# Determinants and consequences of fiscal procyclicality and sustainability

**Junho Park**

**PhD**

**Department of Economics**
**The University of York**

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*for Jeeyoung*

# Abstract

A countercyclical fiscal policy combined with sustainable fiscal finances is considered to be one of the most important objectives in modern economic policy. However, procyclical fiscal policy is widely observed in practice, especially in emerging market countries. The main purposes of this thesis are to examine the determinants of fiscal procyclicality and sustainability with special reference to the role of fiscal rules, and to assess the impact of both fiscal procyclicality and sustainability on economic growth. This thesis deals with several new issues on fiscal procyclicality and sustainability which have been ignored in the existing literature. We explore the role of the time coverage of fiscal rules in determining fiscal procyclicality and assess the effect of fiscal procyclicality on economic growth across spending categories and country groups. We also attempt to answer the determinants of fiscal sustainability and the effect of fiscal sustainability on economic growth for the first time.

Our empirical analyses yield a number of novel and interesting findings. First, we find that government consumption and investment appear to be procyclical while current transfers appear to be countercyclical in a large number of OECD countries. Second, we find that most OECD countries seem to maintain sustainable fiscal finances and several factors such as the growth rate, the level of development, and aging populations could play a role in determining fiscal sustainability. Third, we find that procyclical current expenditure, especially government consumption and current transfers, could have a negative effect on economic growth, and this negative effect is prominent in emerging market countries. We also find that fiscal sustainability does not seem to play any role in economic growth in tranquil times. Finally, we find that the introduction of fiscal rules not only help achieve both countercyclical and sustainable fiscal policy, but also boost economic growth indirectly by stimulating countercyclical fiscal policy. Multi-year fiscal rules contribute more toward mitigating the level of fiscal procyclicality than annual fiscal rules, and fiscal rules with enforceability, such as the Stability and Growth Pact rules, appear to help maintain sustainable fiscal finances.

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# Declaration

I hereby declare that this thesis is my own work and effort. The work contained is original except other source of information which have been acknowledged in the customary manner and has never been submitted for any other degree.

# Chapter 1

# Introduction

The current economic crisis has been the most severe and widespread since the Great Depression in the 1930s (Fernández-Arias and Montiel, 2011). The world economy has been suffering from financial difficulties and a series of economic downturn since the US subprime mortgage crisis in 2007 (Fincke and Greiner, 2012). Most countries conducted substantial fiscal stimulus packages from 2008 to 2010[1] in response to the global financial crisis, but they were accompanied by the expense of the deterioration of fiscal sustainability (Escario, Gadea, and Sabaté, 2012; Misra and Khundrakpam, 2010; Padoan, 2009). In turn, the concern over default of Greece has spread widely and has contributed to a further global economic downturn since autumn 2011.

As a consequence, there has been revived interest in fiscal policy issues. A countercyclical fiscal policy has been highlighted again as an effective economic policy tool to overcome economic crisis in recent literature (Wren-Lewis, 2011; Feldstein, 2009; Auerbach, 2009). However, the risk of deteriorating fiscal sustainability arising from countercyclical fiscal policy has also been recognized by policymakers and economists (Freedman, Kumhof, Laxton, Muir, and Mursula, 2009). Furthermore, it is not easy to recover sustainable fiscal finances once the budget deficit and government debt start to increase due to the inertial properties of fiscal policy. This is why the international credit rating agencies, such as Moody's and Standard and Poor's, consider fiscal situation to be one of the crucial factors for the credit rating of each country in practice.

The objective of economic policy tends to vary at different needs over time (Atkinson, Baker, and Milward, 1996)[2]. It has been argued that there are three main functions of fiscal policy in modern economies: first, efficient resource allocation through the provision of public goods, second, the redistribution of income and wealth for fair state of distribution, and finally, a macroeconomic stabilization function for high employment, price stability, and sustained economic growth (Musgrave and Musgrave, 1989). To achieve these goals of fiscal policy, fiscal authorities should maintain sustainable fiscal finances because they could enable

1. The size of effect of fiscal stimulus packages on budget balance for the period 2008-2010 in OECD countries is -3.3% on average (Padoan, 2009).
2. It has been agreed that the ultimate objective of economic policy is the promotion of social welfare (Grant and Nath, 1984), but the specific shape of social welfare can take a variety of different forms.

governments to undertake the main functions by providing sufficient resources (Berenguer-Rico and Carrion-i-Silvestre, 2011; McLaren, Armstrong, and Harris, 2010). Therefore, both to conduct a cyclical stabilization over a business cycle in the short term and to maintain fiscal sustainability in the long term could be considered to be the most important objectives for fiscal policymakers to aim towards (Wyplosz, 2005)[3]. However, it is not easy to obtain macroeconomic stability and sustainable fiscal finances respectively, as well as both macroeconomic stability and sustainable fiscal finances simultaneously (Huart, 2011; Coeure and Pisani-Ferry. 2005).

As a result, the issues of fiscal cyclicality and sustainability have been widely explored. However, the existing literature has mainly dealt with the determinant of fiscal procyclicality and the measurement of fiscal sustainability. The issues on the determinant of fiscal sustainability and the effect of both fiscal procyclicality and sustainability on economic growth have generally been ignored.

This thesis attempts to fill this gap by dealing with several new issues on both the procyclicality and sustainability of fiscal policy which the existing literature has omitted. The main contributions of this thesis are that our analyses not only comfirm the results of recent literature on fiscal cyclicality that the fiscal policy of advanced countries have also been procyclical at times and procyclical fiscal policy could hinder economic growth, but also provide several novel and interesting implications. First, this thesis explores the role of fiscal rules in determining fiscal procyclicality, and assesses the effect of fiscal procyclicalty on economic growth across spending categories and country groups. Fiscal rules have been considered to be efficient policy tools to improve fiscal sustainability, but they could also have an effect on the cyclical properties of fiscal policy by exerting various restrictions to budget operation. The main contribution of these analyses is that we find a new important determinant of fiscal procyclicality by showing that fiscal rules could play a different role in determining fiscal procyclicality depending on their time coverage. We show that multi-year fiscal rules could contribute more towards mitigating the level of fiscal procyclicality than annual fiscal rules. This finding could provide implications

3. For example, the Stability and Growth Pact (SGP) rules target macroeconomic stability and fiscal sustainability as the main objectives (Buiter, 2004; Buiter and Grafe, 2004).

on the recent debate about the effect of Stability and Growth Pact (SGP) rules[4], which is the form of annual fiscal rules, on fiscal procyclicality. These new trials could also provide the rationale that governments should operate their fiscal policy in a countercyclical way for sustained economic growth, and some policy implications as to how each country should operate fiscal policy across spending categories and its level of development by showing that the effect of procyclical fiscal policy on economic growth is different depending on spending categories and country groups. Second, this thesis attempts to explore the determinants of fiscal sustainability and the effect of fiscal sustainability on economic growth. These issues have been ignored in the existing literature, but they are clearly of increasing concern following from the fiscal aspects of current economic crisis. The main contribution of these analyses is that they could provide policy implications for governments in their effort to maintain sustainable fiscal finances by revealing the determinants of fiscal sustainability. This analysis could also suggest implications on the structure of fiscal rules to improve fiscal sustainability that fiscal rules should be designed in a way that has enforceability. Also, they provide the empirical evidence that unsustainable fiscal finances do not hinder economic growth in tranquil times even though it could lead to sudden economic crisis by endangering default of government debt.

The main purposes of this thesis are to examine the determinants of fiscal procyclicality and sustainability with special reference to the role of fiscal rules, and to assess the effect of both fiscal procyclicality and sustainability on economic growth empirically. This thesis deals with the issue of the macroeconomic stabilization function of fiscal policy, namely the cyclical properties of fiscal policy in chapter 2, the issue of the fiscal sustainability in chapter 3, and the effect of both fiscal procyclicality and sustainability on economic growth in chapter 4. This thesis employs the same methods as the existing literature when we explore the determinants of fiscal procyclicality and the effect of fiscal procyclicality on economic growth. This thesis borrows these approaches to explore the determinants of fiscal sustainability and the effect of fiscal sustainability on economic growth.

4. EU member countries must avoid excessive deficits (three percent of GDP for the general government deficit) and reduce their debt to GDP ratio to below 60 percent. This rule was introduced by the Treaty of the European Union (Maastricht Treaty) in 1992.

The thesis is organised as follows. The second chapter considers the determinants of fiscal procyclicality. We focus on the role of fiscal rules in determining the cyclical properties of fiscal policy. Most of the existing literature shows that the fiscal policies of developed countries are countercyclical while those of developing countries are procyclical, and it mainly suggests weak political institutions or credit constraints as the reason for procyclical fiscal policy. This chapter focuses on analysing the cyclical properties of fiscal policy of OECD countries by decomposing government spending into several categories (government consumption, interest payments, current transfers, and government investment), and examining the role of the time coverage of fiscal rules in determining fiscal procyclicality through both correlation and regression approaches. We find that a large number of OECD countries seem to operate their fiscal policy in a procyclical way. More specifically, government consumption and government investment of a large number of OECD countries appear to be procyclical in line with some recent literature[5]. We also find that multi-year fiscal rules are more effective than annual fiscal rules to achieve a countercyclical fiscal policy. This finding implies that the exisiting studies about the effect of the SGP rules on fiscal cyclicality could be misleading because they do not consider the fact that the effect of the SGP rules, which are annual rules, will be lessened if one excludes the effect of multi-year fiscal rules which each country adopted on their own initiative.

The third chapter attempts to explore the determinants of fiscal sustainability. This chapter analyses the fiscal sustainability of OECD countries, identifies the main determinants of fiscal sustainability by conducting comprehensive survey on the existng theoretical and empirical literature, and examines the role of each factor in determining fiscal sustainability with special reference to fiscal rules. We find that most OECD countries seem to maintain sustainable fiscal finances and that several factors such as the growth rate, the level of development, and aging populations could play a role in determining fiscal sustainability. The growth rate has a positive effect on fiscal sustainability while aging populations have a negative effect. The advanced countries are more likely to maintain sustainable fiscal finances. We also find that the SGP rules appear to have helped policymakers maintain sustainable

5. The recent literature starts to suggest the possibility of procyclical fiscal policy in developed countries (Lane, 2003; Manasse, 2006; Mackiewicz, 2008; Ilzetzki, 2009; Huart, 2011).

fiscal finances in the Economic and Monetary Union (EMU) countries, although other fiscal rules do not seem to any role in maintaing fiscal sustainability in OECD countries due to lack of enforceability when they are violated.

