute value and the  $p$ -value is above 5% (0.58). This implies that this variable is non-stationary without differencing. When the first difference of LRGFCFPC is considered, the null hypothesis of a unit root in the ADF test can be rejected at 5% significance because the  $p$ -value is 0.00 (below 5%) and the ADF statistic is greater than the critical value in absolute terms. Therefore, the ADF tests for LRGFCFPC indicate that the data variable is  $I(1)$ . Under DF-GLS testing, the LRGFCFPC variable is also non-stationary, but this variable is stationary when it is differenced. Interestingly, the result of the KPSS level stationary test shows that LRGFCFPC is not significantly non-stationary in the data set since the null hypothesis of stationarity is not rejected at 5% significance and, after the first differencing, LRGFCFPC is stationary because the null hypothesis is rejected at 5% significance. It can be concluded

that, based on ADF and DF-GLS testing, LRGFCFPC is I(1) but, based on the KPSS tests, LRGFCFPC is I(0).

7. Regarding the log of interest rates (LQIR), the ADF test of the null hypothesis of a unit root rejects the hypothesis and suggests the series is (trend) stationary since the  $p$ -value is below 5% (0.00). The result of the first difference for LQIR also shows that the null hypothesis of a unit root is rejected at 5% significance due to the  $p$ -value of 0.00 (under 5%). It can be said that, based on the ADF test, the LQIR is I(0). Under DF-GLS testing, the LQIR variable is also stationary when level. Interestingly, the result of the KPSS level stationary test shows that LQIR appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LQIR appears to be stationary since the null hypothesis is not rejected at 5% significance. It can therefore be concluded that, based on the ADF and DF-GLS tests, LQIR is I(0) but, based on the KPSS test, LQIR is I(1).
8. The result of ADF testing at level for real reserve (LRRSV) indicates that this variable appears to be non-stationary because, in levels, the  $p$ -value is above 5% (0.61), meaning that the null hypothesis of no unit root cannot be rejected. Nevertheless, the null hypothesis of a unit root is rejected after the first differencing for the LRRSV variable. Therefore, it can be said that the series LRRSV is I(1) based on ADF testing. Under DF-GLS testing, the LRRSV variable is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary test shows that LRRSV appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LRRSV appears to be stationary because the null hypothesis is not rejected at 5% significance. Therefore, it can be concluded that, based on the ADF, DF-GLS and KPSS tests, LRRSV is I(1).
9. The result of the ADF test in levels for the log of the producer price index (LPPI) suggests that the series contains a unit root due to the null hypothesis of a unit root not being rejected, with the  $p$ -value being above 5% (0.37). On the other hand, the ADF test of first difference of the LPPI series rejects the

null because the  $p$ -value is below 5% (0.00). This means that the null hypothesis of no unit root can be rejected. As a consequence, the LPPI variable is  $I(1)$ . Under DF-GLS testing, the LPPI variable is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary test shows that LPPI appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LPPI appears to be stationary with the null hypothesis not being rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LPPI is  $I(1)$ .

10. Finally, the result of the ADF test for the log of the GDP deflator (LP) suggests that the null hypothesis of no unit root cannot be rejected because the  $p$ -value is above 5% (0.33), so the GDP deflator is non-stationary at level. The ADF test for the first difference of the GDP deflator suggests that the hypothesis of a unit root is rejected at 5% significance. As a consequence, the ADF test for the GDP deflator indicates that the data variable is  $I(1)$ . Under DF-GLS testing, the LP variable is also non-stationary, but this variable is stationary when it is differenced. In addition, the result of the KPSS level stationary shows that LP appears to be significantly non-stationary in the data set since the null hypothesis of stationarity is rejected at 5% significance and, after the first differencing, LP appears to be stationary since the null hypothesis is not rejected at 5% significance. It can be concluded that, based on the ADF, DF-GLS and KPSS tests, LP is  $I(1)$ .

Table 5.2 Unit Root Tests of Real Data Per Capita

Variable	Real GDP (LRYPC)	Real Cons. (LRPCPC)	Real Exp. (LREPC)	Real Rev. (LRREV PC)	Real Wages (LRW)	Real Gross Fixed Capital Formation (LRGFCF PC)	Interest Rates (LQIR)	Real Reserve (LRRSV)	Prod. Price Index (LPPI)	GDP Def. (LP)
ADF(Level)	-1.60 [0.79]	-1.50 [0.83]	-5.21* [0.00]	-3.74* [0.02]	-2.74 [0.22]	-2.02 [0.58]	-4.97* [0.00]	-1.96 [0.61]	-2.41 [0.37]	-2.49 [0.33]
ADF(1 <sup>st</sup> diff.)	-10.6* [0.00]	-11.85* [0.00]	-9.51* [0.00]	-19.94* [0.00]	-7.95* [0.00]	-15.5* [0.00]	-7.34* [0.00]	-11.7* [0.00]	-8.27* [0.00]	-5.97* [0.00]
DF-GLS (Level)	-1.34	-0.99	-5.18*	-3.71*	-2.57	-2.02	-4.23*	-0.84	-2.31	-2.20
DF-GLS (1 <sup>st</sup> diff.)	-9.73*	-11.35*	-20.21*	-19.66*	-6.02*	-14.6*	-7.37*	-11.2*	-7.45*	-3.25*
KPSS (Level)	0.21*	0.29*	0.26*	0.07	0.19*	0.10	0.15*	0.33*	0.15*	0.18*
KPSS(1 <sup>st</sup> diff.)	0.12	0.25	0.24	0.32	0.06	0.05	0.03	0.45	0.10	0.11
Implied Order of Integration	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)

Figures in [ ] are *p*-values for the test statistic. An \* indicates significance at the 5% level. The 5% critical value for the DF-GLS test is -2.99 for the level and -1.94 for the 1<sup>st</sup> difference. For the KPSS test, the 5% critical values are 0.15 for the level and 0.46 for the 1<sup>st</sup> difference. SIC for ADF(Level) and ADF(1<sup>st</sup> diff) maxlag 13 are used.

In summary then, and as might have been expected given the results of the previous chapter, the results from testing via ADF, DF-GLS and KPSS suggest that the orders of integration of the ten variables are mixed. Real GDP, real private consumption, real wages, real gross fixed capital formation, real adjusted reserve, producer price index and GDP deflator are all I(1). On the other hand, real government expenditure, real government revenue and interest rates are all I(0). None of the series show any evidence of being integrated at higher orders than I(1). As noted above, while some variables have unit roots when level, a VAR model can be fitted without taking possible co-integration restrictions into account (Lutkepohl and Kratzig 2007). While it is correct that the Granger causality tests do need some idea about the order of integration of the variables, the order of lag augmentation in the test VAR does depend on the order of integration. It is also the case that while technically the SVAR does not rely on the information of the orders of integration, it is, nevertheless, useful to briefly survey such information before estimation. The next section shows the results of Granger causality tests and of the estimated SVAR with sign restrictions.

### **5.3.3 The Empirical Results of Granger Causality Tests**

The main concern of this section is to examine the relationships among the ten variables using Granger Causality tests. This section begins with tests of lag length selection and autocorrelation tests for the levels VAR because these are an important foundation, not only for the Causality tests but also for the SVAR estimation carried out in this chapter.

#### **5.3.3.1 The Lag Length Selection for Real Per Capita Variables**

Lag length selection is a necessary prerequisite for estimating the VAR model, and the method used here follows that used in the previous chapter. One issue here is the large dimensions of the VAR: with ten variables, long lag lengths reduce degrees of freedom in the estimation rapidly. Given this and the quarterly nature of the data, we begin by estimating a VAR with 5 lags [VAR(5)] and then sequentially reduce the lag length by one and re-estimate, reducing the lag length down to a VAR(1)<sup>16</sup>. At each step, the Schwarz Criterion (SC), Akaike Information Criterion (AIC) and Hannan–

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<sup>16</sup> All estimations were carried out on a common sample period, determined by VAR(5).

Quinn (HQ), along with sequential F-tests, are applied to select the optimal lag length. Standard model diagnostics focussing on the potential presence of autocorrelation in the errors are also reported.

Table 5.3 shows the three information criteria and, as is frequently the case, they select differing lag orders; SC, HQ and AIC select a lag length of 1, 1 and 5, respectively, in the VAR.

Table 5.3 VAR Information Criteria and Model Reduction Test Results for Real Per Capita Variables

Lag Length	Sample Size	SC	HQ	AIC
5 lags	133	-21.991	-28.571	-33.075*
4 lags	133	-24.060	-29.350	-32.970
3 lags	133	-26.280	-30.280	-33.017
2 lags	133	-28.299	-31.009	-32.863
1 lags	133	-30.110*	-31.529*	-32.500

SC, HQ and AIC are the Standard Information Criteria, \* indicates the selected minimum value.

Table 5.4 shows the sequence of F-tests on the VAR reduction and, as can be seen, all of the tests suggest strong rejections of the implied zero restrictions at normal significance levels, suggesting that the reduction below VAR(5) is rejected.

Table 5.4 Test of VAR Reduction Sequence for Real Per Capita Variables

Reduction Tested	<i>p</i> -value
VAR(5) to VAR(4)	[0.0000]**
VAR(5) to VAR(3)	[0.0000]**
VAR(5) to VAR(2)	[0.0000]**
VAR(5) to VAR(1)	[0.0000]**
VAR(4) to VAR(3)	[0.0153]*
VAR(4) to VAR(2)	[0.0000]**
VAR(4) to VAR(1)	[0.0000]**
VAR(3) to VAR(2)	[0.0000]**
VAR(3) to VAR(1)	[0.0000]**
VAR(2) to VAR(1)	[0.0000]**

\* indicates significance at the 5% level; \*\* at the 1% level.

Table 5.5 below presents a test for autocorrelation based on single-equation diagnostics (i.e., at each lag length, it reports a test for auto-correlated errors for each of the ten equations in the VAR) using reduced-form residuals. As can be seen from the table for lag 5 none of the individual equations in the VAR reject the null of no

autocorrelation at the 5% level. However, for lower order lags, there is at least one rejection of the null, suggesting evidence of auto-correlated errors.

Table 5.5 Test for Auto-Correlation for Real Per Capita Variables

<b>VAR Equation</b>	<b>Lag 5</b>	<b>Lag 4</b>	<b>Lag 3</b>	<b>Lag 2</b>	<b>Lag 1</b>
LRYPC	0.58621 [0.7105]	1.0232 [0.4091]	1.3689 [0.2427]	0.89792 [0.4854]	1.0188 [0.4099]
LRPC	1.1270 [0.3532]	0.84157 [0.5239]	1.9589 [0.0916]	2.9265 [0.0162]*	1.3103 [0.2644]
LRREVPC	1.3348 [0.2586]	2.0988 [0.0731]	1.9038 [0.1006]	1.3909 [0.2335]	4.4398 [0.0010]**
LQIR	1.1510 [0.3411]	1.2794 [0.2801]	1.8316 [0.1138]	1.6788 [0.1459]	2.9815 [0.0143]*
LRRSV	1.5125 [0.1957]	3.5741 [0.0055]**	2.2863 [0.0520]	4.5482 [0.0008]**	5.7264 [0.0001]**
LPPI	0.24075 [0.9432]	1.9458 [0.0949]	1.4121 [0.2267]	1.4862 [0.2004]	4.4740 [0.0009]**
LP	0.51239 [0.7661]	1.8028 [0.1207]	2.3325 [0.0479]*	2.0262 [0.0807]	2.2994 [0.0493]*
LRPCPC	0.12779 [0.9857]	0.78502 [0.5632]	1.0995 [0.3658]	3.4486 [0.0063]**	2.0352 [0.0787]
LRGFCFPC	0.082033 [0.9948]	1.4398 [0.2181]	1.0409 [0.3982]	1.8253 [0.1140]	2.5609 [0.0308]*
LRW	0.64619 [0.6652]	1.3859 [0.2375]	1.1872 [0.3211]	2.0058 [0.0836]	3.2766 [0.0083]**

\* indicates significance at the 5% level, \*\* at the 1% level.

Finally, the AR roots of the VAR(5) system all lie inside the unit circle, suggesting that VAR(5) is stable, (see Figure 5.1 below).

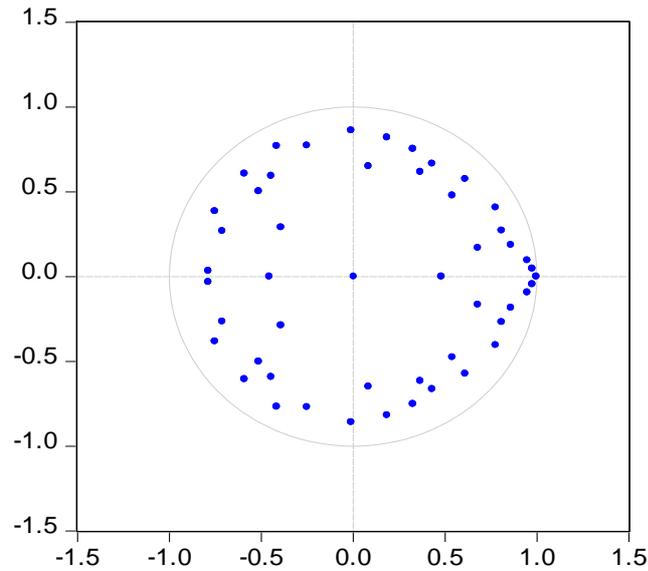


Figure 5.1 Inverse Roots of AR Characteristic Polynomial for Real Per Capita Variables

All of the above suggest that the VAR should be estimated with a lag length of 5. This will be used in the SVAR estimation and, as noted in the previous chapter, it is an important step in the Granger causality tests. Therefore, now that the optimal lag length has been selected, it will be adopted in the next section for the Granger Causality testing.

### 5.3.3.2 Causality Test for Real Per Capita Variables

This section starts by using the Granger Causality method to examine the short-term interactions among ten variables of real economic activities. Two observations should be briefly noted.

The first is that testing for causality in a VAR of such large dimensions is not likely to lead to very helpful results. In particular, in such a large VAR, the matter of indirect causality is an issue. For instance, consider a three-variable VAR with variables X, Y and Z. Suppose that whether or not Y is non-causal for X is examined by testing the zero restriction on the lags of Y in the X equation of the VAR. Failure to reject the null of non-causality, based on such a test, misses the possibility that there is indirect causality. Y may be causal for Z and Z may be causal for X. As a consequence, in the tests of this chapter, the vector of variables is partitioned into two groups [see Lutkepohl (1993) and Dufour and Renault (1998)]. If the groups are denoted  $y_1$  and  $y_2$ , then the causality tests are carried out to test if  $y_2$ , for example, is non-causal for

$y_1$ . Since there are many possible sub groupings, this thesis focuses on checking the simplest groups, that is, investigating whether one of the individual variables is causal for the whole set of other variables. Then, that is reversed and tested as to whether the whole set of nine variables is causal for the remaining variable.