The fourth chapter explores the effect of both fiscal procyclicality and sustainability on economic growth. The existing literature is starting to deal with the former but has ignored the latter. This chapter focuses on analysing the effect of the cyclical properties of fiscal policy and fiscal sustainability on economic growth across spending categories and country groups. We find that procyclical fiscal policy could have negative effect on economic growth, and this effect is prominent in emerging market countries than in advanced countries. We also find that the composition of government spending plays a key role in its effects on economic growth. More specifically, procyclical government consumption and current transfers, which are assumed to be unproductive, could have a negative effect on economic growth while procyclical government investment, which is considered to be productive, does not hinder economic growth. On the other hand, we find that the sustainability of fiscal finances do not seem to play any role in economic growth in tranquil times even though it could lead to sudden economic crisis.

Finally, this thesis presents a set of general conclusions, policy implications, and future research issues.

# Chapter 2

# The role of fiscal rules in determining fiscal procyclicality

# 1. Introduction

There is revival of interest on the use of countercyclical fiscal policy as a macroeconomic policy instrument following the economic recession which started in 2007 (Wren-Lewis, 2011; Feldstein, 2009; Auerbach, 2009)[6]. However, the same policy approach may not be applied to countries with different economic and social backgrounds and different budget systems. It is seen to be difficult to operate countercyclical fiscal policy in practice for most countries: fiscal policymakers in developing countries especially seem to have more difficulties than those in developed countries. The existing literature shows that the fiscal policies of developing countries appear to be more procyclical than those of advanced countries, and it mainly suggests the theoretical features, such as weak political institutions and the constraints to access international capital markets, as the main reason for this phenomenon. In practice, however, there could be several other factors which cause this phenomenon such as weak fiscal institutions.

This chapter focuses on the role of the time horizon of fiscal policy which comprises an important part of fiscal institutions. We utilize the time coverage of fiscal rules as a proxy for the time horizon of fiscal policy. Fiscal rules can be defined as a permanent restriction on fiscal policy and are given by the numerical targets on budget and debt over certain periods. They have been introduced since the 1970s as a guideline of fiscal policy and have become more common in recent years as budget deficits have increased and public debt has accumulated (IMF, 2009). A large number of countries have adopted their own fiscal rules, and some countries have adopted supranational fiscal rules such as Stability and Growth Pact (SGP). Fiscal rules have originally been considered to be an efficient policy tool to strengthen fiscal sustainability. However, fiscal rules could also play an important role in deciding fiscal stance because they give various restrictions to the budget operation. The debate about alleviating the SGP rules which occurred in the mid-

6. Feldstein (2009) argues that governments and economists start to consider fiscal policy to be useful countercyclical instrument. Auerbach (2009) also argues that there has been a policy shift moving toward adopting countercyclical fiscal policy such as fiscal stimulus package. On the other hand, Taylor (2009) argues that there is still no empirical evidence for efficiency of a countercyclical discretionary fiscal policy.

2000s is a good example that shows the importance of fiscal rules in determining the cyclical properties of fiscal policy.

This chapter focuses on analysing the cyclical properties of fiscal policies in the OECD countries by decomposing government spending into several categories, such as consumption, interest payments, current transfers, and investment, and it shows that a large number of OECD countries appear to implement procyclical fiscal policy. More specifically, government consumption and government investment appear to be procyclical while current transfers appear to be countercyclical in a large number of OECD countries. Also, this chapter combines the existing explanation, political constraints or credit constraints, with fiscal rules to explain the reason for fiscal procyclicality. This chapter, especially, deals with the effect of introducing fiscal rules explicitly by analysing the effect of the time coverage of these rules for the first time, and it shows that multi-year fiscal rules contribute more towards mitigating the level of fiscal procyclicality than annual fiscal rules. These findings provide some implications for governments to operate fiscal policy in a more countercyclical way by revealing the determinants of fiscal procyclicality more practically. These findings also provide implications on the recent debate about the effect of the SGP rules on fiscal cyclicality by showing that the effect of the SGP rules will be lessened if one excludes the effect of national fiscal rules.

The remainder of this chapter is organized as follows. Section 2 contains theoretical issues on fiscal procyclicality and fiscal rules. Section 3 provides empirical evidence about the cyclical properties of fiscal policies in OECD countries and the effect of the time coverage of fiscal rules on fiscal procyclicality. Finally, this chapter ends with some concluding remarks and policy implications to mitigate fiscal procyclicality.

# 2. The theoretical Issues on fiscal procyclicality and fiscal rules

## 2.1. The concept of fiscal procyclicality

Following the pioneering work of Gavin and Perotti (1997) which shows that the fiscal policy of Latin American countries is procyclical[7], a series of studies have analysed whether this phenomenon is applied to all developing countries. There is a general consensus on the definition of fiscal procyclicality: fiscal policy is defined as procyclical if fiscal policy is expansionary in booms and contractionary in recessions (Manasse, 2006; Kaminsky, Reinhart, and Végh, 2004). This chapter follows the general notion of fiscal procyclicality in the existing literature. Procyclical fiscal policy is assumed to be accompanied by an increase in government spending, the drop in tax rates, and the decrease in budget balance when the economy is in good times.

At first, one should decide which fiscal variable, such as government spending, tax revenue[8], and budget balance, can be utilized as a proxy for fiscal policy in the analysis of fiscal cyclicality. There are some differences in the list of fiscal variables employed in the existing literature to estimate fiscal cyclicality. Most studies utilize the government spending or government consumption as a proxy for fiscal policy (see, for example, Talvi and Végh, 2005; Alesina, Campante, and Tabellini, 2008; Ilzetzki and Végh, 2008; Woo, 2009; Lledó, Yackovlev, and Gadenne, 2009; Ilzetzki, 2011; Frankel, Végh, and Vuletin, 2011; Badinger, 2012), whereas some studies utilize the budget balance (Gavin and Perotti, 1997; Manasse, 2006; Aghion and Marinescu, 2007; Mackiewicz, 2008; Alesina, Campante, and Tabellini, 2008; Çiçek

7. The authors analyse the covariation of fiscal outcomes with macroeconomic fluctuation using the data of 13 Latin American countries for the period 1968-1995, and they show that the fiscal policy of these countries is procyclical in bad times.

8. We review tax revenue instead of tax rates even though tax rates are theoretically more suitable index to estimate fiscal cyclicality rather than tax revenue. This is because every country has a large number of tax rates responding to the different tax base, so it is difficult to find out representative tax rates of each country. Recently, Végh, and Vuletin (2012) show that tax policy of emerging market countries tends to be procyclical by constructing dataset on tax rates for 62 countries, but it has several drawbacks on collecting data as they stated in their article.

and Elgin, 2011) or cyclically adjusted budget balance[9] (Galí and Perotti, 2003; Marinheiro, 2007; Plessis and Boshoff, 2007; Alberola and Montero, 2007; Forni and Momigliano, 2007; Huart, 2011).

It seems reasonable to utilize government spending as the basis of analysis, as is done in the most existing literature. Tax revenue, which depends on both tax rates and the tax base, cannot be considered as an appropriate proxy for fiscal cyclicality because the tax base is positively associated with business cycle (Kaminsky, Reinhart, and Végh, 2004). The budget balance can fully reflect the effect of fiscal policy on savings and demand, but it cannot reflect appropriately policymaker's discretionary action (Mackiewicz, 2008). In other words, tax revenue and the budget balance cannot be controlled by the government since they are endogenous to the business cycle due to the function of automatic stabilizers in budget systems (Ilzetzki and Végh, 2008; Frankel, Végh, and Vuletin, 2011; Badinger, 2012). A cyclically adjusted budget balance could be a possible alternative of the proxy for fiscal policy in the sense that it excludes the cyclical component of the budget balance, but it could be different depending on the measurement methods about potential GDP (Mackiewicz, 2008) and could be systematically overestimated or underestimated (Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003). Therefore, this chapter utilizes government spending as a proxy for fiscal policy considering the fact that it can be considered to be actual discretionary response of fiscal policy to business cycle in practice [10].

## 2.2. The main determinants of fiscal procyclicality

One should also consider the main factors which could cause fiscal procyclicality. Two main sets of factors have been proposed as determinants of fiscal procyclicality in the existing literature. One is related to the borrowing constraints which arise from imperfection of capital markets (Gavin and Perotti,

9. The cyclically adjusted budget balance could show the current fiscal stance when the effects of the business cycle on government spending and tax revenues are removed (CBO, 2008).
10. Ilzetzki and Végh (2008) argue that actual response of spending to business cycle is important to assess fiscal stance in practice regardless of whether it is the cyclical component or the discretionary component because the cyclical component is implicit.

1997; Riascoc and Végh, 2003; Kaminsky, Reinhart, and Végh, 2004; Cuadra, Sanchez, and Sapriza, 2010). They argue that the lack of the ability to access to international capital market could make fiscal policy procyclical when the economy is in bad times, which is a common feature of emerging market countries. This approach could explain the situation of developing countries persuasively, but it has been criticized in the sense that it cannot explain the reason why these countries do not prepare by accumulating reserves in booms (Alesina, Campante, and Tabellini, 2008; Ilzetzki, 2011) and that it is not based on econometric evidence (Woo, 2009).

Recent studies focus on the political economy constraints. These are related to the political distortions such as political power dispersion, corruption, rent seeking behaviour, and social inequality. Tornell and Lane (1999, pp.85-86) and Lane (2003, p.2665) suggest "the voracity effect" as the main reason for fiscal procyclicality. They argue that spending could grow more than the proportional increase in income if multiple power groups compete for fiscal revenues since the intensity of fiscal competition increases during booms. Talvi and Végh (2005) argue that a budget surplus arouses pressure to increase expenditure in good times, and they show that procyclical fiscal policy could be optimal if the government has a huge fluctuation in the tax base, which is common in the developing countries since tax systems in these countries tend to be consumption rather than income based. Alesina, Campante, and Tabellini (2008) show that corrupt governments could appropriate some part of tax revenue for political rents. They assume that voters face corrupt governments, and therefore voters require more benefit from tax cuts or increases in spending when the economy is in good times, fearing that otherwise the government would appropriate more rents. Ilzetzki (2011) suggests a political friction between incumbent and successive governments as the main reason for fiscal procyclicality. The author argues that the incumbent government want to allocate more benefit its own constituency when available. Woo (2009) shows that the social polarization of preferences over fiscal spending could make fiscal policy procyclical.

To empirically examine the effect of these two main sets of factors, the existing studies include a variety of variables. Several of these are introduced to assess the positive effect of borrowing constraints on fiscal procyclicality. Trade openness, which is measured by the sum of exports and imports over GDP, is prevalently

utilized (Lane, 2003; Aghion and Marinescu, 2007; Mackiewicz, 2008; Woo, 2009)[11]. Aghion and Marinescu (2007) also introduce financial development, and show a positive effect of the ratio of private credit to GDP. Woo (2009) employs the volatility of capital flows, measured by the standard deviation of annual percentage change in capital flow. The use of emergency credit from IMF (Gavin and Perotti, 1997), credit ratings and the spread of sovereign debt over the US debt (Alesina, Campante, and Tabellini, 2008), the current account balance (Woo, 2009), and aid flow (Lledó, Yackovlev, and Gadenne, 2009) are also introduced to assess the effect of credit constraints.

The second set of factor is political constraints. It has been extensively introduced to assess the positive effect of political distortions on fiscal procyclicality. Several studies (Lane, 2003; Mackiewicz, 2008; Woo, 2009) utilize a political power dispersion index[12]. Corruption is an important variable which has been introduced in recent studies (Alesina, Campante, and Tabellini, 2008; Mackiewicz, 2008; Çiçek and Elgin, 2011). Polarization of preferences has been also introduced in recent studies. The gini coefficient (Woo, 2009; Mackiewicz, 2008) and educational inequality (Woo, 2009), measured as standard deviation of schooling, have been utilized as proxies of polarization of preference.

Other control variables are also introduced to find out the determinants of fiscal procyclicality. The level of development[13] has been widely introduced in the existing literature. GDP per capita (Lane, 2003; Mackiewicz, 2008; Çiçek and Elgin, 2011), initial GDP per capita (Alesina, Campante, and Tabellini, 2008; Woo, 2009), the age of democracy (Mackiewicz, 2008) are utilized as appropriate proxies. Output volatility has also been frequently introduced (Lane, 2003; Aghion and Marinescu, 2007; Woo, 2009; Frankel, Végh, and Vuletin, 2011), which is associated with tax base volatility in the model introduced in Talvi and Végh (2005).

11. Some studies argue that high trade openness makes fiscal policy less procyclical since it indicates high access to international capital (Woo, 2009), but others argue that high openness could make fiscal policy more procyclical since it leads to an increase in the cost of financing from international market, especially during recessions (Aghion and Marinescu, 2007).

12. Lane (2003) shows a positive effect of the political power dispersion index on fiscal procyclicality, while Woo (2009) shows negative effect.

13. Developed countries tend to have good institutions which can be seen from much literature concerned with economic growth theory. Therefore, this variable can be associated with the quality of institutions.

The size of public sector is also included; Lane (2003) utilizes the ratio of public sector employment relative to total employment to capture the potential power of public sector workers in influencing fiscal policy, while Woo (2009) employs the ratio of government expenditure relative to GDP, and Aghion and Marinescu (2007) employ government share of GDP. Fiscal space[14] has also been introduced recently, where it is argued that high debt could affect government's ability to respond to the business cycle. Mackiewicz (2008) employs the stock of public debt and Lledó, Yackovlev, and Gadenne (2009) employ the external debt to GDP ratio. Membership in the OECD (Kaminsky, Reinhart, and Végh, 2004), EMU membership (Aghion and Marinescu, 2007), the adoption of an inflation targeting regime (Aghion and Marinescu, 2007), and terms of trade (Gavin and Perotti, 1997; Alesina, Campante, and Tabellini, 2008; Lledó, Yackovlev, and Gadenne, 2009) are also introduced.

More recent studies focus on the role of the quality of institutions which comes from studies on the determinants of economic growth. They show that better institutions enable fiscal policy to be more countercyclical. Manasse (2006) employs several institutional indices including government stability, bureaucracy quality, law and order, and democratic accountability. Mackiewicz (2008) employs economic freedom, and Diallo (2009) employs the political rights and civil liberty indices to capture the degree of democratization. Frankel, Végh, and Vuletin (2011) construct an institutional quality index including law and order, bureaucracy quality, corruption, and non-political, non-economic, and non-financial factors affecting investment risk. Çiçek and Elgin (2011) show that the size of shadow economy, which is affected by institutional quality, such as the degree of tax enforcement, the level of law and order, and bureaucratic quality, is positively related to procyclical fiscal policy. However, institutions are considered to be a difficult concept to define[15] and there is no consensus on how to measure. One could consider fiscal

14. Fiscal space is related to international credit constraints, and a greater fiscal space can help reduce fiscal procyclicality (Lledó, Yackovlev, and Gadenne, 2009).

15. North (1999, p.3) defines institutions as "the rules of game in society". The existing literature on growth theory generally considers institutions to be the level of property rights and the rules of law.

institutions[16], such as budget system and fiscal transparency, instead of implicit concept of institutions when one explores fiscal procyclicality because fiscal performances appear to be affected by fiscal institutions which have not been dealt with the existing literature.

There are several practical issues about fiscal institutions which might affect fiscal procyclicality. First, fiscal transparency could reduce corruption and rent seeking behavior, and it in turn may help mitigate fiscal procyclicality.

Second, one can think of the implementation time lags caused by the political procedure and institutional reason. Spending adjustments to the business cycle takes considerable time since they need formal procedure, such as the approval of the assembly[17]. Also, it might take time or cost to adjust spending items because a large number of spending items are non-flexible. These characteristics make it more difficult for governments to operate countercyclical fiscal stimulus in both developed and developing countries.

Third, the lack of forecasting ability could be one of the reasons behind fiscal procyclicality. It is difficult for policymakers to predict the exact timing of the business cycle. Policymakers determine fiscal policy under a veil of ignorance about the state of the economy in practice (Manasse, 2005), so they often decide expansionary fiscal policy after the economy starts to recover (Burger and Jimmy, 2006). This phenomenon is more common in developing countries because they have poor forecasting ability on economic situation. Furthermore, the difference between ex-ante budget plan and ex-post outcomes could also lead to fiscal procyclicality. Talvi and Végh (2005) argue that finance ministers of all countries tend to underestimate fiscal revenues to avoid political spending pressures. A decrease in expenditure and an increase in revenues could make fiscal policy procyclical, especially in recessions (He, 2003). On the other hand, Frankel (2011,

16. Fatás (2010) identifies transparency, the role of legislature, and the degree of centralization of the budget processes as an example of the budget processes and institutions. The author suggests fiscal rules as a narrower set of institutions.

17. Some studies differentiate legislative lag and implementation lag. The former indicates the time lag between when it is proposed and when it is signed into law, and the latter indicates the time lag between when a new fiscal law is enacted and when it takes effect. Mankiw (1997) calls these inside lag and outside lag, and the author explains that fiscal policy has long inside lag while monetary policy has long outside lag.

2011c) argues that official forecast of the budget balance and GDP growth tends to be optimistic by showing empirical evidence of 33 advanced and emerging market countries. Therefore, fiscal stance could be changed from the initial budget plan, and it in turn can lead to procyclical fiscal policy. Forni and Momigliano (2007) show that the fiscal policies of EU and OECD countries are more countercyclical when using budget plan data than when using real outcomes data.

Fourth, the characteristics of government spending could affect the stance of fiscal policy. The level of fiscal procyclicality could vary depending on spending categories (Ilzetzki, 2011; Lane, 2003). Therefore, the composition of spending of each country could lead to a different level of fiscal procyclicality. Developed countries tend to have larger current transfers than developing countries, so they can mitigate the level of fiscal procyclicality through automatic stabilizers.

Finally and more importantly, the time horizon of fiscal policy could be one of crucial determinants of fiscal procyclicality. Most developing countries tend to operate fiscal policy from a short-term perspective. The most common rule is the principle of expenditure in revenue, so fiscal policy cannot be utilized as a tool for macroeconomic management. On the other hand, developed countries tend to target longer time horizons, for example, the medium-term goal of balanced budgets. Most countries that operate fiscal policy from a long-term perspective have multi-year fiscal rules, so they can reduce the level of fiscal procyclicality. The time horizon of fiscal policy can be specified by the time coverage of fiscal rules in a large number of countries[18], and therefore this chapter utilizes the latter as a proxy for the former.

## 2.3. Theoretical issues on the role of fiscal rules

The practical issues discussed in subsection 2.2 can be one of the factors which consist of fiscal institutions. These factors cannot be a necessary condition for countercyclical fiscal policy. Schick (2003) argues that a sound budget process cannot confirm sound fiscal performance, but an unsound budget process could be

18. Of the 185 IMF full fund membership countries in 2009, 80 of these are adopting fiscal rules, according to the IMF fiscal rules database.

one of the reasons for poor fiscal outcomes. This is why international organisations, such as the IMF and the OECD, have made an effort of promoting a sound budget system to developing countries.

This chapter focuses on the role of the time horizon of fiscal policy by assuming the behaviour of policymakers employing the political economics model. We assume that policymakers will operate fiscal policy in a way that maximizes their utility arises from it. They might attempt to maximize electoral support (Manasse, 2005), weighted average of consumer's welfare and political contributions (Grossman and Helpman, 1994), or the size of the public sector and budget (Brennan and Buchanan, 1981; Niskanen, 1971; Brandt and Svendsen, 2006).

In this chapter, we employ a framework where policymakers attempt to maximize the size of budget because allocating this budget provides them with power to affect the people and groups which obtain spending from the government, which is consistent with a bureaucratic model of the modern political economy. Brennan and Buchanan (1981, p.350) argue that bureaucrats are "the leviathan" which intends to maximize the size of public sector using the ignorance of voters, and Niskanen (1971) assumes bureaucrats as budget maximizers because they intend to maximize their personal utility such as salary and power. Brandt and Svendsen (2006) extend Niskanen's model by introducing lobbying cost, and they show that bureaucrats will expend budgets more than the optimal level, just like fishermen who can access sea without control.