The second observation is simply to note that the tests are carried out using the same method suggested in the previous chapter, based on the ideas of Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), that simply involves adding extra lags to the VAR. As the highest order of integration in the ten variables was found to be  $I(1)$ , a VAR of the order  $5 + 1$  is estimated and the zero restrictions on the first five lags are tested.

The results of Granger Causality tests are presented in Table 5.6 and they are briefly reviewed below. The numbers in the table present the  $p$ -values for selected variables, with the null hypothesis being that the selected variable does not Granger-cause the set of other (9) variables and that the set of other (9) variables do not Granger-cause the selected variable. The results of Granger causality testing indicate that:

1. There is bidirectional Granger causality between LRYPC and the set of other (9) variables because both the null hypothesis that LRYPC does not Granger-cause the other (9) variables and the null hypothesis that the set of other (9) variables does not Granger-cause LRYPC are rejected since the relevant  $p$ -values are under 5% (at 0.0000). This means both that the changes in the real GDP per capita affect the real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve, producer price index and population, and that the changes in these nine variables affect the growth of the real GDP per capita in Indonesia.
2. There is bidirectional Granger causality between LRPCPC and the set of other (9) variables. This is because the null hypothesis that LRPCPC does not Granger-cause the other (9) variables is rejected due to the relevant  $p$ -value being below 5% (0.0000) and the null hypothesis that the set of other (9) variables does not Granger-cause LRPCPC is also rejected as the relevant  $p$ -value is also under 5% (at 0.0027). This means both that the changes in the real private consumption per capita affects the real GDP per capita, real

government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve, producer price index and population, and that the changes in these nine variables affect the growth of the real private consumption per capita in Indonesia.

3. There is bidirectional Granger causality between LREPC and the set of other (9) variables because both the null hypothesis that LREPC does not Granger-cause the other (9) variables and the null hypothesis that the set of other (9) variables does not Granger-cause LREPC are rejected since the relevant  $p$ -values are both under 5% (at 0.0000). This indicates both that the changes in the real government expenditure per capita affect the real GDP per capita, real private consumption per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve, producer price index and population, and that the changes in these nine variables affect the growth of the real government expenditure per capita in Indonesia.
4. There is bidirectional Granger causality between LRREVPC and the set of other (9) variables because both the null hypothesis that LRREVPC does not Granger-cause the other (9) variables and the null hypothesis that the set of other (9) variables does not Granger-cause LRREVPC are rejected due to the  $p$ -values both being under 5% (at 0.0000). Therefore, both the changes in the real government revenue per capita affect the real GDP per capita, real private consumption, real government expenditure per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve, producer price index and population, and the changes in these nine variables affect the growth of the real government revenues per capita in Indonesia.
5. There is bidirectional Granger causality between LRW and the set of other (9) variables because both the null hypotheses - that LRW does not Granger-cause the other (9) variables and that the set of other (9) variables does not Granger cause LRW - are rejected, due to the relevant  $p$ -values being below 5% (0.0000 and 0.0004, respectively). This shows both that the changes in the real wages affect the real GDP per capita, real private consumption per capita, real government expenditure per capita, real government revenue per capita, real gross fixed capital formation per capita, interest rates, real adjusted reserve,

producer price index and population, and that the changes in these nine variables affect the growth of real wages in Indonesia.

6. There is bidirectional Granger causality between LRGFCFPC and the set of other (9) variables. This is based on the facts that the null hypothesis that LRGFCFPC does not Granger-cause the other (9) variables is rejected and the null hypothesis that the set of other (9) variables does not Granger-cause LRGFCFPC is also rejected, since the relevant  $p$ -values are both under 5% (at 0.0000). This reveals both that the changes in the real gross fixed capital formation per capita affect the real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, interest rates, real adjusted reserve, producer price index and population, and that the changes in these nine variables affect the growth of the real gross fixed capital formation per capita in Indonesia.
7. There is bidirectional Granger causality between LQIR and the set of other (9) variables. This is because both the null hypotheses that LQIR does not Granger-cause the other (9) variables and that the set of other (9) variables does not Granger-cause LQIR are rejected, since the relevant  $p$ -values are both under 5% (at 0.0000). This indicates both that the changes in the interest rates affect the real GDP per capita, the real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, real adjusted reserve, producer price index and population, and that the changes in these nine variables affect the growth of the interest rates in Indonesia.
8. There is bidirectional Granger causality between LRRSV and the set of other (9) variables. This is because, due to the relevant  $p$ -values being under 5% (at 0.0000), both of the null hypotheses, that LRRSV does not Granger-cause the other (9) variables and that the set of other (9) variables does not Granger-cause LRRSV, are rejected. This signifies both that the changes in the real adjusted reserve affect the real GDP per capita, real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, producer price index and population, and that the changes in these nine variables affect the growth of the real adjusted reserve in Indonesia.

9. There is bidirectional Granger causality between LPPI and the set of other (9) variables due to the rejection of both null hypotheses, that the LPPI does not Granger-cause the other (9) variables and that the set of other (9) variables does not Granger-cause LPPI, with the relevant  $p$ -values both being under 5% (at 0.0000). This means both that the changes in the producer price index affect the real GDP per capita, real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve and population, and that the changes in these nine variables affect the growth of the producer price index in Indonesia.
10. Finally, there is bidirectional Granger causality between LP and the set of other (9) variables. This is because both the relevant  $p$ -values are below 5% (at 0.0000), meaning that both null hypotheses, that LP does not Granger-cause the other (9) variables and that the set of other (9) variables does not Granger-cause LP, are rejected. This indicates both that the changes in the population affect the real GDP per capita, real private consumption per capita, real government expenditure per capita, real government revenue per capita, real wages, real gross fixed capital formation per capita, interest rates, real adjusted reserve and producer price index, and that the changes in these nine variables affect the growth of the population in Indonesia.

Table 5.6 Granger Causality Tests for Real Per Capita Variables

Variable	NULL HYPOTHESIS IS	NULL HYPOTHESIS IS
Selected variable in column below	Selected variable does not Granger-cause the set of other (9) variables	Set of other (9) variables does not Granger-cause the selected variable
LRYPC	2.3501 [0.0000]*	2.8502 [0.0000]*
LRPCPC	2.1611 [0.0000]*	1.7265 [0.0027]*
LREPC	2.0971 [0.0000]*	4.2318 [0.0000]*
LRREVPC	2.3792 [0.0000]*	4.5297 [0.0000]*
LRW	2.1734 [0.0000]*	1.9235 [0.0004]*
LRGFCFPC	2.6168 [0.0000]*	3.3039 [0.0000]*
LQIR	3.4002 [0.0000]*	3.5335 [0.0000]*
LRRSV	3.5581 [0.0000]*	5.8001 [0.0000]*
LPPI	4.3175 [0.0000]*	4.0671 [0.0000]*
LP	3.7823 [0.0000]*	4.1327 [0.0000]*

All tests are F-tests with degrees of freedom (45,710), figures in [ ] are  $p$ -values, \* indicates significance at the 5% level.

In summation, as expected, the causality tests are not particularly informative, but they do suggest that there are strong causal links among the set of variables in the VAR, hinting that the estimated SVAR will shed more light on the linkages.

### **5.3.4 SVAR with Sign Restrictions**

The primary objective of this section is to examine the impact of shocks to fiscal policy on the key macroeconomic variables, such as Consumption and GDP. To do this, a VAR with five lags is estimated and, using the sign restriction method discussed in Section 2 of this chapter, the shocks are identified. The focus here will be simply to discuss the results using the estimated impulse response functions. Since the focus of this chapter is on fiscal policy, the spotlight will be on the following five sets of simulation results:

1. The impact of a simple (positive) shock to government revenue.
2. The impact of a simple (positive) shock to government spending.
3. The outcome of an increase in government spending of 1% over the first four quarters of the simulation, while keeping government revenue constant over the same four quarters.
4. The outcome of a cut in government revenue of 1% over the first four quarters of the simulation, while keeping government expenditure constant over the same four quarters.
5. The effect of a balanced budget, whereby both spending and revenue rise by 1% over the first four quarters of the simulation.

#### **5.3.4.1 Simple Government Revenue Shock**

The first simulation is a simple shock to government revenue in the first quarter, with no restrictions on the other variables in the SVAR, although it should be noted that the shock is, by construction, orthogonal to the monetary policy and business cycle shocks and the only restriction placed on it by the sign restriction technique is to ensure that the shock is positive for the first four quarters. The full set of IRFs are in Appendix I to IX, but this section focuses only on key results.

It can be seen below that there is a positive shock to government revenue. This could potentially be caused by, for example, an increase in taxes. Such a positive shock

would have a negative impact on the level of demand in the economy. Therefore, it would tend to lower government revenue and expenditure as well as consumption and output. Figure 5.2, 5.3, 5.4 and 5.5 provide evidence for this analysis.

The revenue shock seen in Figure 5.2 is not particularly persistent. By construction, it is positive for the first four quarters, but it falls close to zero after five quarters and then stays close to zero for the rest of the simulation.

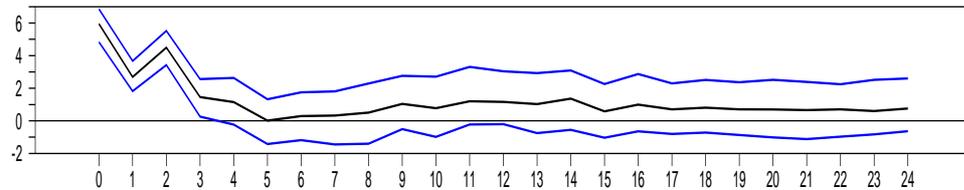


Figure 5.2 Impact of Shock to Government Revenue on Government Revenue

Consumption appears to fall immediately, dropping by around 0.5% and staying at around this level for the next six or seven quarters before rising and staying around zero for the rest of the period, as shown in Figure 5.3.

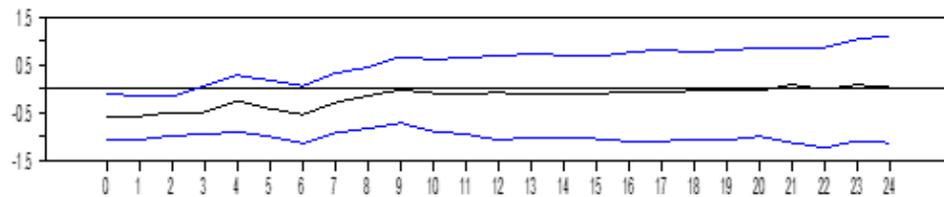


Figure 5.3 Impact of Shock to Government Revenue on Consumption

GDP also falls slightly when the shock hits, and then continues to fall for around three quarters. At its lowest point, it has fallen by around 0.5%. After that, as can be seen in Figure 5.4, GDP rises, and after eight or nine quarters the effect on GDP is virtually zero, suggesting that the impact of a revenue shock is muted in the longer run.

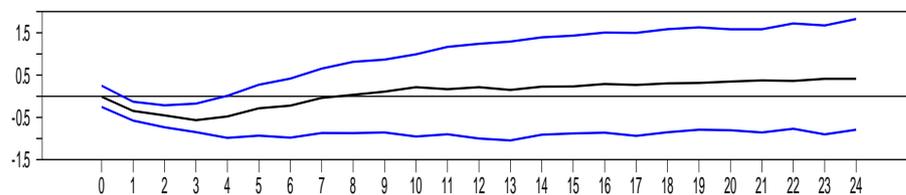


Figure 5.4 Impact of Shock to Government Revenue on GDP

Finally, Figure 5.5 shows that government expenditure fluctuates in response to the shock. Its response seems a little erratic, but is clearly positive for the first four or five quarters before also falling back to zero. One possible interpretation of this (which fits

with the discussion at the end of Chapter 4) is that the response represents a degree of counter-cyclicality in government expenditure because it reacts to the fall in output and consumption generated by the government revenue shock.

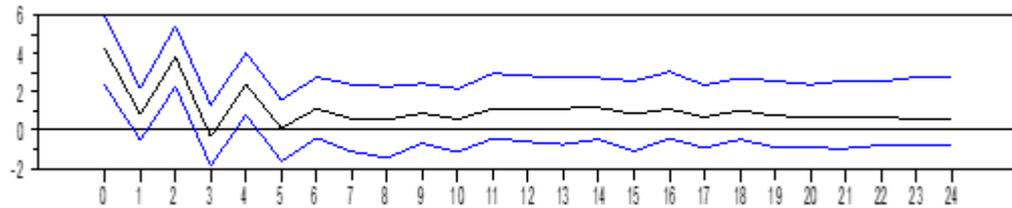


Figure 5.5 Impact of Shock to Government Revenue on Government Expenditure

### 5.3.4.2 Simple Government Expenditure Shock

The second simulation is a simple shock to government expenditure in the first quarter, with no restrictions on the other variables in the SVAR. Again, the full set of IRFs is in Appendix 1 and this section focuses on key results. Once again, the shock is orthogonal to the monetary and business cycle shocks and the sign restriction method is used to ensure that government expenditure is positive for the first four quarters.

It can be seen that there is a positive shock to government expenditure. This could potentially be caused by, for example, an increase in infrastructure expenditure. Such a positive shock would have a positive impact on the level of demand in the economy. Therefore, it would tend to raise output, consumption and investment. Figures 5.6, 5.7, 5.8 and 5.9 provide evidence for this analysis.

The government expenditure shock, as illustrated in Figure 5.6, is not initially particularly persistent. By construction, it is positive for the first four quarters, but it falls to zero after five quarters before then increasing to about 1.5-2% and then remaining stable for the rest of the simulation.