Bureaucrats maximize budget size since they can obtain additional benefit from it, and therefore public service tends to be supplied excessively. In this context, the government's utility function (U) is defined as equation (2.1) where $G_t$ is government spending, and $\delta$ is discount factor.

$$U = \sum_{t=1}^{n} \delta U(G_t) \qquad (2.1)$$

Assume that the government implements fiscal policy from the short-term perspective. The budget constraint is defined as equation (2.2) since the government can finance from either revenue or borrowing, where $R_t$ is government revenue and $B_t$ is the affordable budget deficit, in other words, the deficit ceiling which is

representative of fiscal rules. If the government intends to keep a balanced budget, the constraint can be written as equation (2.3) which indicates that the government cannot borrow.

$$G_t \leq R_t + B_t \tag{2.2}$$

$$G_t \leq R_t \quad (B_t = 0) \tag{2.3}$$

The optimal decision of the government will be to spend all its revenue and borrowing at each period regardless of economic situation ( $G_t = R_t + B_t$) [19] as long as the government has normal monotone preferences[20]. Therefore, if the economy is in good times, the government will increase spending because revenue is forecasted to increase. If the economy is in bad times, the government will decrease spending because revenue is forecasted to decrease. Fiscal policy inevitably becomes procyclical due to the budget maximization behaviour of government.

However, if one assumes that the government operates fiscal policy from the long-term perspective, for example, n periods, then the budget constraint can be written as equation (2.4). The government can borrow or save at the rate of r at each period. If the government intends to keep a balanced budget over n periods, the budget constraint can be written as equation (2.5).

$$\sum_{t=1}^{n} \frac{G_t}{(1+r)^{t-1}} = \sum_{t=1}^{n} \frac{R_t}{(1+r)^{t-1}} + \sum_{t=1}^{n} \frac{B_t}{(1+r)^{t-1}} \tag{2.4}$$

$$\sum_{t=1}^{n} \frac{G_t}{(1+r)^{t-1}} = \sum_{t=1}^{n} \frac{R_t}{(1+r)^{t-1}} \tag{2.5}$$

The equilibrium trajectory of government spending is determined by the present value of future revenue and borrowing[21]. The government can maximize its utility

19. We can solve government's maximization problem in one period by utilizing the Lagrangian function $L(G_t) = U(G_t) - \lambda(G_t - R_t - B_t)$. The first order conditions of maximization problem are $U'(G_t) = \lambda$ where λ (Lagrange multiplier) indicates marginal effect of government spending and $G_t = R_t + B_t$ .

20. The assumption of monotone preferences implies that large commodities are preferred to small ones. It can be satisfied when commodities are 'goods' rather than 'bads' (Mas-Colell, Whinston, and Green, 1995).

21 . In a two-period framework, we solve government's maximization problem by utilizing Lagrangian function $L(G_1, G_2) = U(G_1, G_2) - \lambda\{\left(G_1 + \frac{G_2}{1+r}\right) - \left(R_1 + \frac{R_2}{1+r}\right) - \left(B_1 + \frac{B_2}{1+r}\right)\}$ (see Obstfeld and Rogoff, 1996, for example of private consumption). The first order conditions of

by smoothing spending across periods through saving and borrowing. If the economy is in boom in the first period, then tax revenue is expected to increase, so the government can spend a fraction of this expected increase in revenue and save a fraction of it. If the economy is in recession, then tax revenue is expected to decrease. Therefore, the government have to decrease spending, but it can supplement some parts of decreases in spending by borrowing from the credit market or by utilizing savings. The government could operate fiscal policy in a less procyclical way because it could save some portion of its revenue or borrow some source of spending from the financial markets.

This simple model implies that the time horizon of fiscal policy could play an important role in determining fiscal stance. If the government operates fiscal policy from the short-term perspective, fiscal policy might be procyclical. However, if the government operates fiscal policy from the long-term perspective, the government could reduce the level of procyclicality. These results imply that fiscal policy from the long-term perspective, such as multi-year fiscal rules, could be more efficient in mitigating the level of fiscal procyclicality than fiscal policy from the short-term perspective, such as annual fiscal rules.

## 2.4. The existing literature on the role of fiscal rules

Fiscal rules are introduced to keep government spending more affordable by compelling governments to tax and spend within fixed constraints (Schick, 2003). They have been considered to be an essential part of budget reforms since 1990s. Proponents argue that fiscal rules under weak fiscal institutions can raise responsibility and credibility of fiscal policy, while opponents argue that they keep

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maximization problem are $\frac{\delta U\prime(G_2)}{U\prime(G_1)} = \frac{1}{1+r}$ and $\left(G_1 + \frac{G_2}{1+r}\right) = \left(R_1 + \frac{R_2}{1+r}\right) + \left(B_1 + \frac{B_2}{1+r}\right)$. The former indicates that government's marginal rate of substitution of government spending at period 1 for period 2 equals the relative price of government spending in period 2 relative to period 1, which implies that government will reduce current government spending if the interest rate (r) or discount factor (δ) increases since the cost of borrowing will also increase. If we assume that subjective discount factor equals market discount factor $\left(\delta = \frac{1}{1+r}\right)$, then government spending in periods 1 and 2 are same ($G_1 = G_2 = \bar{G}$). Therefore, optimal government spending can be obtained as $\bar{G} = \frac{(1+r)(R_1+B_1)+(R_2+B_2)}{2+r}$, which is determined by current and future revenue and borrowing as well as the interest rate.

governments from operating countercyclical fiscal policy since they focus more on long-run fiscal sustainability rather than short-run output stabilization over business cycle (Tanner, 2004; Wyplosz, 2005).

A common form of fiscal rules which have been studied prevalently is the balanced budget rule, requiring spending not to exceed revenue. This rule can be considered as fiscal policy under the short-term perspective above, when combined with an annual budget. According to the existing literature, it generally tends to make fiscal policy more procyclical except under special circumstances. Sorensen and Yosha (2001) suggest that a balanced budget rule could limit the ability of governments to borrow in recessions. The authors show that the US state government which has a less strict rule could accumulate rainy day funds in booms, in other words, the state could operate more countercyclical fiscal policy. Manasse (2005) also argues that a balanced budget rule could induce procyclical fiscal policy. The author points out that if policymakers could observe the output gap, a strict balanced budget rule could mitigate the political distortions but restricting the countercyclicality of fiscal policy. Tanner (2004) also argues that a balanced budget rule could prevent countercyclical policy. However, the author shows that a balanced budget rule could be compatible with a tax smoothing policy under practical situations that permits persistent deficit and debt accumulation, and therefore governments could operate countercyclical fiscal policy.

Other studies in this literature debate the effect of the SGP rules on the fiscal stance of the Euro area after its implementation[22]. It has been a controversial issue whether the SGP rules should be more flexible or not. Mackiewicz (2006) argues that strict fiscal rules could be helpful to operate countercyclical fiscal policy sometimes. The author points out that making the SGP rules more flexible could lead to more procyclical fiscal policy rather than countercyclical policy because high deficits could arouse credit constraints, and it finally leads to a reduction in the room for countercyclical policy. Galí and Perotti (2003) show that the fiscal policy of 11 EMU countries has become more countercyclical after introducing the SGP rules by comparing the fiscal stance before and after introducing the SGP rules. However,

22. On the other hand, Carmignani (2010) argues that supernational fiscal rules by Central African Economic and Monetary Community (CEMAC), and West African Economic and Monetary Union (WAEMU) could prevent governments from implementing countercyclical fiscal policy.

the authors also show that there is a global trend towards a more countercyclical fiscal policy by showing not only the trend of 11 EMU countries but also the trend of three non-EMU European countries and five OECD countries; therefore the authors argue that there is no empirical evidence on the effect of the SGP rules on fiscal cyclicality.

On the other hand, Arreaza, Sorensen, and Yosha (1999) suggest that SGP rules should be relaxed because the government deficit helps provide large consumption smoothing. Schick (2003) argues that the SGP rules could induce procyclical fiscal policy. Marinheiro (2007) also shows that SGP rules force fiscal policy to be procyclical. The author points out that the conclusion of Galí and Perotti (2003), that fiscal policy of EU countries become more countercyclical after introducing the SGP rules, is not supported by the robust test which utilizes real-time data instead of ex-post data. Afonso and Claeys (2008) also show that the SGP rules have not removed procyclical fiscal policy of four EMU countries (France, Germany, Portugal, and Spain) by analysing three periods of the fiscal procyclicality of these countries. Candelon, Muysken, and Vermeulen (2010) also show that the discretionary fiscal policy of EMU countries remains procyclical after introducing the SGP rules even though they utilize the same data source as Galí and Perotti (2003). Frankel (2011c) argues that SGP rules could make governments' official forecasts about economic growth more optimistic, especially in booms, and they in turn could lead to procyclical fiscal policy.

However, there are several weaknesses in the existing literature. It mainly analyses a sample of annual fiscal rules, such as balanced budget rules or the SGP rules, without considering the time coverage of these rules. In addition, it focuses on the theoretical explanation on the effect of fiscal rules without being supported by the empirical evidence[23], or it simply examines the effect of fiscal rules by comparing each period. Therefore, this chapter analyses the effect of fiscal rules empirically discriminating between annual fiscal rules and multi-year fiscal rules to assess the effect of fiscal rules more accurately.

23. To the best of our knowledge, only Manasse (2006) analyses the role of fiscal rules empirically by including the dummy variable for fiscal rules into the regression equation through a sample of 49 emerging and industrial countries, and the author shows that fiscal rules enable fiscal policy more countercyclical.

## 3. Empirical analysis

This chapter analyses the role of the time coverage of fiscal rules in determining fiscal procyclicality. This section firstly analyses the cyclical properties of fiscal policy of OECD countries across spending categories through a correlation approach. We also compare the level of fiscal procyclicality of each country before and after introducing fiscal rules dividing annual fiscal rules and multi-year fiscal rules respectively. Then, this section analyses the cyclical properties of fiscal policy of OECD countries across spending categories through a regression approach. We estimate the level of fiscal procyclicality of OECD countries both individually and collectively through time series and panel analysis. Finally, this section examines the role of fiscal rules in determining fiscal procyclicality through a panel data model. We compare the effect of annual fiscal rules with multi-year fiscal rules on fiscal procyclicality.

### 3.1. Data description

The sample consists of 26 OECD countries[24], and we employ annual data for the period 1970–2008[25]. For the data on GDP and fiscal variables, this chapter utilizes the data of OECD Economic Outlook No.86, published in 2010. All nominal data are converted into constant prices by using the GDP deflator following the existing literature[26]. This chapter analyses six categories of government spending[27]: government consumption (CGAAV), interest payments (GGINTPV), current transfers (TCTV), current expenditure (YPGV), government investment (IGAAV), and total expenditure (YPGTV): where those references in brackets are the

24. Czech Republic, Poland, Mexico, and Turkey are excluded because their fiscal data are not provided by the OECD Economic Outlook database or can be used only after mid-1990s.

25. It does not start at 1970 for all countries because of the data availability.

26. Utilizing nominal fiscal variables has a weakness that it could eliminate a change in fiscal variables that takes the form of the relative price (Lane, 2003).

27. Total spending consists of current expenditure and capital expenditure. Current expenditure is made up of government consumption (purchases of goods and services, and salary of employees), interest payments, and current transfers (spending on property, social security benefit, subsidy, etc). Capital expenditure is comprised of government investment (gross fixed capital formation) and other capital spending on land and intangible asset.

databases' references. This classification of government spending is based on economic characteristics of government spending following the existing literature (Ilzetzki and Végh, 2008; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003). Table 2.1 presents descriptive statistics of the data. The fifth and sixth columns indicate the share of government spending relative to total expenditure and GDP respectively. The fifth column shows that government consumption (CGAAV) occupies nearly a half of total expenditure (YPGTV) followed by current transfer (TCTV, 28.8%), government investment (IGAAV, 17.1%), and interest payments (GGINTPV, 6.7%).

Table 2.1 Summary statistics of fiscal data

| | No. of countries | No. of observations | Mean (A) | A/H | A/B |
|---|---|---|---|---|---|
| GDPV (B) | 26 | 889 | 36.817 | - | 100% |
| CGAAV (C) | 26 | 889 | 5.159 | 49.6% | 14.0% |
| GGINTPV (D) | 26 | 863 | 0.700 | 6.7% | 1.9% |
| TCTV (E) | 26 | 862 | 2.988 | 28.8% | 8.1% |
| YPGV (F=C+D+E) | 26 | 870 | 8.637 | 83.1% | 23.5% |
| IGAAV (G) | 26 | 881 | 1.781 | 17.1% | 4.8% |
| YPGTV (H=F+G) | 26 | 857 | 10.392 | 100.0% | 28.2% |

Note : (1) Unit of each variables is 1,000 billion unit of local currency.
(2) The sample period is 1970–2008. Some variables have a shorter period due to the data availability.
Source: OECD Economic Outlook Database No.86.

With regard to the main control variables, we employ five main variables which have been commonly utilized in the existing literature, and we additionally include a dummy variable for fiscal rules. The summary statistics of control variables are explained in Table 2.2.

Table 2.2 Summary statistics of control variables

| | No. of countries | No. of observations | Mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|---|
| OPEN | 26 | 865 | 58.824 % | 42.404 | 10.193 | 301.412 |
| POLCON | 26 | 852 | 0.468 | 0.094 | 0.148 | 0.718 |
| GDPPC | 26 | 865 | $23,130 | 9,091 | 3,030 | 77,766 |
| GOVSIZE | 26 | 857 | 43.553 % | 9.563 | 17.078 | 70.928 |
| DEBTRT | 26 | 704 | 57.818 % | 29.599 | 4.980 | 175.274 |
| RULE | 26 | 889 | 0.362 | 0.481 | 0 | 1 |

Note : (1) OPEN is a measure of trade openness, POLCON is a political power dispersion index, GDPPC is income per capita, GOVSIZE is the size of public sector, DEBTRT is the government debt to GDP ratio, and RULE is a dummy variable for the fiscal rules.
(2) The sample period is 1970–2008. Some variables have a shorter period due to the data availability.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, Henisz database (2010), and IMF fiscal rules database (2009).

Trade openness (OPEN) is included to assess the effect of credit constraints following Woo (2009), Mackiewicz (2008), Aghion and Marinescu (2007), and Lane (2003). This variable is defined as the sum of exports and imports over GDP which is taken from Penn World Tables 6.3 (2009).

Power dispersion index (POLCON) is included to assess the effect of political constraints following Lane (2003) and is taken from Henisz database (2010). It measures political risk by considering the number of independent branches of the government with veto power over policy change, and the distribution of preferences across branches of the government and within each legislative branch. Therefore, a high index means a lower probability that policy will change due to the veto power in the government. This index measures political risk range from zero when it is most hazardous (concentrated power) to one when it is most constrained (dispersed power).

Income per capita (GDPPC) is included to check the effect of the level of development and is in PPP (Purchasing Power Parity) terms taking from Penn World Tables 6.3. This variable is defined as the log of GDP per capita. The size of public sector (GOVSIZE) is included to check whether the cyclical properties of fiscal policy are different depending on the government size and is defined as the ratio of total expenditure relative to GDP following Woo (2009). The government debt to GDP ratio (DEBTRT) is also included to check the effect of fiscal space following Lledó, Yackovlev, and Gadenne (2009) and Mackiewicz (2008).

Table 2.3 The types of fiscal rules

| | |
|---|---|
| Expenditure Rule | A nominal expenditure ceiling<br>A real expenditure ceiling<br>A nominal expenditure growth rate<br>A real expenditure growth rate |
| Revenue Rule | Constraints on the allocation of higher than an expected revenues in good times<br>A tax rate cannot be raised |
| Balance Rule | A specific budget balance in nominal terms<br>A specific budget balance as a % of GDP<br>A specific budget balance as a % of GDP in cyclically adjusted or structural terms<br>As a % of GDP within a range of possible value on growth development<br>Improvement budget balance as a % of GDP |
| Debt Rule | A specific amount of debt in nominal terms<br>A specific debt/GDP ratio<br>A given reduction in specific debt/GDP ratio<br>A ceiling for government debt |

Source : 2007 OECD survey of budget practices and procedures.

A dummy for fiscal rules (RULE) is included to check the effect of introducing fiscal rules. Regarding the data about fiscal rules, this chapter employs the survey which was conducted by IMF. According to the IMF fiscal rules database (2009), 27 countries out of 30 OECD countries utilize several types of fiscal rules to respond to their fiscal situation. Table 2.3 presents the detailed types of fiscal rules: expenditure rule, revenue rule, budget balance rule, and debt rule. Four countries utilize only one fiscal rule and 23 countries utilize two or more than two fiscal rules. Most countries introduced budget balanced rules and debt rules at the same time. EU countries have adopted supranational rules through the Stability and Growth Pact as well as their own national fiscal rules. Table 2.4 shows the time coverage of fiscal rules across countries. Ten countries set fiscal target annually, and 17 countries target multi-year or over business cycle. Our empirical analysis divides OECD countries into three groups depending on both the existence of fiscal rules and the time coverage of fiscal rules regardless of the types of fiscal rules which each country introduces. This analysis can be consistent with our theoretical model in subsection 2.3 considering the fact that most countries are adopting the budget balance rules.

Table 2.4 The time coverage of fiscal rules

| Time coverage | Countries |
|---|---|
| Annual rules[2)] (10 countries) | Austria(1995, BD), Belgium(1992, BD) Canada(1998, EBD), Greece(1992, BD), Hungary(2004, BD), Ireland(1992, BD), Italy(1992, BD), Poland(2004, BD), Portugal(1992, BD), Slovakia(2004, BD) |
| Multi-year rules (17 countries) | Australia(1998, RBD), Czech Republic(2004, EBD), Denmark(1992, ERBD), France(1992, ERBD), Finland(1995, EBD), Germany(1972, EBD), Iceland(2004, E), Japan[3)] (1947, E), Mexico(2006, RB), Netherlands(1992, ERBD), New Zealand(1994, BD), Norway(2001, B), Luxembourg(1992, EBD), Spain(2003, BD), Sweden(2000, EBD), Switzerland(2003, B), UK(1997, BD) |
| No fiscal rules (3 countries) | Korea, Turkey, USA[4)] |

Note : 1) Start year of fiscal rules and the types of fiscal rules which are introduced are in parentheses (E: expenditure rule, R: revenue rule, B: budget balance rule, D: debt rule).
2) Five countries (Belgium, Greece, Ireland, Italy, and Slovakia) have only the SGP rules.
3) The expenditure rule of Japan is similar to the budget balance rule rather than an expenditure ceiling. However, the Japanese government has waived this rule since 1975 except for the period 1990-1993. Therefore, it will be classified as 'the countries with no fiscal rules' in our correlation analysis.
4) The USA government introduced multi-year fiscal plans from 1985 to 2002 (Gramm-Rudman-Hollings Act of 1985, replaced by the Budget Enforcement Act of 1990). However, we include the USA in the 'No fiscal rules country' because it covered only discretionary spending and IMF database exclude the USA in their list.
Source: IMF fiscal rules database.

## 3.2. Empirical methodology

There are two methodologies adopted in the existing literature in measuring the cyclicality of fiscal policies. One is the correlation based measure of cyclicality (Lane 2003; Riascoc and Végh, 2004; Talvi and Végh, 2005; Carmignani, 2010; Ilzetzki, 2011; Huart, 2011), and the other is the regression based measurement. The former has a weakness that the result of correlation might be misleading under different volatilities of samples (Lane, 2003; Woo, 2009) even though it has an advantage of simplicity. Therefore, the latter is prevalently utilized in the literature. This chapter employs both of methods.

With regard to the correlation based method, this chapter analyses the correlation between the cyclical component of government spending and the cyclical component of GDP. This chapter calculates the cyclical component of government spending and GDP utilizing two types of methods; the difference of log real variables and detrended series using Hodrick-Prescott filter following the existing literature[28].

With regard to the regression based method, this chapter utilizes both time series analysis and panel data analysis. Firstly, this chapter conducts country by country time series regression of the form (2.6) and the panel data model of the form (2.7) in order to obtain measures of procyclicality in the various categories of government spending.

$$\Delta \log G_{it} = \alpha_i + \sum_{j=0}^{2} \beta_{ij} \Delta \, logGDP_{i,t-j} + \varepsilon_{it} \qquad (2.6)$$

$$\Delta \log G_{it} = \alpha_i + \sum_{j=0}^{2} \beta_{j} \Delta \, logGDP_{i,t-j} + \varepsilon_{it} \qquad (2.7)$$

where $\Delta \log G_{it}$ is various categories of first difference of the log real government spending in country i and year t. The lagged values of the first difference of log real GDP are included in this equation to control the effect of past economic growth on current government spending. We choose two years lags by nature of budget process

28. Utilizing the difference of log real variables refers to a classical notion of business cycle while utilizing detrended series corresponds to a notion of cycles in deviation (Carmignani, 2010).

and regression results. A positive value of $\beta_0$ implies procyclical behaviour of government spending.