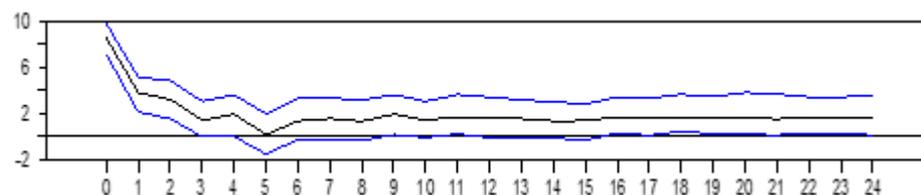


Figure 5.6 Impact of Shock to Government Expenditure on Government Expenditure

The effects on GDP and consumption also are examined, as shown in Figure 5.7 and Figure 5.8 respectively. Both results are rather muted, suggesting that a simple government expenditure shock is not particularly effective at stimulating the Indonesian economy. Indeed, GDP falls after the first quarter and doesn't become positive until around the two-year mark, suggestive of significant lags in the impact of such government expenditure on the economy. However, [and as noted in contrast to Mountford and Uhlig (2009)], the longer run impact is positive, if relatively weak, suggesting GDP is raised by around 0.5%.

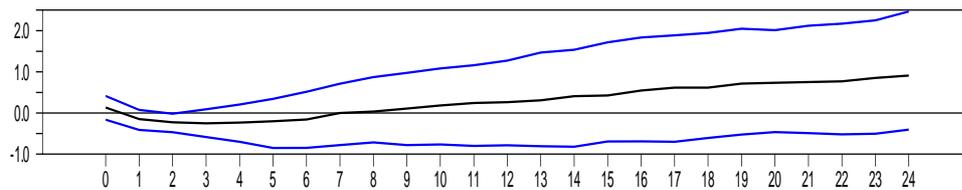


Figure 5.7 Shocks to Government Expenditure on GDP

The muted effect on output is reflected in consumption which, after falling initially, shows no positive effect in the long run.

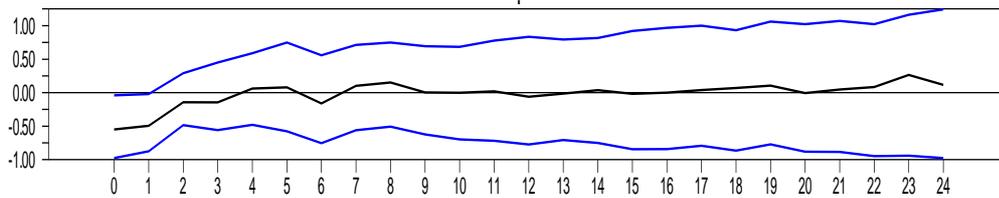


Figure 5.8 Impact of Government Expenditure on Consumption

One possible reason for the muted effect on economic activity is the negative response of gross fixed capital formation, which falls in the first quarter and stays negative (at around -1%) for around sixteen quarters (one year and four months). In disagreement with the findings of Mountford and Uhlig (2009), Figure 5.9 does not appear to be due to significant increases in the interest rate, which is largely unaffected by the shock (and, indeed, it falls initially).

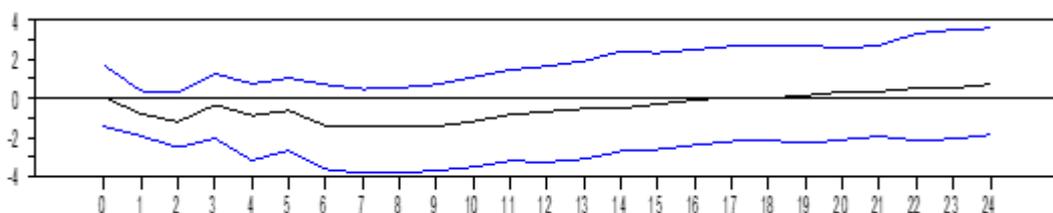


Figure 5.9 Shocks of Government Expenditure on Gross Fixed Capital Formation

Finally, once more in contrast to the conclusions of Mountford and Uhlig (2009), government revenue responds positively to the shock, suggesting that, when the balanced budget simulation is investigated, the responses are likely to be similar to this.

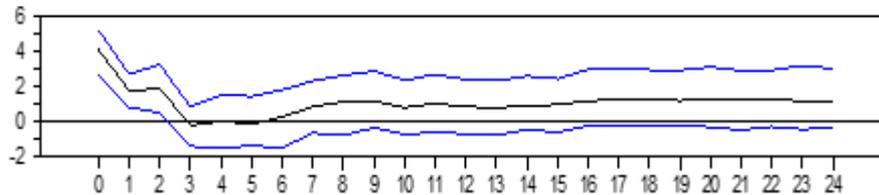


Figure 5.10 Shocks of Government Expenditure on Government Revenue

The two basic simulations above show the effects of a rise in government revenue and a rise in government expenditure. The impacts of different fiscal policies can be analysed by recombining these two main shocks. This section compares three of the most popular fiscal policy shocks, which are referred to as:

1. a deficit-spending shock, which simulates an increase in government spending of 1% over the first four quarters of the simulation, while keeping government revenue constant over the same four quarters;
2. a deficit-financed tax cut shock, which is a cut in government revenue of 1% over the first four quarters of the simulation, while keeping government expenditure constant over the same four quarters; and
3. a balanced budget expenditure shock, whereby both spending and revenue rise by 1% over the first four quarters of the simulation.

### 5.3.4.3 Analysis of a Deficit-Spending Fiscal Policy Scenario

The analysis below shows the effect of the deficit-spending policy scenario. As can be seen in Figure 5.11, government revenue does not change drastically in response to the standard basic government shocks. It remains stable at zero for the first four quarters, but it falls to about 0.2% in quarter four and then increases steadily until quarter twelve before remaining stable for the rest of the simulation at close to zero.

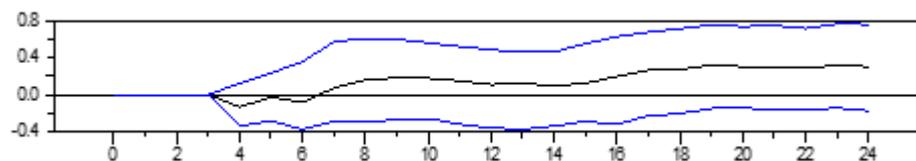


Figure 5.11 Impact of a Deficit-Spending Fiscal Policy on Government Revenue

It is interesting to present the government expenditure IRF and an insight from the two simulations above. The first point is the fact that the sign restriction technique “fixes” the revenue change at zero for the first four quarters (quarters 0, 1, 2, 3), while the expenditure change is “fixed” at +1% for the first four quarters. Secondly, it should be noted that, after the first four quarters, government expenditure falls and revenue rises, both to around 0.2-0.3%, once more suggesting that this simulation will, after the first four quarters, resemble a balanced budget approach, perhaps reflecting Indonesia’s desire to keep the budget balanced.

Therefore, Figure 5.12 shows that government expenditure remains stable at 1% for the first four quarters in response to this fiscal policy. After that, it falls drastically to 0.2% in quarter 6 before remaining steady at about 0.3% for the rest of the simulation.

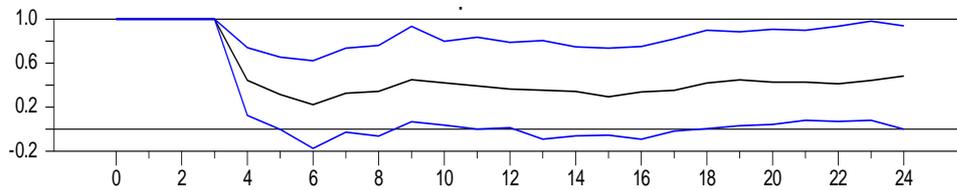


Figure 5.12 Impact of a Deficit-Spending Fiscal Policy on Government Expenditure

The same is true for the impulses in Figure 5.13. During the first four quarters, GDP is not stimulated by the deficit-spending scenario. Then it increases steadily until the end of the simulation to approximately 0.2-0.25%, suggesting a relatively weak and lagging response to the policy.

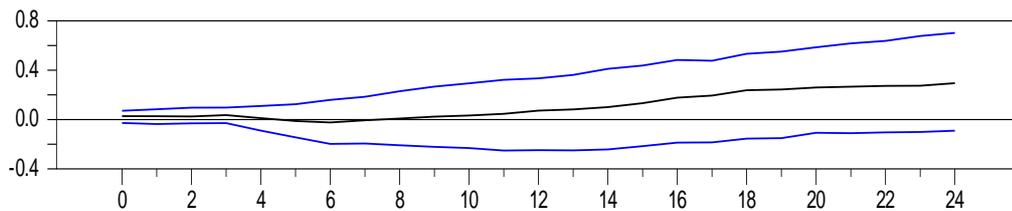


Figure 5.13 Impact of a Deficit-Spending Fiscal Policy on GDP

Figure 5.14, which shows the impact on consumption, is not much different. During the first four quarters, consumption is not stimulated by the deficit-spending scenario and then, after quarter 4, it goes up and remains above zero throughout the rest of simulation but shows a relatively muted response.

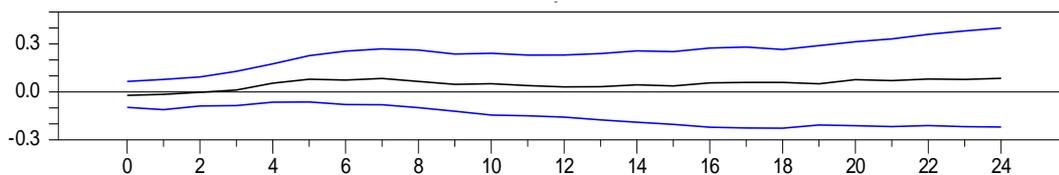


Figure 5.14 Impact of a Deficit-Spending Fiscal Policy on Consumption

Meanwhile, the deficit-spending scenario also reduces gross fixed capital formation, as shown in Figure 5.15, falling to approximately -0.5% at around the 2 year-mark before increasing to close to zero around quarter 19 or 20 and then staying close to zero for the rest of the simulation.

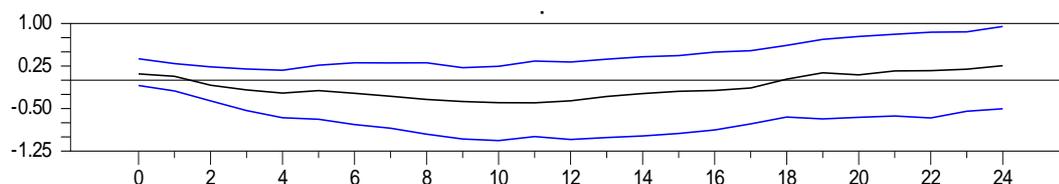


Figure 5.15 Impact of a Deficit-Spending Fiscal Policy on Gross Fixed Capital Formation

This scenario highlights the key economic indicators, showing little stimulus from the deficit-spending policy. There is some weak growth in GDP but, after the initial four quarters, the fall in spending and the rise in revenue lead to a relatively weak response, which is also probably partly due to the fall in gross fixed capital formation.

#### 5.3.4.4 Analysis of a Deficit-Financed Tax Cut Fiscal Policy Scenario

The figures below show the impulse responses for a deficit-financed tax cut fiscal policy scenario. This fiscal policy scenario means that there is a cut in government revenue of 1% over the first four quarters of the simulations, while keeping government expenditure constant over the same four quarters. The results show that GDP, consumption, gross fixed capital formation, government revenue and government expenditure increase slightly in response to a deficit-financed tax cut fiscal policy scenario.

The impact of this fiscal policy upon government revenue is depicted in Figure 5.16. It is -1% for the first three quarters, but it increases drastically to zero at quarter 7 and then decreases slightly (by about 0.2%) after 13 quarters. It then stays close to, but below, zero for the rest of the simulation.

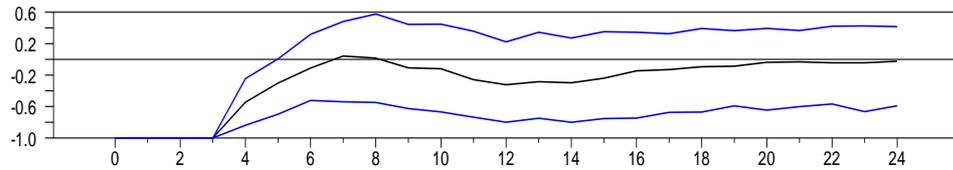


Figure 5.16 Impact of a Deficit-Financed Tax Cut Fiscal Policy on Government Revenue

Following this, Figure 5.17 shows that government expenditure fluctuates in response to this fiscal policy and it seems a little erratic. After remaining stable at zero for the first three quarters, it is clearly negative from quarter 4 to quarter 7 (at approximately -0.25%) before increasing to above zero from quarter 8 to quarter 10. After that, it stays close to just below zero for the rest of the simulation.

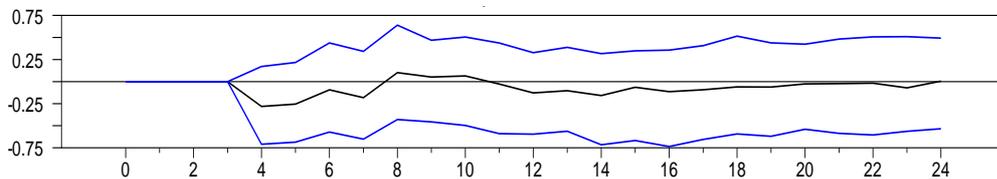


Figure 5.17 Impact of a Deficit-Financed Tax Cut Fiscal Policy on Government Expenditure

As can be seen in Figure 5.18, GDP increases slightly when the shock hits and then falls for the next three or four quarters. At its lowest point it has fallen to zero, at quarter 12 or 13. After that, GDP rises slightly and, after eight or nine quarters, the effect on GDP is virtually zero, suggesting that the impact of this fiscal policy is muted in the longer run.

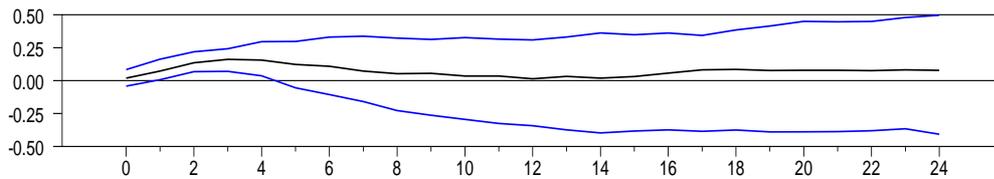


Figure 5.18 Impact of a Deficit-Financed Tax Cut Fiscal Policy on GDP

Consumption appears to increase immediately and for the first six quarters to about 0.2% before dropping to around 0 and staying at around this level for the rest of the period, as shown in Figure 5.19.

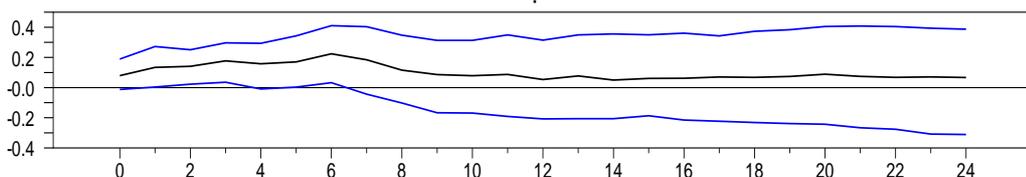


Figure 5.19 Impact of a Deficit-Financed Tax Cut Fiscal Policy on Consumption

Although positive, gross fixed capital formation falls in the first three quarters and stays close to zero for around seven quarters before falling into the negative at approximately -0.25% until quarter 19. After that, it remains stable at zero for the rest of the simulation, as shown in Figure 5.20.

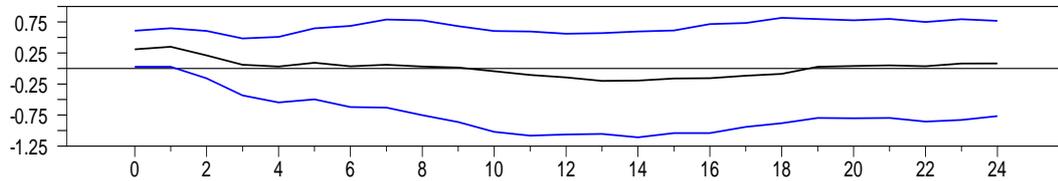


Figure 5.20 Impact of a Deficit-Financed Tax Cut Fiscal Policy on Gross Fixed Capital Formation

### 5.3.4.5 Analysis of a Balanced Budget Expenditure Fiscal Policy Scenario

Finally, we look at a balanced budget simulation whereby both spending and revenue rise by 1% over the first four quarters of the simulation. It means that both government expenditure and government revenue are set to increase in such a way that the increase in expenditure and revenue is equal for every period in the four-quarter window following the initial shock<sup>17</sup>. The figures below show the results; there is a relatively large expansionary effect on GDP and, therefore, the stimulating effects of tax increases dominate the expenditure effects, and GDP, consumption and gross fixed capital formation increase significantly in the medium term.

Firstly, the effects on government revenue are examined, as shown in Figure 5.21. Government revenue remains stable at above 0.8% for the first three quarters before it falls drastically to just above zero at quarter 6. After that, it increases significantly to approximately 0.4%, where it remains until the end of the simulation.

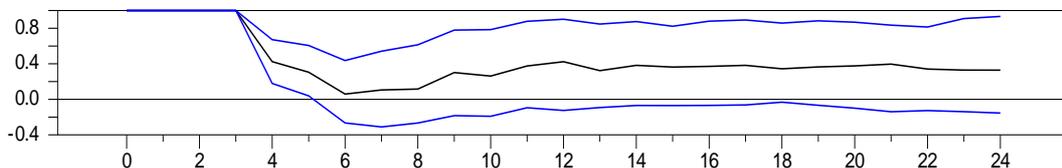


Figure 5.21 Impact of a Balanced Budget Expenditure Fiscal Policy on Government Revenue

Next, Figure 5.22 shows that government expenditure remains stable at 1% for the first three quarters in response to this fiscal policy. Then, it decreases to about 0.2%

<sup>17</sup> Mountford and Uhlig (2009) scaled the shock to government expenditure and revenue to reflect their relative shares in GDP (so that the two shocks were equal in size). In the case of Indonesia, the average shares are approximately the same so, in this simulation, both do increase by 1%.

in quarter 8 before increasing significantly to approximately 0.6% for the rest of the simulation.

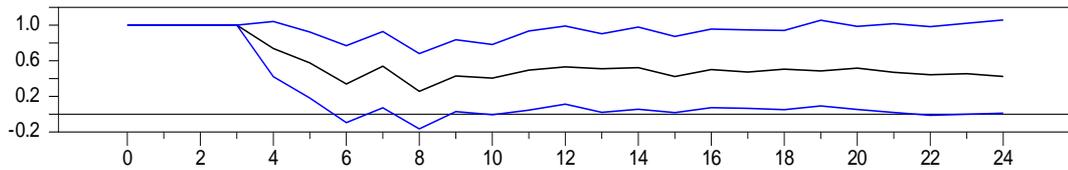


Figure 5.22 Impact of a Balanced Budget Expenditure Fiscal Policy on Government Expenditure

Figure 5.23 shows that, in the first nine quarters, GDP decreases to below zero within the balanced budget spending scenario. Then, it increases steadily in the positive from period 10 until the end of the simulation when it reaches approximately 0.20%.

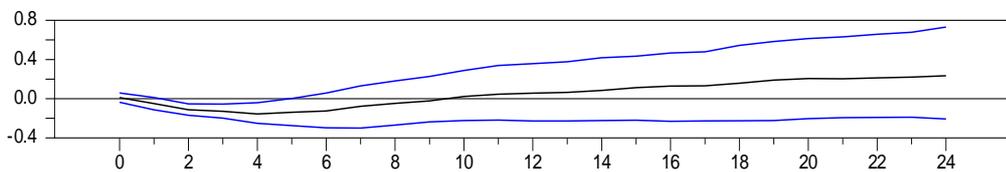


Figure 5.23 Impact of a Balanced Budget Expenditure Fiscal Policy on GDP

Consumption appears to steadily increase from -0.1% in the first quarter to zero in quarter 9 and then stays at around this level for the rest of the period, as shown in Figure 5.25.

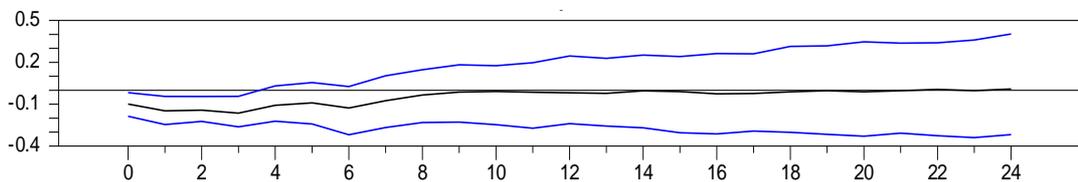


Figure 5.24 Impact of a Balanced Budget Expenditure Fiscal Policy on Consumption

Finally, gross fixed capital formation decreases slightly, remaining between approximately -0.1% and -0.5% from quarter 0 to quarter 9, then increases steadily to about 0.3% for the rest of the period, as shown in Figure 5.25.

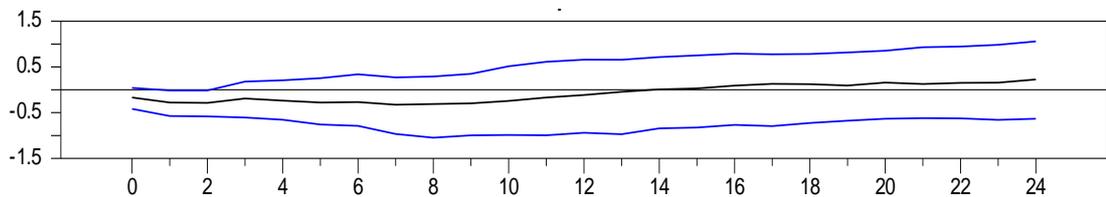


Figure 5.25 Impact of a Balanced Budget Expenditure Fiscal Policy on Gross Fixed Capital Formation

Overall, based on these figures, a deficit-spending policy option appears to be the best one for the Indonesian economy because this simulation might have a better

consequence in increasing GDP, consumption, expenditure, revenue, wages and gross fixed capital formation in Indonesia than the other options.

To support the summation above, the size impact of multipliers among the three options can also be measured and compared by using the approach of Mountford and Uhlig (2009) with the formula:

$$\text{Multiplier for GDP} = \frac{\left( \frac{\text{GDP response}}{\text{Initial fiscal shock}} \right)}{\text{Average fiscal variable share of GDP}} \quad (5.17)$$

The results of the size impacts of the multipliers are listed in Table 5.7 below. It can be seen that the greatest impact of the multipliers is for the deficit-spending policy simulation with the highest maximum value of 1.567 in quarter 20. This is followed by a balanced budget (1.266) in quarter 20 and the deficit-financed tax cut (1.074) in quarter 4. There seems to be little difference among the policies in terms of their impacts on the key indicators. In other words, there is little to choose between them as the actual size of some of these multipliers are very similar.

Table 5.7 Size Impact Comparison of the Three Fiscal Policy Simulations

	1 qrt	4 qrts	8 qrts	12 qrts	20 qrts	Max (qrt)
<b>Deficit Expenditure</b>						
GDP	0.177	0.234	-0.040	0.299	1.567	1.567(20)
Gov. Exp.	1.000	1.000	0.327	0.393	0.448	
Gov. Rev.	0.000	0.000	0.074	0.149	0.320	
<b>Deficit-Financed Tax Cut</b>						
GDP	0.124	1.074	0.481	0.229	0.509	1.074 (4)
Gov. Exp.	0.000	0.000	-0.182	-0.028	-0.062	
Gov. Rev.	-1.000	-1.000	0.043	-0.259	-0.087	
<b>Balanced Budget</b>						
GDP	0.077	-0.852	-0.515	0.304	1.266	1.266(20)
Gov. Exp.	1.000	1.000	0.539	0.495	0.486	
Gov. Rev.	1.000	1.000	0.106	0.376	0.365	

## 5.4 Conclusions

This chapter has, by adapting the methods of Mountford and Uhlig (2009) and Uhlig (2005), provided a new approach that allows distinctions to be made about the impacts of fiscal policy shocks within the Indonesian economy. In particular, no restrictions have been imposed on the signs of the responses of important variables of interest to fiscal policy shocks, such as GDP, government revenue, government expenditure,

private consumption, real wages and gross fixed capital formation. This study has used Indonesia data from 1980 to 2014.

The ten variables used in the SVAR have been firstly examined by using unit root tests and Granger causality tests. The results from the ADF, DF-GLS and KPSS tests have suggested that the orders of integration of the ten variables are mixed. Real GDP, real private consumption, real wages, real gross fixed capital formation, real adjusted reserve, producer price index and GDP deflator are all  $I(1)$ . Nevertheless, real government expenditure, real government revenue and interest rates are all  $I(0)$ . None of the series has shown any evidence of being integrated at higher orders than  $I(1)$ . Meanwhile, the causality test results, even though not particularly informative, have suggested that there are strong causal links within the set of variables in the VAR.

This chapter, then, has tested five particular SVAR simulations: the impact of a simple (positive) shock to government revenue; the impact of a simple (positive) shock to government spending; an increase in government spending of 1% over the first four quarters of the simulations, while keeping government revenue constant over the same four quarters (deficit-financed expenditure); a cut in government revenue of 1% over the first four quarters of the simulations, while keeping government expenditure constant over the same four quarters (a deficit-financed tax cut); and a balanced budget simulation whereby both spending and revenue rise by 1% over the first four quarters of the simulations. The results in these analyses suggest that a deficit-spending scenario stimulates the economy in Indonesia and it is stronger compared to that for a balanced budget or a deficit-financed tax cut, as found in this thesis. The crowding out of investment as a result of both types of spending scenario seems to be one of the factors that have limited the impacts of all the variants of fiscal policy shocks.

A deficit-spending simulation appears to be the best fiscal policy for stimulating the economy, compared to a balanced budget and a deficit-financed tax cut. This may sensible that a deficit-spending scenario may have a better consequence in increasing GDP, consumption, expenditure, revenue, wages, and gross fixed capital formation in Indonesia. Moreover, from the measurement and the comparison of the size impacts of its multipliers among the three simulations, the results have clearly proved that a deficit-spending scenario has the highest value. This has been supported by the Indonesian government's actions, due to the fact that this deficit-spending fiscal policy

has been effectively conducted in Indonesia as one of the ways to stabilise the economy, to maintain its economic performance and to overcome some economic issues, as discussed in the Chapter 3. However, because there is little to distinguish between the deficit spending and balanced budget multipliers in terms of size and that leaves the Indonesian government with some choices. It might also be relevant to the requirements for the debt-to-income ratio not to exceed 60% and the deficit-to-income ratio being required to be below 3% (Financial Law No.17/2003), as explained in Chapter 1 to 3.

# CHAPTER 6

## CONCLUSIONS

### 6.1 Introduction

This chapter concisely summarises the major findings of the thesis and the resultant policy implications. The chapter is divided into three sections. After this brief introduction, Section 2 considers the main results from Chapter 4, which examined Wagner's Law and from Chapter 5, which estimated fiscal multipliers for Indonesia, and formed the core of the thesis. Section 3 provides the policy implications and suggestions for future research.

### 6.2 The Main Empirical Findings

The empirical results of Wagner's Law, as applied to government expenditure of Indonesia, were presented in Chapter 4. Firstly, the time series properties of a range of variables commonly used in time series work were considered and, secondly, the question of co-integration among subsets of the variables was explored. In particular, Chapter 4 used three-unit root tests, ADF, DF-GLS and KPSS, both in the absence of a structural break and with one break (i.e. allowing for a break and setting the break at 2003 quarter 4) to test for the presence of a unit root in the observed time series. Overall, it was concluded that the two sets of unit root tests, both without and with a break, told the same story: that the nominal variables and the price deflator were  $I(1)$ , that real GDP was  $I(1)$ , but that real Government Expenditure tended to be stationary, while Population was  $I(2)$ . Therefore, with Population being  $I(2)$ , this suggested that it should be left out of further analysis because there should be no relationship between the  $I(1)$  and  $I(2)$  variables. This was similar to what Oxley (1994) had found. Furthermore, the results also showed that converting the basic series to a per capita basis had little impact since the Indonesian population statistics were very smooth. Thus, except for Population, all other variables were considered for co-integration.

The second stage reported in Chapter 4 was the testing of the relationships between variables using simple bivariate VAR models of the three variables, and examining

the possibility of causal relationships existing among the variables. The levels VAR was used to test for Granger non-causality and the co-integration tests yielded information about causal relationships, following the work of Toda and Yamamoto (1995) to test for non-causality in a simple augmented levels VAR. The results suggested that there was evidence that Government Expenditure and Prices were co-integrated and that, if allowance was made for a trend in the co-integrating vector, the restriction that the co-integrating vector was (1, -1) could not be rejected, as implied by the unit root tests that showed real Government Expenditure was  $I(0)$  when allowance was made for a trend. The results of tests also suggested co-integration without the need to consider a break in the co-integrating vector, although allowing for one still yielded the result that the variables were co-integrated. Then, the examination of the recursively estimated eigenvalues suggested that the co-integration result was robust, showing no sign of a significant break either around the time of the Asian Financial Crisis or at the introduction of Financial Law No.17/2003.