Secondly, to find out the effect of fiscal rules, this chapter estimates a one-step approach of the form (see, for example, Alesina, Campante, and Tabellini, 2008; Mackiewicz, 2008; Lledó, Yackovlev, and Gadenne, 2009; Diallo, 2009):

$$\Delta \log G_{it} = \alpha_i + \sum_{j=0}^{2} \beta_j \Delta \, logGDP_{i,t-j} + \gamma Z_{it} \times \Delta logGDP_{it} + \varepsilon_{it} \qquad (2.8)$$ [29]

where $Z_{it}$ is a set of control variables including trade openness (OPEN), political power dispersion index (POLCON), income per capita (GDPPC), the size of public sector (GOVSIZE), the government debt to GDP ratio (DEBTRT), and the dummy variable for the existence of fiscal rules (RULE) . All control variables are included as the form of interaction variables to estimate the effect of these variables on fiscal procyclicality. This is because the coefficient of the interaction term measures the change in the coefficient $\beta_0$ when each control variable changes by one unit (Preacher, 2003). In other words, it indicates the effect of each control variable on the level of fiscal procyclicality.

Some existing literature (Lane, 2003; Aghion and Marinescu, 2007; Woo, 2009) utilize a two-step approach[30] to examine the determinants of fiscal procyclicality. This approach could reflect a different output elasticity of each country avoiding unitary elasticity assumption of a one-step approach (Lane, 2003). However, it is likely to be biased and overestimate the true effect of control variable on the level of procyclicality even though it is weak or insignificant because the procedure considers the estimated variables in the first stage to be observable (Mackiewicz, 2008) even though it could give a nosy signal of true values (Aghion, Hemous, and Kharroubi, 2009).

This chapter employs the one-step approach to check the effect of fiscal rules on fiscal procyclicality in line with most existing literature. This is because the

29. The reason for including constant is the existence of structural balance (see Schick, 2003) or inflexible spending.

30. At first stage, an indicator of fiscal procyclicality is estimated using time series analysis of each country, and then the determinants are found by regressing estimated fiscal procyclicality indicators on control variables using a cross-section analysis.

dummy variables for fiscal rules are different across each period, but the two-step approach cannot allow time invariant regressors in the second stage. This is also because the two-step analysis could suffer from small sample bias since our sample includes only 26 countries.

## 3.3. Estimation results

### 3.3.1. Correlation approach

This section firstly analyses the cyclical properties of government spending of OECD countries across spending categories and country groups, and then examines the difference of the cyclical properties between before and after introducing fiscal rules through correlation approach.

**(1) The cyclical properties of fiscal policy across spending categories**

Table 2.5 presents the average of the correlation between the cyclical component of government spending and the cyclical component of GDP in OECD countries by utilizing the first difference of log real variables. One can see from the results that the cyclical properties of fiscal policy of OECD countries are different across spending categories. Government consumption (CGAAV) and investment (IGAAV) have a positive correlation with GDP, while interest payments (GGINTPV) and current transfers (TCTV) have a negative correlation with GDP. These results could be interpreted that government consumption and investment show a procyclical pattern, while interest payments and current transfers show a countercyclical pattern. Current expenditure (YPTV) and total expenditure

(YPGTV), therefore, appear to have an acyclical pattern[31]. These results could be rationalized if one considers the characteristics of spending categories. Government consumption and investment are spending categories which policymakers control discretionarily. On the other hand, current transfers can be functioned as automatic stabilizers since they include cyclical sensitive spending items such as unemployment benefit, and governments cannot adjust current transfers easily.

Table 2.5 The average of correlation between government spending and GDP

| | Mean | S.D. | Max | Min |
|---|---|---|---|---|
| Government consumption (CGAAV) | 0.141 | 0.240 | 0.648 | -0.264 |
| Interest payments (GGINTPV) | -0.063 | 0.282 | 0.521 | -0.447 |
| Current transfers (TCTV) | -0.101 | 0.272 | 0.456 | -0.700 |
| Current expenditure (YPGV) | -0.011 | 0.265 | 0.414 | -0.689 |
| Government Investment (IGAAV) | 0.180 | 0.168 | 0.484 | -0.106 |
| Total expenditure (YPGTV) | 0.006 | 0.240 | 0.507 | -0.395 |

Note : All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

These results are generally consistent with the existing literature which analyses the cyclical properties of fiscal policy across spending categories. Ilzetzki (2011) analyses data with 21 high-income countries and 81 developing countries using the correlation approach, and the author shows that government consumption and investment appear to be procyclical both in high-income and developing countries. Lane (2003) examines the cyclical properties of fiscal policy of 22 traditional OECD countries by both the correlation approach and the two-step regression approach, and the author shows that government consumption and investment appear to be procyclical, while current expenditure and total expenditure to be acyclical or countercyclical[32]. Galí and Perotti (2003) find that government investment of 11

31. When we calculate the correlation between the cyclical component of government spending and GDP collectively following Talvi and Végh (2005), the results show a large degree of similarity with our results. Government consumption and investment have a significantly positive correlation with GDP as can be seen from Appendix 2. Table 2A.2.

32. Lane (2003) analyses the cyclical properties of fiscal policy across six spending categories: government consumption, current expenditure, current expenditure net of interest payments, government investment, total expenditure, and total expenditure net of interest payments. However, one needs not to deal with total (current) expenditure net of interest payments. One can suggest two factors for the reason. From the short term viewpoints, there is no strong reason to exclude only interest payments rather than other nonflexible expenditure. From the long term viewpoints, governments can adjust the amount of interest payments by changing the combination of debt and tax.

EMU countries shows mild procyclical behaviour. Alberola, Mínguez, Hernández de Cos, and Marqueés (2003) also show that government investment appears to be procyclical while current transfers and interest payments are countercyclical by analysing 14 EU member countries.

Government spending can be divided by discretionary component which is decided by fiscal authorities and the cyclical component which is affected by business cycle fluctuations (Candelon, Muysken, and Vermeulen, 2010; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003; Galí and Perotti, 2003). Automatic stabilizers are mainly related to current transfers, not government consumption and investment (Romero-Ávila and Strauch, 2008). The only item of government spending which is treated as cyclically sensitive is unemployment-related current transfers (Girouard and André, 2005; CBO, 2008), which implies that the existence of automatic stabilizers make government spending more countercyclical since unemployment benefit payments increase in recessions and decrease in booms. Table 2.6 confirms these arguments, which presents the average of the correlation between the cyclical component of cyclically adjusted government spending[33] and the cyclical component of GDP. One can see from the results that government spending generally becomes less countercyclical when the effect of automatic stabilizers is excluded. These results are consistent with the existing literature (Galí and Perotti, 2003; Braun, 2001).

Table 2.6 The average of correlation between government spending and GDP (cyclically adjusted government spending)

| | Mean | S.D. | Max | Min |
|---|---|---|---|---|
| Cyclically adjusted current transfers (TCTAV) | -0.023 | 0.263 | 0.569 | -0.520 |
| Cyclically adjusted current expenditure (YPGAV) | 0.032 | 0.262 | 0.535 | -0.585 |
| Cyclically adjusted total expenditure (YPGTAV) | 0.057 | 0.243 | 0.607 | -0.311 |

Note : All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

Empirical results also show that there is no big difference between the cyclical properties of total (current) expenditure and total (current) expenditure exclusive of interest payments.

33. Cyclically adjusted government spending is government spending net of the effect of automatic stabilizers.

To check the robustness of our results, this section also examines the average of the correlation between the cyclical component of government spending and the cyclical component of GDP by utilizing detrended series using the Hodrick-Prescott filter. Table 2.7 generally confirms our baseline results. The results show that government investment appears to be procyclical, while current transfers appear to be countercyclical. The level of procyclicality is lower than that of when the first difference of log real variables is utilized in Tabel 2.5 and 2.6. These results are consistent with Riascoc and Végh (2004) who show that the level of procyclicality of government consumption is lower when detrended series are utilized in the G7 and industrial countries. However, the interest payments move from countercyclical to procyclical. There are contradictive arguments about the cyclical properties of interest payments in the existing literature. Lane (2003) argues that interest payments can be procyclical considering the strategic behaviour of public debt managers. Ilzetzki and Végh (2008) show that interest payments are acyclical by analysing 21 high-income and 81 developing countries, while Alberola, Mínguez, Hernández de Cos, and Marqueés (2003) show that interest payments are countercyclical by analysing the 14 EU member countries.

Table 2.7 The average of correlation between government spending and GDP (HP filter)

| | Mean | S.D. | Max | Min |
|---|---|---|---|---|
| Government consumption (CGAAV) | 0.001 | 0.286 | 0.603 | -0.408 |
| Interest payments (GGINTPV) | 0.078 | 0.259 | 0.406 | -0.471 |
| Current transfers (TCTV) | -0.261 | 0.277 | 0.377 | -0.861 |
| Current expenditure (YPGV) | -0.158 | 0.313 | 0.381 | -0.773 |
| Government Investment (IGAAV) | 0.173 | 0.185 | 0.558 | -0.199 |
| Total expenditure (YPGTV) | -0.150 | 0.274 | 0.420 | -0.781 |
| Cyclically adjusted current transfers (TCTAV) | -0.109 | 0.273 | 0.373 | -0.779 |
| Cyclically adjusted current expenditure (YPGAV) | -0.067 | 0.314 | 0.564 | -0.691 |
| Cyclically adjusted total expenditure (YPGTAV) | -0.065 | 0.284 | 0.596 | -0.697 |

Note : All variables are the cyclical components which are derived by HP filter. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

To conclude, government consumption and investment seem to be procyclical, while current transfers appear to be countercyclical, in general. The procyclical properties of government consumption and investment are offset by automatic

stabilizers in budget system such as current transfers. Therefore, the fiscal policy of OECD countries appears to be acyclical from the viewpoint of total expenditure. However, one should note that governments cannot adjust the amount of total expenditure timely and easily because of automatic stabilizers. Therefore, government consumption and investment could be the most appropriate indices to measure fiscal cyclicality. These results could provide meaningful policy implications in the sense that government consumption and investment[34] are the important fiscal policy tools which policymakers can control discretionarily.