Furthermore, the co-integration results supported the notion that, within the context of Indonesia, real Government Expenditure was trend stationary – it was simply co-integrated with the GDP Deflator. There was evidence, from both the bivariate and trivariate models, of causality leading from GDP and Prices to Government Expenditure, but there was no evidence whatsoever of causality running from Government Expenditure to economic activity, thus providing support for the Wagner Hypothesis in this case. Also, the fact that there was no significant role for economic activity in the co-integrating vector strengthens this finding.

The last stage of Chapter 4 was the further testing for the relationship between the cyclical components of government expenditure and economic activity in Indonesia. The test started by estimating a VECM model. The results suggested, through the parameters of the loading vector, that it was the level of government expenditure that did most of the correction, with its co-efficient being clearly significant, while the coefficient of the ECM term in the change of price was relatively low. The orthogonalised forecast error variance decomposition suggested that most of the variance in the growth of government expenditure was due to transitory shocks, whereas, for the variance in the growth of prices, the equivalent figure was under 1%. The practical implication of these results in the present case is that the vast majority

of the deviations from the equilibrium relationship between government expenditure and prices can be inferred to be due to transitory shocks to government expenditure. Finally, this thesis found a significant level of coherence between the two series and the cyclical components of nominal GDP, with government expenditure being counter-cyclical.

Based on the results of Chapter 4, the lack of long-run causality from government expenditure to GDP would suggest that fiscal policy has not impacted on economic activity-rather the other way around. In the sense that while there seem to be no long-run evidence of government expenditure causing GDP, there is evidence that government expenditure has influences GDP in the short run and that there has been some attempt at using fiscal policy to stabilise the economy.

The results in Chapter 4 and Chapter 5 may seem to be conflicting with respect to Wagner's Law. However, we would argue are not necessarily so. The long run causality tests of Chapter 4 found clear evidence of causality running from GDP (and Prices) to government expenditure, but not vice versa-clear support for Wagner's hypothesis. On the other hand, in a short run dynamic setting we do find evidence that government spending can impact on economic activity, acting to stabilise short run economic fluctuations. What the results in Chapter 4 tell us is that most of the shocks to government expenditure are transitory and result from the error correcting nature of the relationship, this we would argue does not contradict the long run results regarding Wagner's Law. However, we do note that it could be also be argued that if the countercyclical policies do stabilise output fluctuations, then it could be possible to argue that this more stable outcome is likely to enhance investment and thus lead to growth. Hence, there could be some indirect causal effect. We leave this for further research.

Chapter 5 examined the multiplier effect of fiscal policy and identified the shocks of fiscal policy in Indonesia. This began by extracting the information of ten variables through unit root and causality tests. The SVAR, was then estimated using the identification method suggested in the methodology of Mountford and Uhlig (2009) and Uhlig (2005).

The results of the ADF, DF-GLS and KPSS tests suggested that the orders of integration of the ten variables were mixed. Real GDP, real private consumption, real wages, real gross fixed capital formation, real adjusted reserve, producer price index and GDP deflator were all I(1). On the other hand, real government expenditure, real government revenue and interest rates were all I(0). None of the series showed any evidence of being integrated at higher orders than I(1). The causality tests were not particularly informative, but they suggested that there were strong causal links among the set of variables in the VAR, so that the estimated SVAR gave more directions on the relationships.

This chapter then tested five particular SVAR simulations: the impact of a simple (positive) shock to government revenue, the impact of a simple (positive) shock to government spending, a deficit-spending situation, a deficit-financed tax and a balanced budget simulation. The results in these analyses suggested that a deficit spending scenario would stimulate the economy in Indonesia and its effect would be stronger than for the scenarios of either a balanced-budget or a deficit-financed tax cut. The crowding out of investment as a result of both types of spending scenario seemed to be one of the factors that had limited the impact of all the variants of fiscal policy shocks.

Moreover, from the measure and comparison of the size impact of its multipliers among the three simulations, the results clearly suggested that a deficit-spending scenario had the highest value. A deficit-spending simulation appeared to be the best fiscal policy for stimulating the economy, when compared to a balanced budget and deficit-financed tax cut. Therefore, it might be sensible that a deficit spending scenario would lead to better consequences in increasing GDP, consumption, expenditure, revenue, wages and gross fixed capital formation in Indonesia. Nevertheless, Indonesia's government have some choices due to a little discrepancy size of multipliers between deficit spending and balanced multipliers.

### **6.3 Policy Implications and Future Research**

As the empirical results of this thesis have shown in Chapter 4, Wagner's Law did apply in Indonesia. In other words, a long-run relationship occurred between GDP and government expenditure in Indonesia with causality running uni-directionally from

GDP to government expenditure. This result implies that the development of the economy in Indonesia is likely to be accompanied by increasing government expenditure in GDP in the long run, as commonly has occurred in developed countries. Other results in Chapter 4 indicated significant evidence of a strong counter-cyclical relationship between the cyclical components of GDP and government expenditure, suggesting that government spending acted to stabilise the economy.

It can be seen that the empirical results of Chapter 4 showed that Wagner's Law and counter-cyclical fiscal policy exist in Indonesia. These findings support the notion that the government and its fiscal policy are able to effectively contribute in stabilising the economy in Indonesia. Both the existence of Wagner's Law and the counter-cyclical nature of fiscal policy in Indonesia were interesting findings because those patterns usually occur in developed countries (see Chapter 2), while Indonesia is still grouped as one of the emerging nations. However, these findings were understandable due to the characteristics of Indonesia: it is a fast-growing economy by world standards, expected to become the seventh leading economy in the world by 2030, as explained in Chapter 1 and, as highlighted in Chapter 3, there is an arrangement that the debt-to-income ratio must not exceed 60% and the deficit-to-income ratio must be below 3% (Financial Law No.17/2003).

A number of results emerged from the work in Chapter 5, which examined the fiscal multipliers in Indonesia using ten variables of real per capita, suggesting that there was evidence of crowding out of investment as a result of both the deficit-financed tax cut scenario and the balanced budget simulation. On the other hand, using a method suggested by Mountford and Uhlig (2009), it was found that a deficit spending scenario appeared to be the best fiscal policy for stimulating the economy in Indonesia. The results of Chapter 5 were relevant to the deficit spending policy that was carried out in Indonesia and the disciplinary implementation of Financial Law No.17/2003, as was elaborated upon in Chapter 3. This has been supported by the Indonesian government's actions, due to the fact that this deficit spending fiscal policy has been effectively conducted in Indonesia as one of the ways to stabilise the economy, to maintain its economic performance and to overcome some economic issues, as also discussed in Chapter 3.

For future research on the role of fiscal policy in stabilising the economy in Indonesia, it is suggested that the study of fiscal policy stabilisation might consider utilising the full SVAR results to explain the transmission mechanisms behind the outcome showcased and the application of multiple structural breaks (more than one break at the same time) and the use of the GDP per capita variable to catch up Indonesia's long-run fiscal policy stabilisation. In addition, the role of fiscal policy in stabilising the economy should be considered for future research through the ARDL and DSGE methodologies. Furthermore, the effects of shocks without zero constraints via use of the rejection method, both with and without delayed shocks, could be examined and compared. Another final suggestion is that government investment and government debt should be considered in future research because it has been ignored in this thesis due to the limitations of the data set.

Finally, While this may be the case from simply looking at the size of an estimated multiplier, the multiplier of pursuing the balance budget is actually not that too far apart. The longer term implication of pursuing a balance budget policy would certainly be much more benign than pursuing a continuous deficit spending policy that may risk the economy to be trapped at some chronic deficit issues that may lead into a crisis. Therefore, even though the balanced budget is slightly smaller, government might prefer to select this in the light of its potential long-term effects on government deficit and debt. This could be an area for further study in a model with broader context.”

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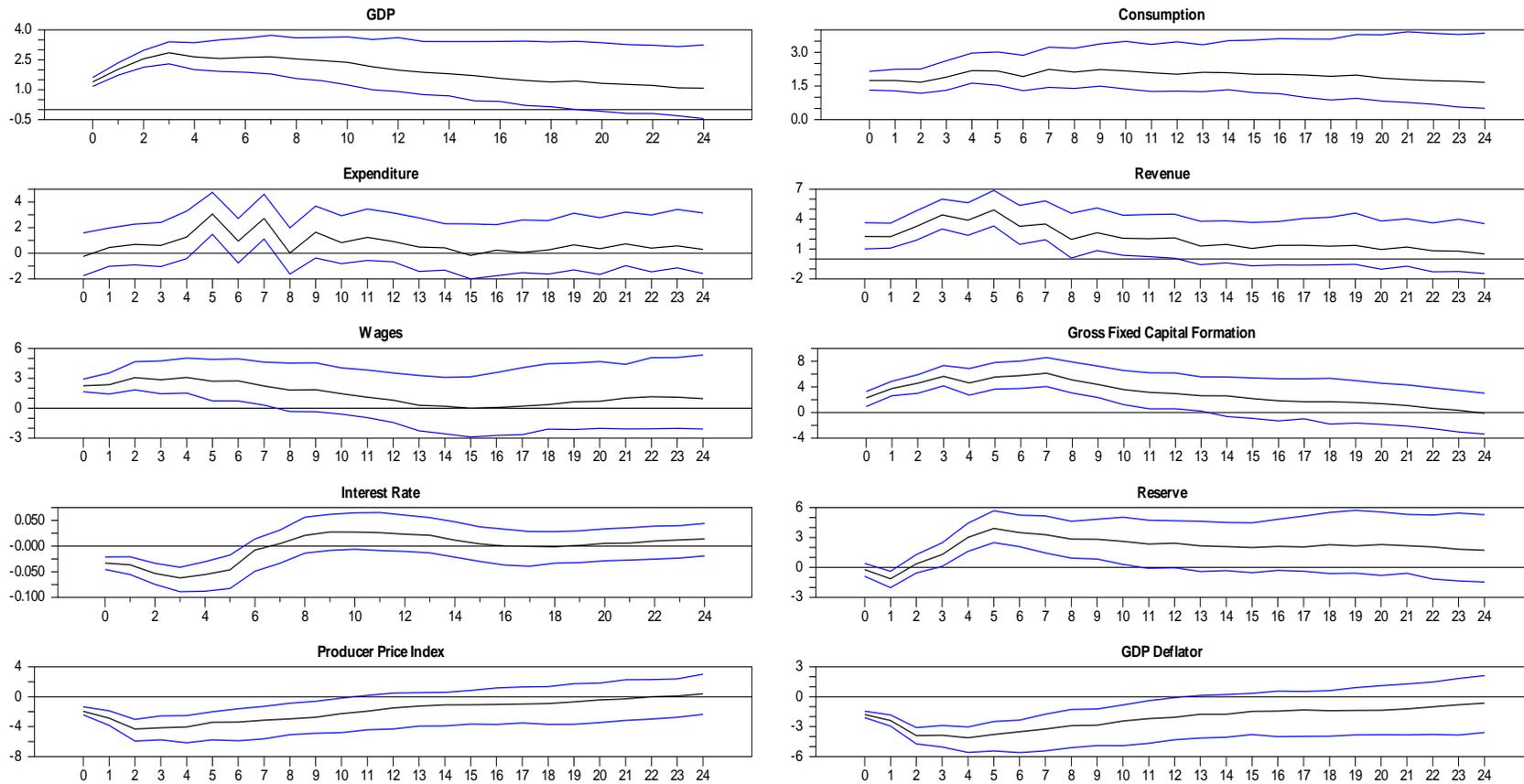
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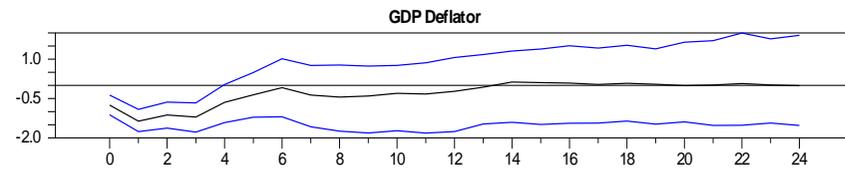
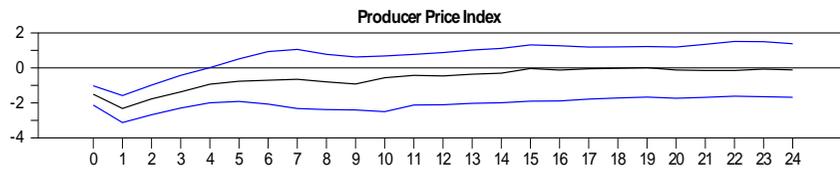
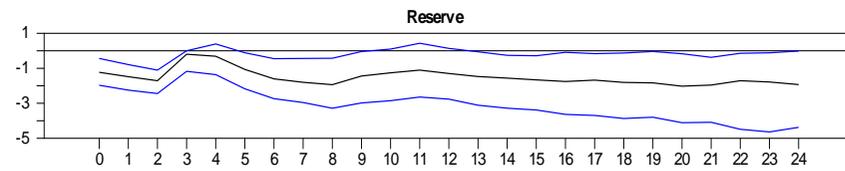
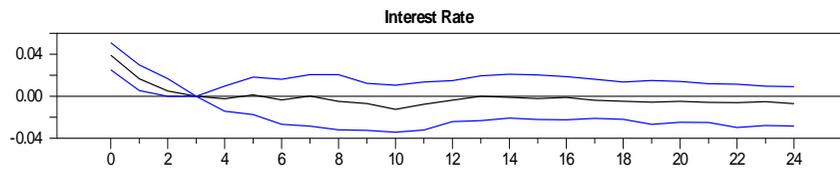
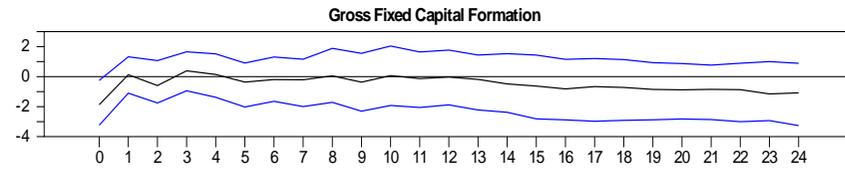
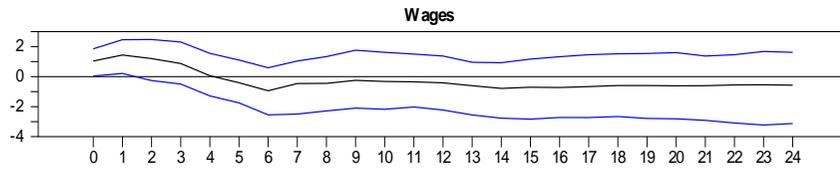
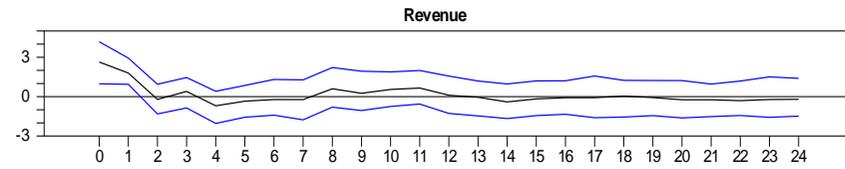
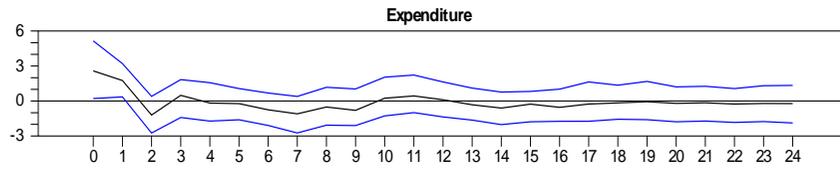
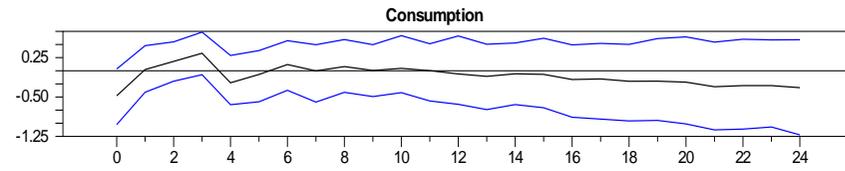
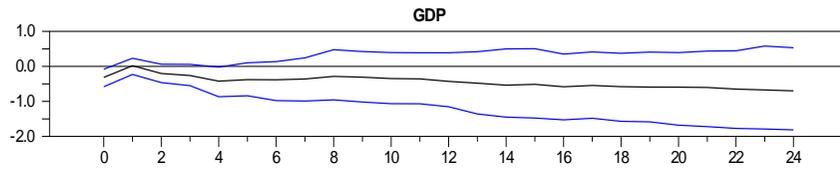
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# APPENDICES

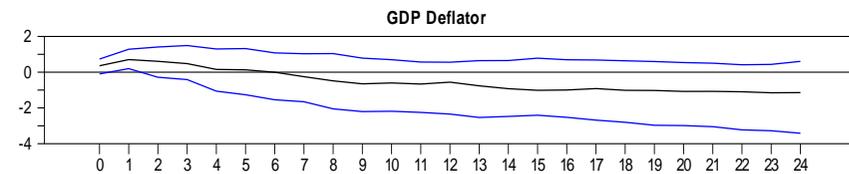
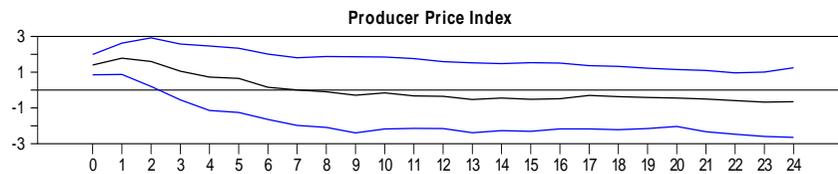
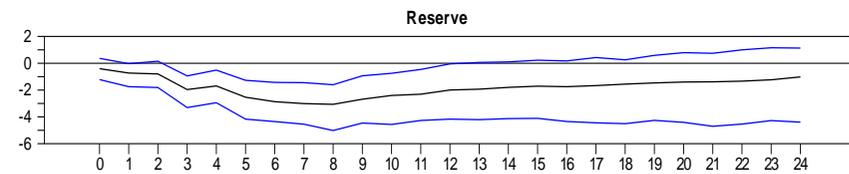
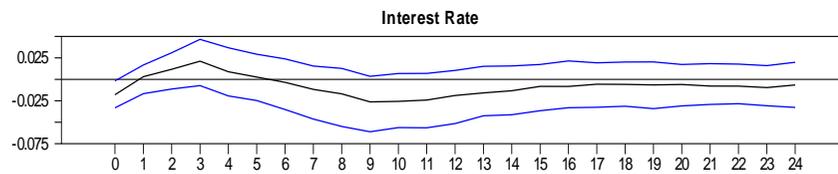
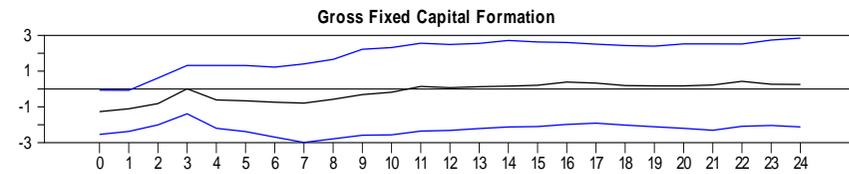
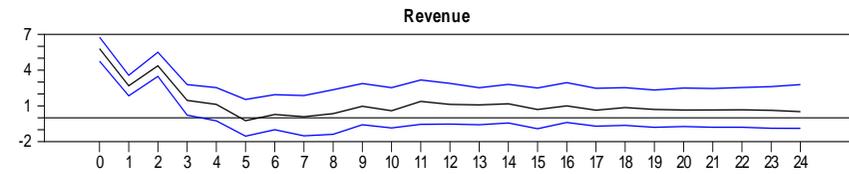
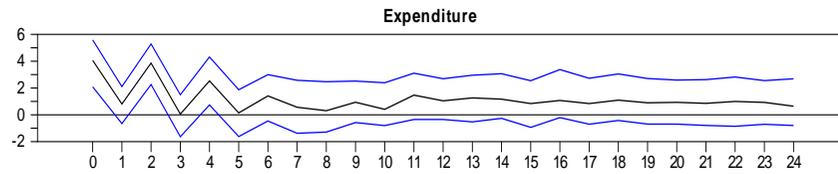
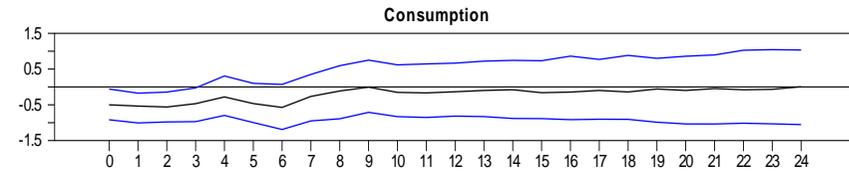
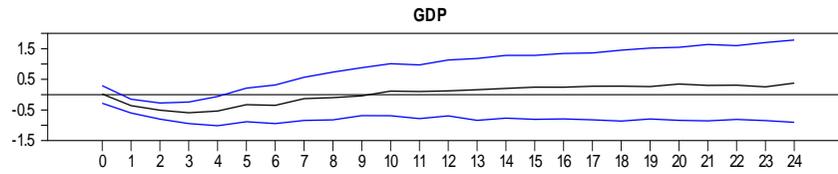
## Appendix I Responses to Business Cycle