### (2) The cyclical properties of fiscal policy across countries

Table 2.8 and 2.9 present the cyclical properties of government spending across countries. Table 2.8 shows the correlation between the cyclical component of government spending and the cyclical component of GDP across three different groups of countries according to the type of fiscal rules which each country is adopting, and Table 2.9 shows the correlation between the cyclical component of government spending and the cyclical component of GDP across four different groups of countries according to the level of development and region. One can see from the results of Table 2.8 that the fiscal policy of OECD countries seems to be procyclical from the viewpoint of some spending categories. The countries with annual fiscal rules seem to operate procyclical fiscal policy on average across all spending categories except interest payments (GGINTPV), while the countries with multi-year fiscal rules seem to operate procyclical fiscal policy on average only in terms of government consumption (CGAAV) and investment (IGAAV).

34. Average shares of government consumption and investment relative to total expenditure is about 50-70% across countries.

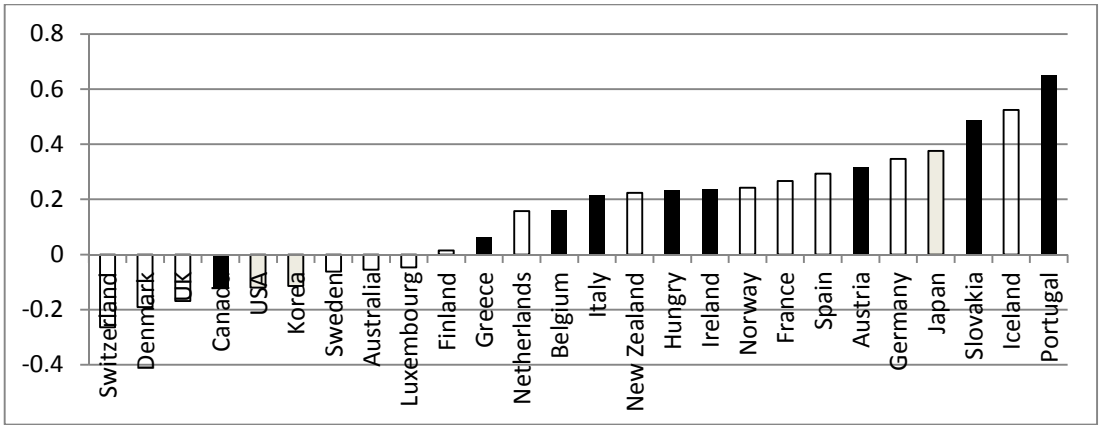
Table 2.8 Correlation between government spending and GDP across countries (type of rules)

| rule | country | (1) CGAAV | (2) GGINTPV | (3) TCTV | (4) YPGV | (5) IGAAV | (6) YPGTV |
|---|---|---|---|---|---|---|---|
| Annual rules (9) | Austria | 0.317 | -0.069 | 0.069 | 0.162 | 0.175 | 0.166 |
| | Belgium | 0.161 | 0.019 | -0.005 | 0.080 | 0.041 | -0.043 |
| | Canada | -0.125 | 0.173 | -0.266 | -0.140 | -0.017 | -0.184 |
| | Greece | 0.061 | -0.203 | 0.290 | 0.048 | 0.471 | 0.125 |
| | Ireland | 0.238 | -0.390 | -0.173 | -0.116 | 0.386 | -0.009 |
| | Hungary | 0.231 | -0.412 | 0.456 | 0.277 | -0.097 | 0.379 |
| | Italy | 0.214 | 0.215 | -0.168 | 0.103 | 0.052 | 0.081 |
| | Portugal | 0.648 | -0.007 | 0.158 | 0.414 | 0.402 | 0.460 |
| | Slovakia | 0.487 | -0.418 | 0.103 | 0.285 | 0.267 | 0.115 |
| | Mean | 0.248 | -0.121 | 0.052 | 0.124 | 0.187 | 0.121 |
| Multi-year rules (14) | Australia | -0.055 | 0.158 | -0.553 | -0.212 | -0.048 | -0.056 |
| | Denmark | -0.191 | 0.178 | -0.160 | -0.108 | 0.163 | -0.219 |
| | France | 0.266 | -0.447 | 0.003 | 0.062 | 0.177 | -0.219 |
| | Finland | 0.015 | -0.433 | -0.538 | -0.448 | 0.291 | -0.395 |
| | Germany | 0.347 | 0.305 | -0.248 | 0.040 | 0.322 | 0.030 |
| | Iceland | 0.524 | -0.341 | -0.101 | 0.185 | 0.347 | 0.001 |
| | Luxembourg | -0.047 | 0.081 | 0.172 | 0.110 | -0.106 | 0.085 |
| | Netherlands | 0.158 | -0.154 | 0.006 | 0.029 | 0.067 | -0.042 |
| | Norway | 0.242 | 0.183 | 0.119 | 0.216 | 0.181 | 0.208 |
| | New Zealand | 0.223 | 0.277 | -0.083 | 0.204 | 0.166 | 0.507 |
| | Spain | 0.294 | -0.335 | 0.018 | 0.009 | 0.140 | -0.068 |
| | Sweden | -0.062 | -0.215 | -0.228 | -0.259 | 0.055 | -0.301 |
| | Switzerland | -0.264 | -0.443 | -0.700 | -0.689 | 0.315 | -0.237 |
| | UK | -0.169 | 0.132 | -0.437 | -0.349 | 0.135 | -0.214 |
| | Mean | 0.092 | -0.075 | -0.195 | -0.086 | 0.157 | -0.066 |
| No rules (3) | Japan | 0.376 | 0.521 | 0.114 | 0.350 | 0.484 | 0.302 |
| | Korea | -0.114 | -0.135 | -0.091 | -0.149 | 0.289 | 0.053 |
| | USA | -0.119 | 0.131 | -0.393 | -0.377 | 0.024 | -0.359 |
| | Mean | 0.047 | 0.172 | -0.123 | -0.059 | 0.266 | -0.002 |
| All (26) | Mean | 0.141 | -0.063 | -0.101 | -0.011 | 0.180 | 0.006 |
| | S.D. | 0.240 | 0.282 | 0.272 | 0.265 | 0.168 | 0.240 |
| | MAX | 0.648 | 0.521 | 0.456 | 0.414 | 0.484 | 0.507 |
| | MIN | -0.264 | -0.447 | -0.700 | -0.689 | -0.106 | -0.395 |

Note : CGAAV is government consumption, GGINTPV is interest payments, TCTV is current transfers, YPGV is current expenditure, IGAAV is government investment, and YPGTV is total expenditure. All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

With regard to explaining government consumption (CGAAV) in column (1), about two thirds of OECD countries seem to operate their government consumption in a procyclical pattern as can be seen from Graph 2.1. All countries, except Canada, which introduce annual fiscal rules (black bars in graph) show a procyclical pattern while a half of countries which introduce multi-year fiscal rules (white bars in graph) show procyclical pattern.

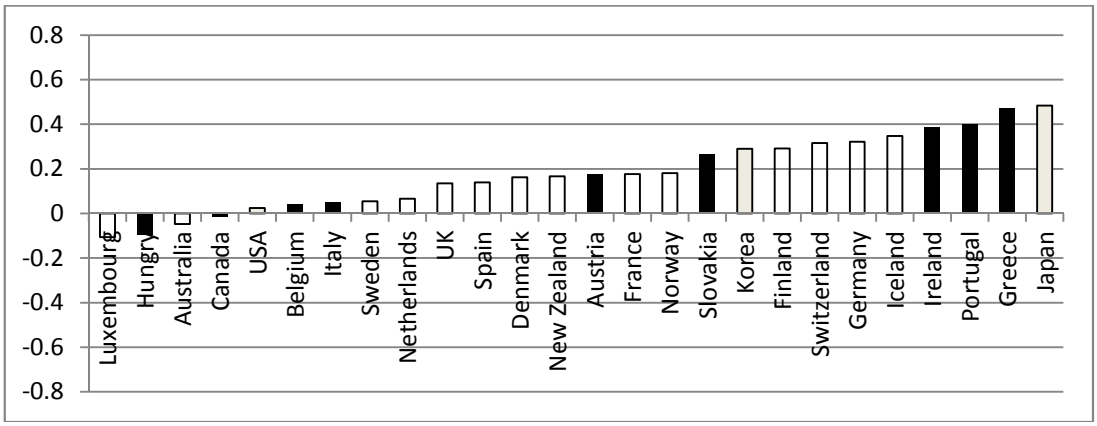
Graph 2.1 Correlation between government consumption and GDP




Note: Black bars are the countries which adopt annual fiscal rules, white bars are the countries which adopt multi-year fiscal rules, and grey bars are the countries with no fiscal rules. The height of bar graphs represents the level of correlation between the cyclical component of government consumption and GDP, which indicates the level of procyclicality. The average of correlation coefficients is 0.141.

With regard to explaining government investment (IGAAV) in column (5) of Table 2.8, most OECD countries seem to operate their government investment in a procyclical pattern as can be seen from Graph 2.2. With regard to explaining other spending categories, such as current transfers (TCTV), current expenditure (YPGV), and total expenditure (VPGTV), the countries which introduce annual fiscal rules show a more procyclical patterns than the countries with multi-year fiscal rules[35].

Graph 2.2 Correlation between government investment and GDP




Note: Black bars are the countries which adopt annual fiscal rules, white bars are the countries which adopt multi-year fiscal rules, and grey bars are the countries with no fiscal rules. The height of bar graphs represents the level of correlation between the cyclical component of government investment and GDP, which indicates the level of procyclicality. The average of correlation coefficients is 0.180.

35. When we calculate the correlation between the cyclical component of government spending and GDP collectively following Talvi and Végh (2005), the results show a large degree of similarity with our results. The countries which introduce annual fiscal rules show more procyclical patterns than the countries with multi-year fiscal rules, as can be seen from Appendix 2. Table 2A.2.

One can also see from the results in Table 2.9 that the fiscal policy of the EMU countries shows a more procyclical pattern than that of other advanced countries[36].