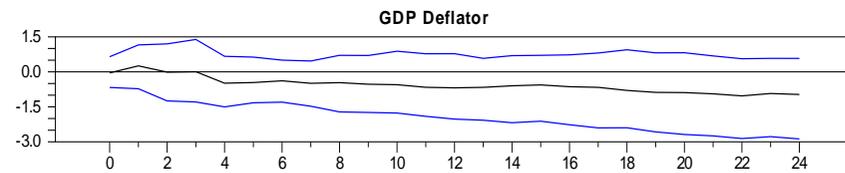
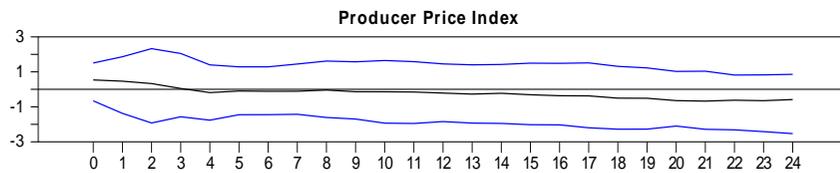
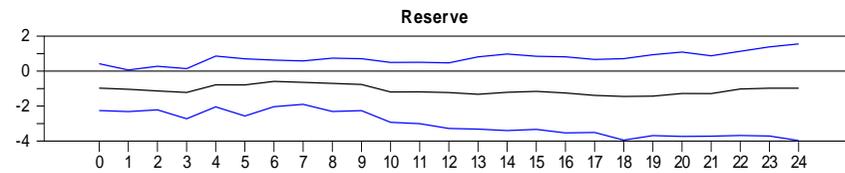
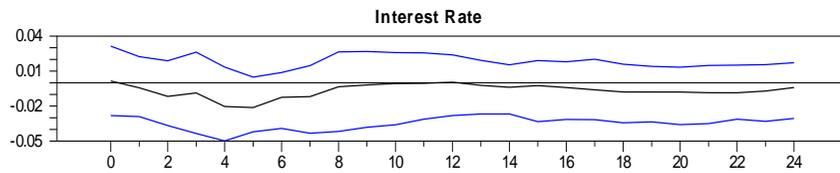
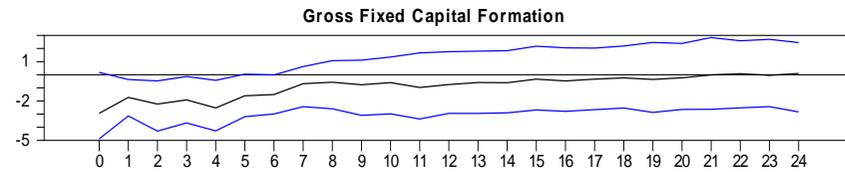
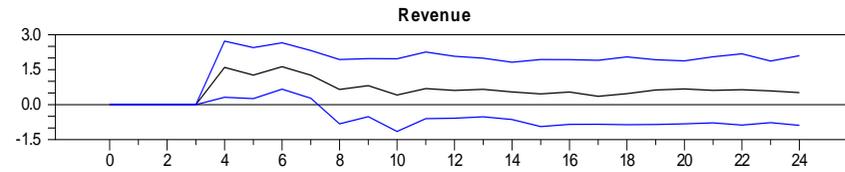
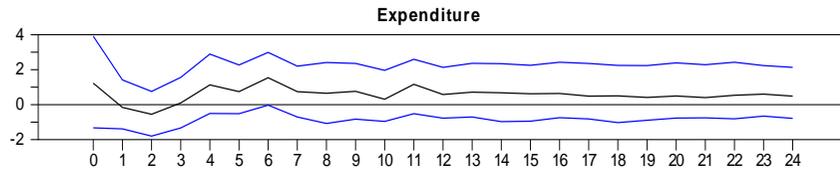
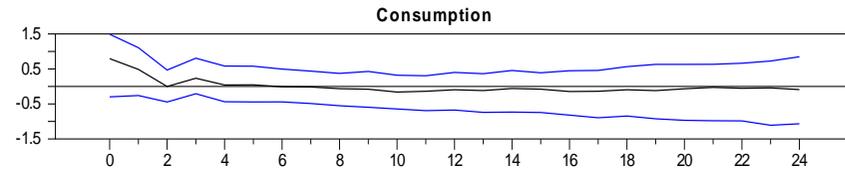
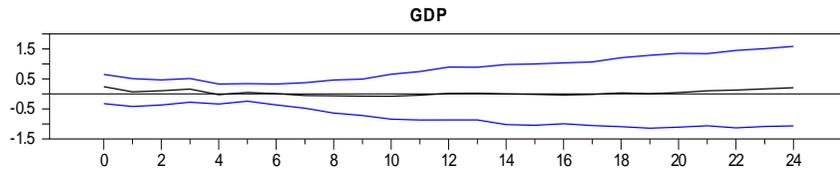
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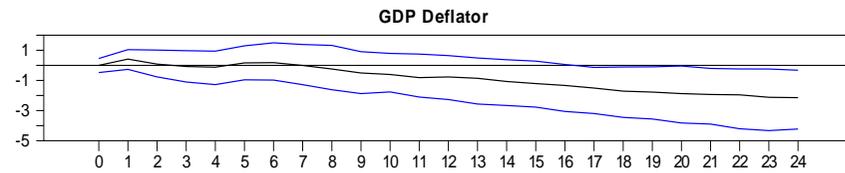
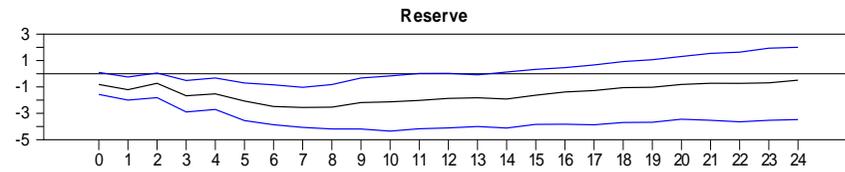
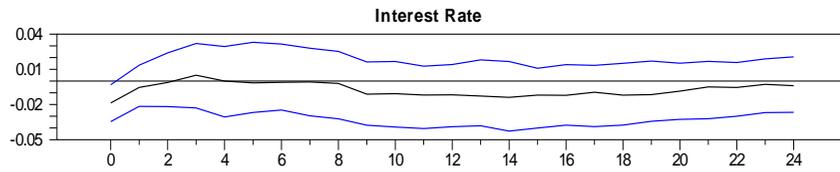
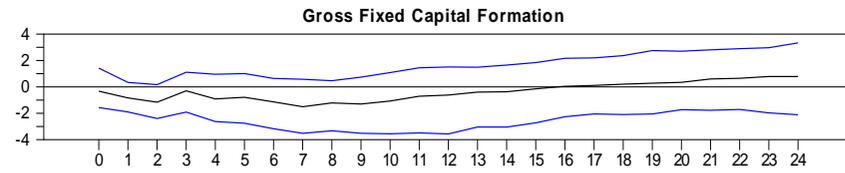
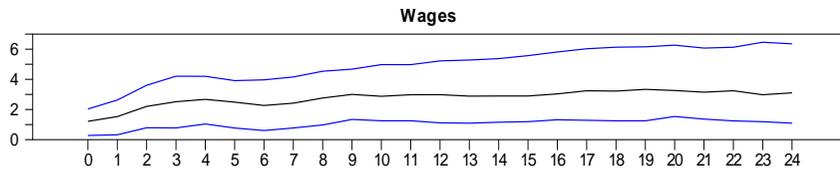
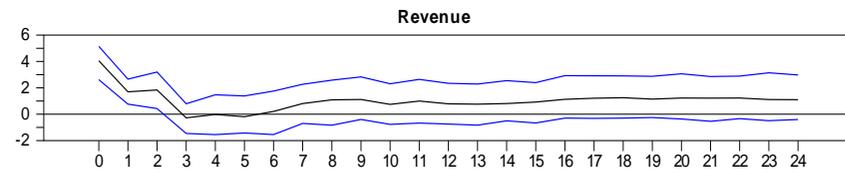
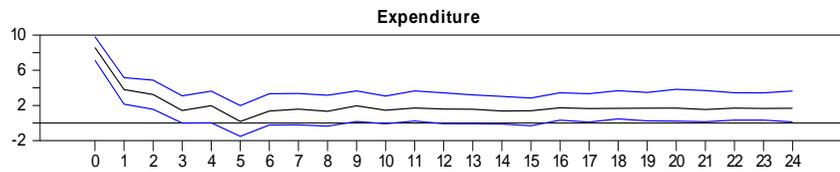
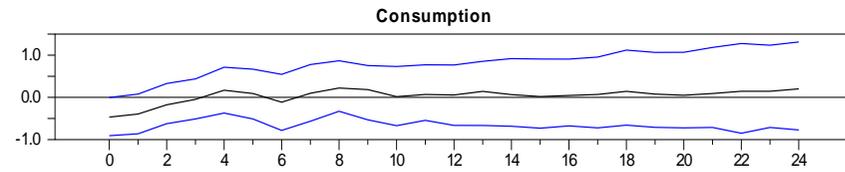
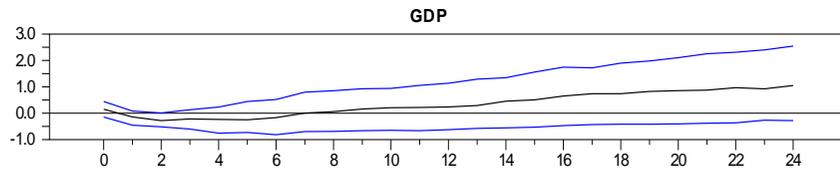
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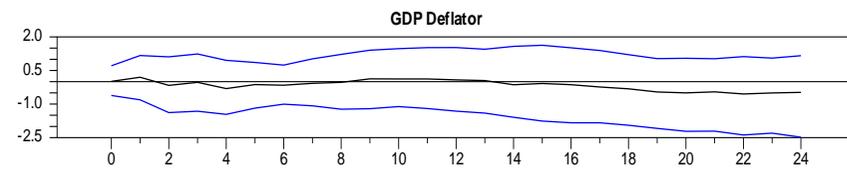
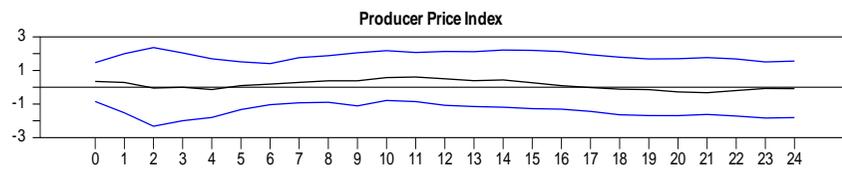
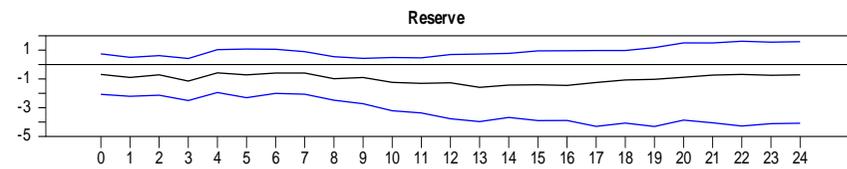
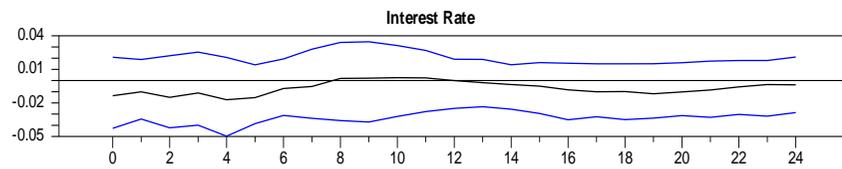
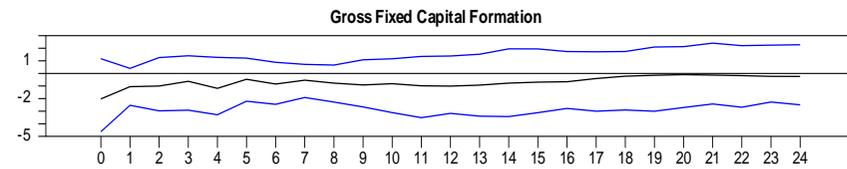
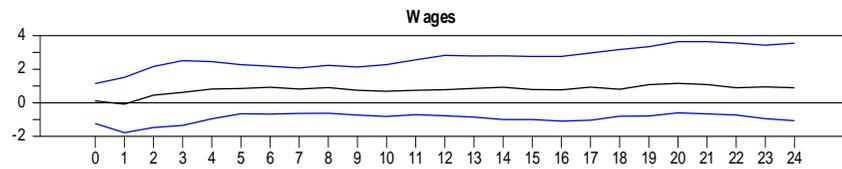
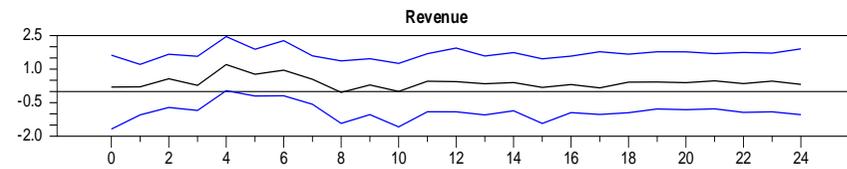
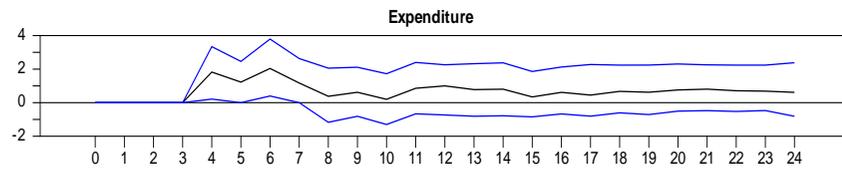
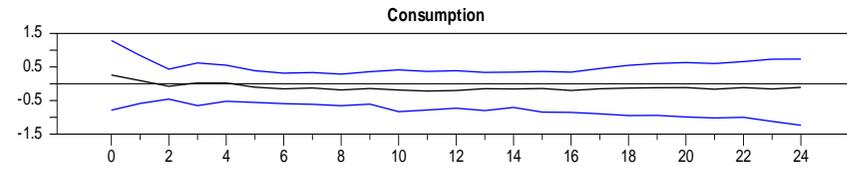
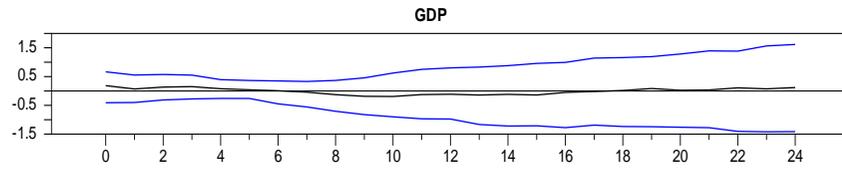
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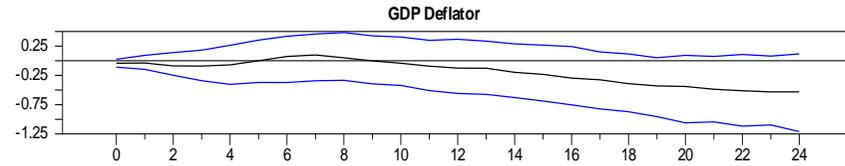
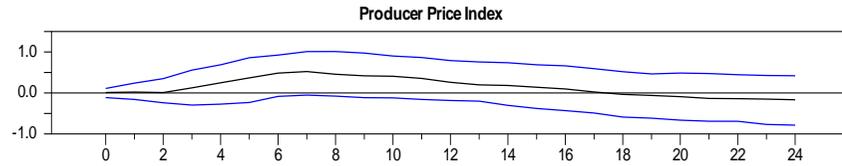
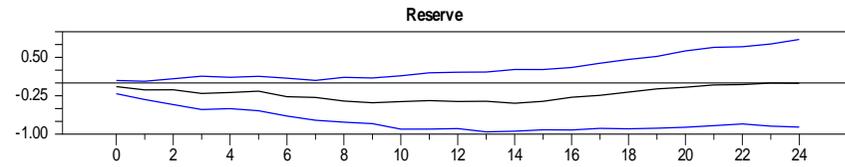
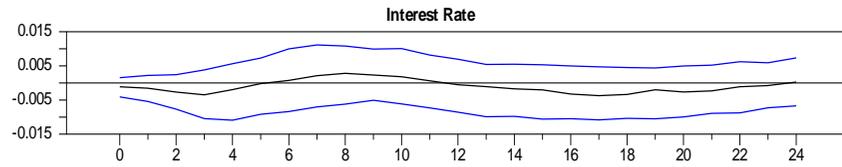
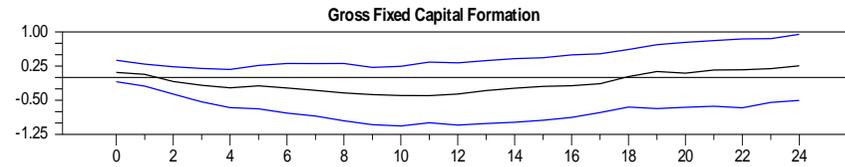
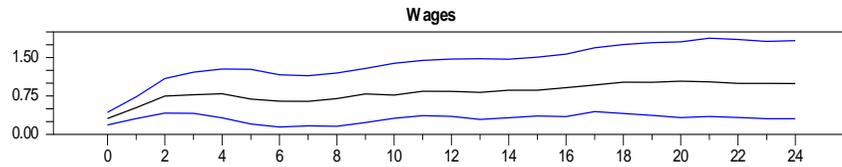
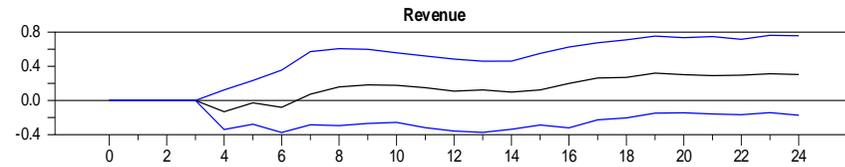
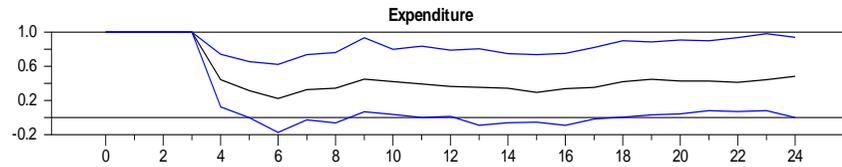
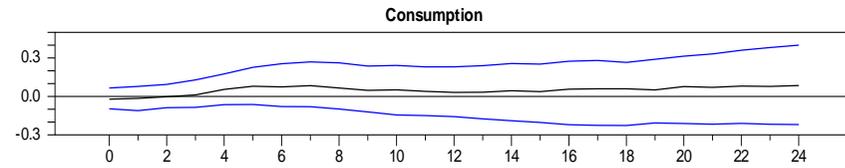
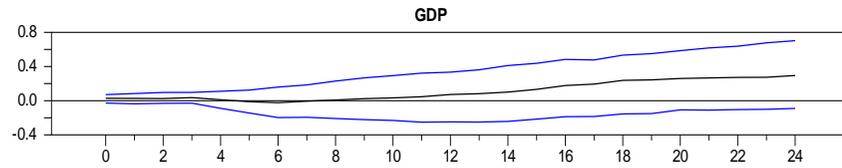
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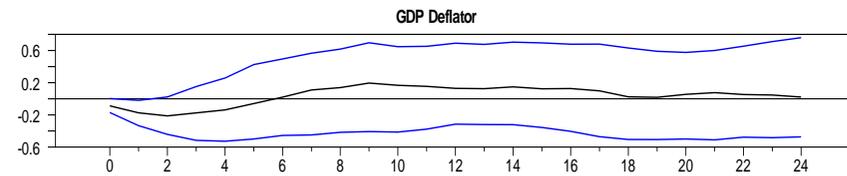
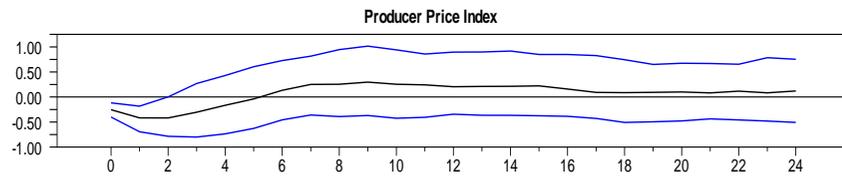
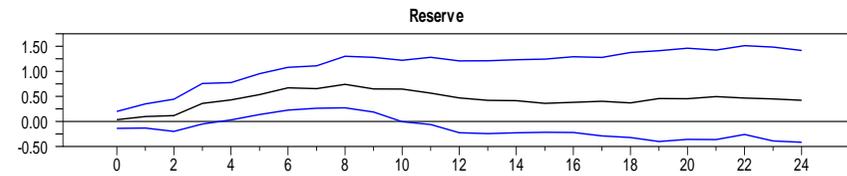
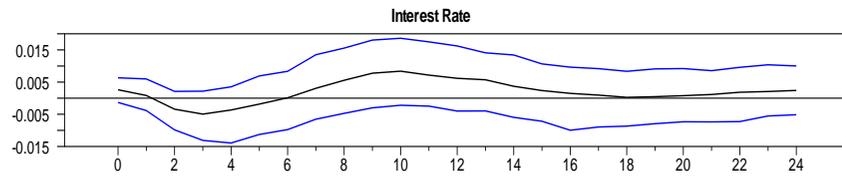
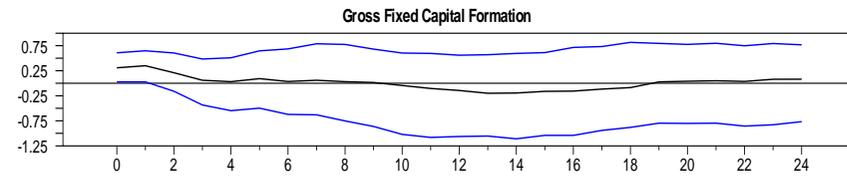
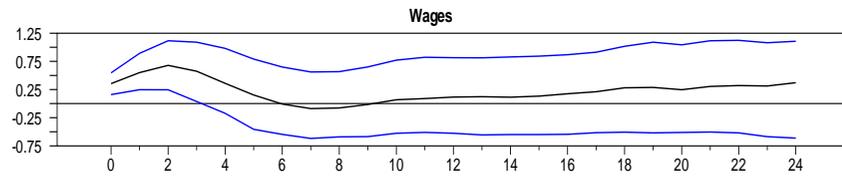
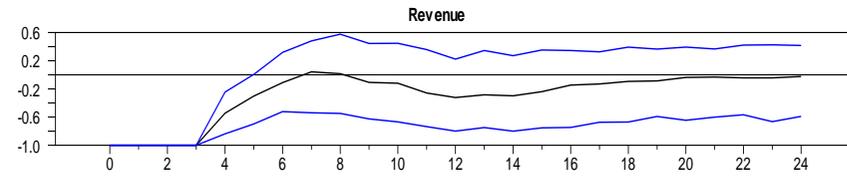
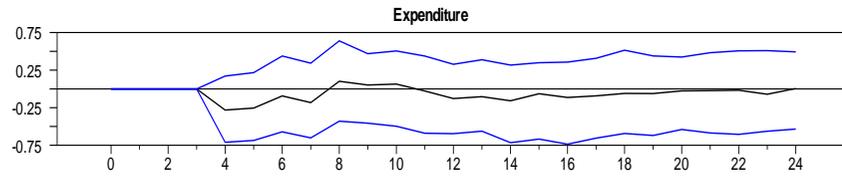
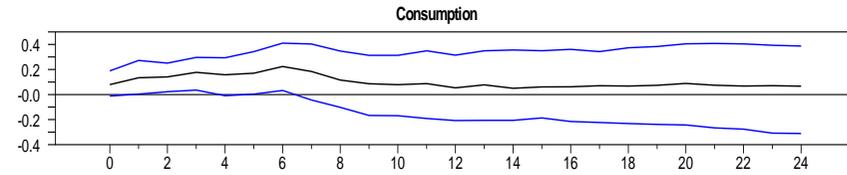
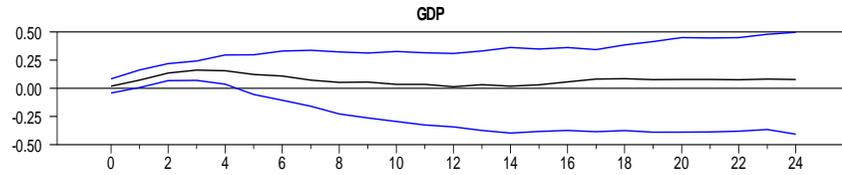
## Appendix VI Responses to Spending (Delayed)



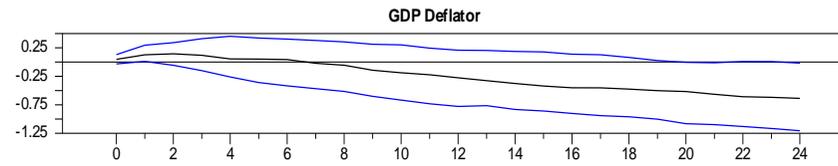
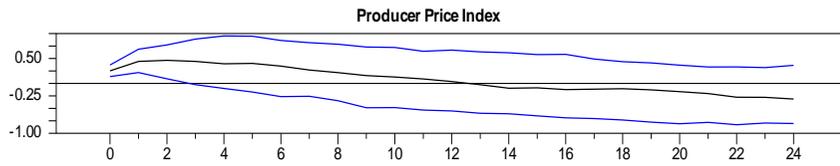
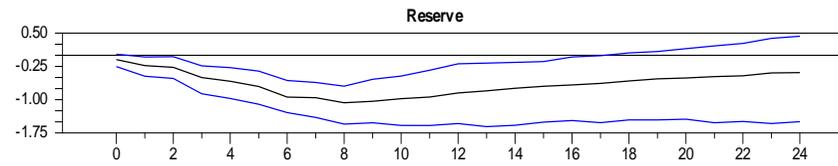
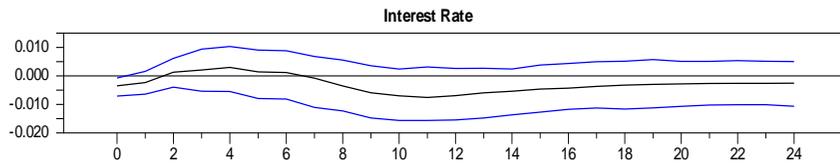
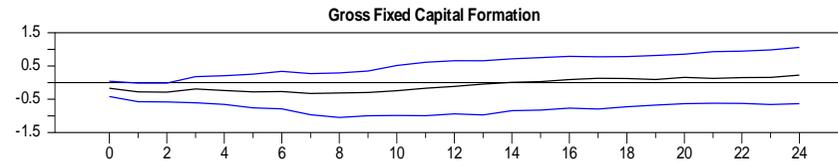
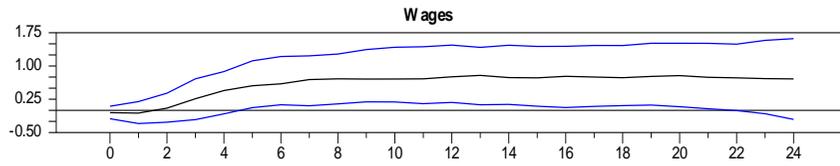
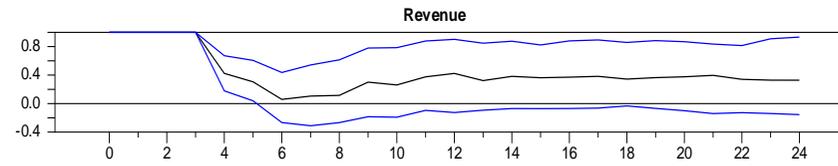
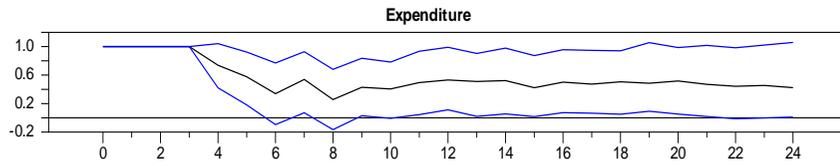
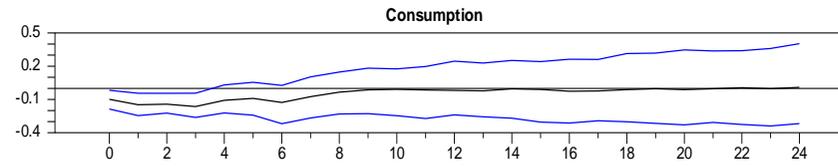
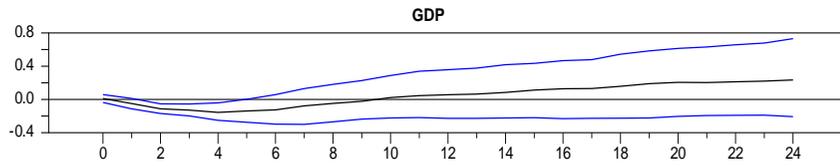
## Appendix VII Responses to Deficit Spending



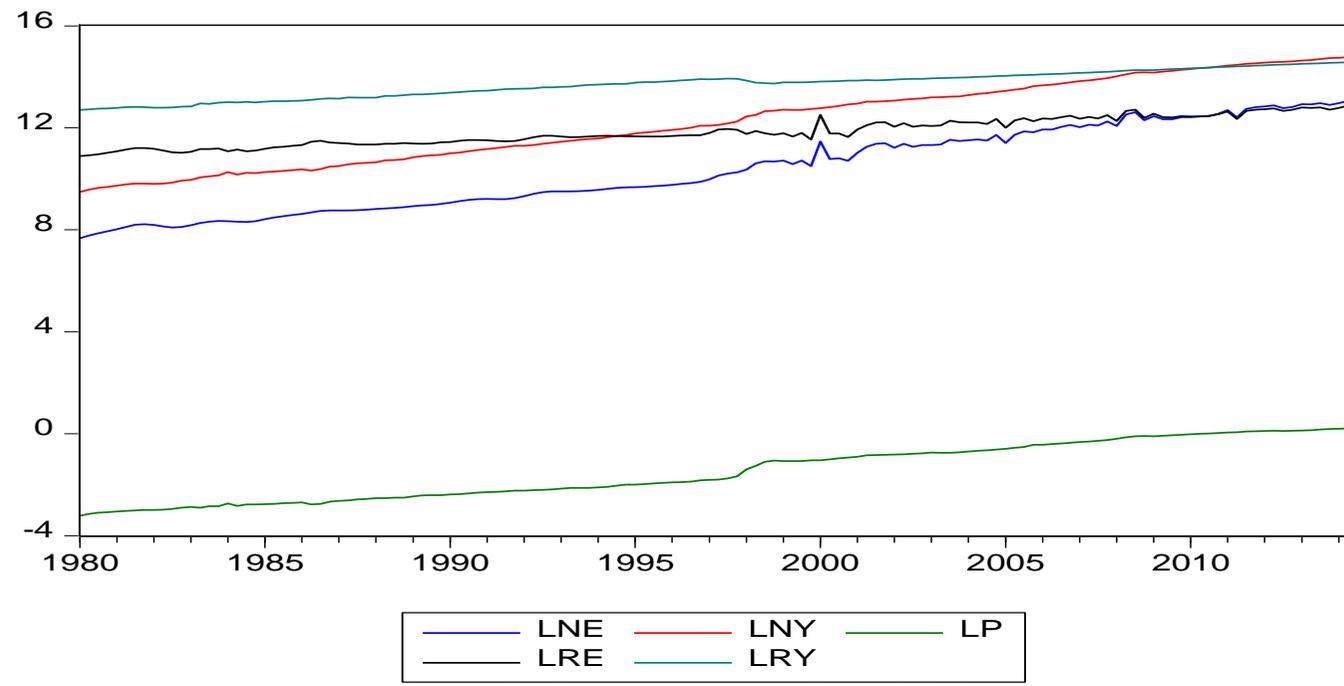
## Appendix VIII Responses to Deficit Tax Cut



## Appendix IX Responses to Balanced Budget

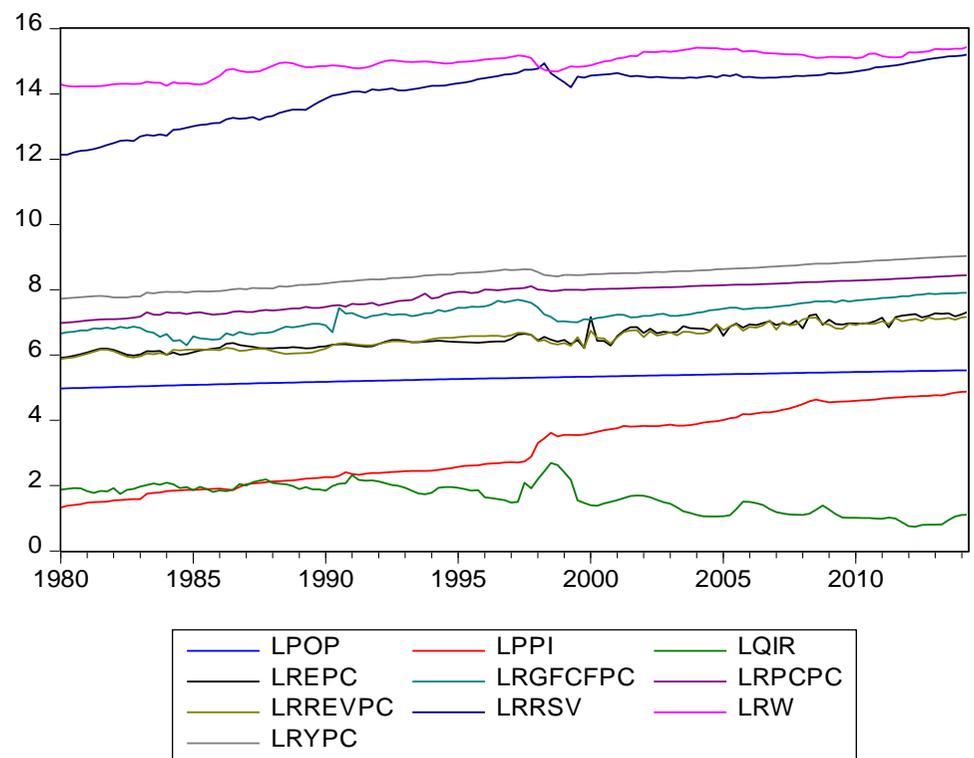


**Appendix X Dynamic Visualisation of Log Nominal Expenditure (LNE), Log Nominal GDP (LNY), Log GDP Deflator (LP), Log Real Expenditure (LRE) and Log Real GDP (LRY) 1980Q1-2014Q2**



Source: The Thompson Reuters Data Stream Oxford

**Appendix XI Dynamic Visualisation of LREPC ( Log of real Government Expenditure per capita), LRREVPC (Log of real Government Revenue per capita), LRW (Log of real Wages), LRGFCFPC (Log of real Gross Fixed Capital Formation per capita), LQIR (Log of Quarterly Interest Rates of BI), LRRSV (Log of Real Reserve), LPPI (Log of Producer Price Index) and LP (Log of Price Deflator) 1980Q1-2014Q2**



Source: The Thompson Reuters Data Stream Oxford