Table 2.9 Correlation between government spending and GDP across countries (country groups)

| | country | (1) CGAAV | (2) GGINTPV | (3) TCTV | (4) YPGV | (5) IGAAV | (6) YPGTV |
|---|---|---|---|---|---|---|---|
| EMU(12) | Austria | 0.317 | -0.069 | 0.069 | 0.162 | 0.175 | 0.166 |
| | Belgium | 0.161 | 0.019 | -0.005 | 0.080 | 0.041 | -0.043 |
| | France | 0.266 | -0.447 | 0.003 | 0.062 | 0.177 | -0.219 |
| | Finland | 0.015 | -0.433 | -0.538 | -0.448 | 0.291 | -0.395 |
| | Germany | 0.347 | 0.305 | -0.248 | 0.040 | 0.322 | 0.030 |
| | Greece | 0.061 | -0.203 | 0.290 | 0.048 | 0.471 | 0.125 |
| | Ireland | 0.238 | -0.390 | -0.173 | -0.116 | 0.386 | -0.009 |
| | Italy | 0.214 | 0.215 | -0.168 | 0.103 | 0.052 | 0.081 |
| | Luxembourg | -0.047 | 0.081 | 0.172 | 0.110 | -0.106 | 0.085 |
| | Netherlands | 0.158 | -0.154 | 0.006 | 0.029 | 0.067 | -0.042 |
| | Portugal | 0.648 | -0.007 | 0.158 | 0.414 | 0.402 | 0.460 |
| | Spain | 0.294 | -0.335 | 0.018 | 0.009 | 0.140 | -0.068 |
| | Mean | 0.223 | -0.118 | -0.035 | 0.041 | 0.201 | 0.014 |
| Other Advanced European countries (7) | Denmark | -0.191 | 0.178 | -0.160 | -0.108 | 0.163 | -0.219 |
| | Iceland | 0.524 | -0.341 | -0.101 | 0.185 | 0.347 | 0.001 |
| | Norway | 0.242 | 0.183 | 0.119 | 0.216 | 0.181 | 0.208 |
| | Slovakia | 0.487 | -0.418 | 0.103 | 0.285 | 0.267 | 0.115 |
| | Sweden | -0.062 | -0.215 | -0.228 | -0.259 | 0.055 | -0.301 |
| | Switzerland | -0.264 | -0.443 | -0.700 | -0.689 | 0.315 | -0.237 |
| | UK | -0.169 | 0.132 | -0.437 | -0.349 | 0.135 | -0.214 |
| | Mean | 0.081 | -0.132 | -0.201 | -0.103 | 0.209 | -0.092 |
| Other Advanced non-European countries (6) | Australia | -0.055 | 0.158 | -0.553 | -0.212 | -0.048 | -0.056 |
| | Canada | -0.125 | 0.173 | -0.266 | -0.140 | -0.017 | -0.184 |
| | Japan | 0.376 | 0.521 | 0.114 | 0.350 | 0.484 | 0.302 |
| | Korea | -0.114 | -0.135 | -0.091 | -0.149 | 0.289 | 0.053 |
| | New Zealand | 0.223 | 0.277 | -0.083 | 0.204 | 0.166 | 0.507 |
| | USA | -0.119 | 0.131 | -0.393 | -0.377 | 0.024 | -0.359 |
| | Mean | 0.031 | 0.187 | -0.212 | -0.054 | 0.150 | 0.044 |
| Emerging(1) | Hungary | 0.231 | -0.412 | 0.456 | 0.277 | -0.097 | 0.379 |

Note : CGAAV is government consumption, GGINTPV is interest payments, TCTV is current transfers, YPGV is current expenditure, IGAAV is government investment, and YPGTV is total expenditure. All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

With regard to explaining government consumption (CGAAV) in column (1), current transfers (TCTV) in column (3), current expenditure (YPGV) in column (4),

36. With regard to the classification of countries, this thesis follows that of IMF World Economic Outlook. OECD countries can be divided into 26 Advanced Economies and four Emerging market Economies. This thesis divides 26 Advanced Economies into three groups: 12 EMU countries (we include Slovakia into other European countries because it joined EMU in 2009), seven other European countries, and six other non-European countries. The results of emerging market countries are difficult to be considered to be meaningful since the sample is only one.

and total expenditure (YPGTV) in column (6), EMU countries generally show a procyclical or acyclical pattern while other advanced countries show an acyclical or countercyclical pattern. These results are consistent with Huart (2011) who shows that procyclical fiscal policy is more frequent in EMU countries than in other OECD countries by analysing panel data from 20 OECD countries which is the same dataset as we utilize. This relationship between EMU countries and other advanced countries is similar to the relationship between the countries which introduce annual fiscal rules and multi-year fiscal rules. This could be because a large number of EMU countries introduce only annual fiscal rules compared with the other advanced countries[37]. This implies that the countries which adopt annual fiscal rules are more likely to implement procyclical fiscal policy while the countries which adopt multi-year fiscal rules are more likely to implement countercyclical fiscal policy.

### (3) The effect of introducing fiscal rules

This subsection examines the difference of the cyclical properties of fiscal policy before and after the introduction of fiscal rules. Three countries (Hungary, Iceland, and Slovakia) are excluded from the analysis because of the data availability[38]. Table 2.10 presents the average change in the correlation between the cyclical component of government spending and the cyclical component of GDP before and after the introduction of fiscal rules. The correlation between spending and GDP generally becomes more negative after introducing fiscal rules except interest payments (GGINTPV). However, this phenomenon cannot be interpreted as the only effect of fiscal rules because it could come from a global trend (Galí and Perotti, 2003). In this subsection, we compare the change in correlation either side of the implementation of fiscal rules by dividing OECD countries into several groups to assess the role of the different time coverage of fiscal rules.

In the case of countries which introduce annual fiscal rules, the correlations between spending and GDP do not show meaningful differences except interest

37. The ratio of countries which introduce only annual fiscal rules is 50% in EMU countries (six out of 12 countries) and 14% in other advanced countries (two out of 13 countries).
38. The number of data in these countries is only four since they introduced fiscal rules in 2004.

payments (GGINTPV). On the other hand, in the case of countries which introduce multi-year fiscal rules, the correlation between spending and GDP becomes more negative after introducing fiscal rules except interest payments (GGINTPV). It shows meaningful differences except government investment (IGAAV).

Table 2.10 The change in correlation between government spending and GDP

| | | (1) CGAAV | (2) GGINTPV | (3) TCTV | (4) YPGV | (5) IGAAV | (6) YPGTV |
|---|---|---|---|---|---|---|---|
| All countries (23) | Overall | 0.105 | -0.020 | -0.134 | -0.044 | 0.181 | -0.014 |
| | Before | 0.123 | -0.131 | -0.167 | -0.089 | 0.161 | -0.046 |
| | After | -0.034 | -0.027 | -0.244 | -0.179 | 0.140 | -0.173 |
| | Difference | -0.158 | 0.104 | -0.077 | -0.090 | -0.020 | -0.127 |
| Annual rules (7) | Overall | 0.216 | -0.037 | -0.013 | 0.079 | 0.216 | 0.085 |
| | Before | 0.192 | -0.133 | -0.039 | 0.007 | 0.177 | -0.001 |
| | After | 0.194 | -0.026 | -0.129 | -0.016 | 0.178 | -0.016 |
| | Difference | 0.002 | 0.107 | -0.090 | -0.023 | 0.001 | -0.015 |
| Multi-year rules (13) | Overall | 0.058 | -0.055 | -0.202 | -0.107 | 0.143 | -0.071 |
| | Before | 0.080 | -0.130 | -0.249 | -0.150 | 0.150 | -0.074 |
| | After | -0.180 | -0.029 | -0.318 | -0.282 | 0.116 | -0.273 |
| | Difference | -0.260 | 0.102 | -0.069 | -0.132 | -0.034 | -0.199 |

Note : CGAAV is government consumption, GGINTPV is interest payments, TCTV is current transfers, YPGV is current expenditure, IGAAV is government investment, and YPGTV is total expenditure. All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

If one compares the effect of both types of rules, one can see the fact that the countries which introduce multi-year fiscal rules generally tend to become more countercyclical than the countries which introduce annual fiscal rules. In the case of government consumption (CGAAV), the annual rules do not affect the level of procyclicality very much while multi-year rules tend to make it more countercyclical[39]. For example, government consumption of Finland had maintained a similar level of procyclicality after 1995 when annual rules was adopted, but it became clearly more countercyclical after introducing multi-year rules in 1999[40].

To conclude, the introduction of fiscal rules could reduce the level of fiscal procyclicality of some spending categories such as government consumption and

39. Huart (2011) compares the correlation between the change in cyclically-adjusted primary balance and the change in output gap dividing pre and post 1999. The result for each country is generally consistent with our results.
40. The correlations between the cyclical component of government consumption and GDP in Finland are: (1971-1994) 0.015 → (1995-1998) 0.149 → (1999-2008) -0.839

current transfers. Multi-year fiscal rules tend to enhance the countercyclicality of fiscal policy, but the favourable effect of annual rule is not certain[41].

### 3.3.2. Regression approach

This section examines the cyclical properties of fiscal policy and the role of the time coverage of fiscal rules in determining fiscal cyclicality through regression analysis. At first, this section explores the cyclical properties of fiscal policy in OECD countries by analysing across various spending categories through both time series analysis and panel data analysis. Then, this section examines the role of fiscal rules by dividing annual fiscal rules and multi-year fiscal rules using a panel data model. We conduct several analyses to check robustness using instrumental variables, the dynamic panel model, and a sample of the SGP rules.

#### (1) The cyclical properties of fiscal policy across spending categories and countries

We first analyse the cyclical properties of government spending across countries utilizing time series analysis of the form of equation (2.6). Table 2.11 presents the average coefficients of GDP growth across spending categories. Government consumption (CGAAV) and investment (IGAAV) are both positively associated with GDP, while interest payments (GGIMTPV) and current transfers (TCTV) are negatively associated with GDP. Government consumption and investment are estimated to increase by 0.26 and 0.88 percentage points on average, while interest payments and current transfers are estimated to decrease by 0.55 and 0.25 percentage points on average, for every one percentage point increase in GDP. These results could be interpreted as government consumption and investment showing a procyclical pattern, while interest payments and current transfers showing a countercyclical pattern. Therefore, current expenditure and total expenditure seem

41. If one examines the average change in the correlation between the cyclical component of government spending and the cyclical component of GDP before and after introducing fiscal rules across country groups, we cannot find a clear picture among county groups since the sample of other advanced European countries (5) and other non-European countries (3) are small.

to show acyclical patterns, which could be interpreted that the procyclical behaviours of government consumption and investment are offset by the countercyclical behaviours of interest payments and current transfers.

Table 2.11 Fiscal procyclicality of OECD countries across spending categories

| Dependent variable | Mean | S.D. | Max | Min |
|---|---|---|---|---|
| Government consumption (CGAAV) | 0.255 | 0.752 | 3.091 | -0.359 |
| Interest payments (GGINTPV) | -0.552 | 1.336 | 2.016 | -3.304 |
| Current transfers (TCTV) | -0.245 | 0.813 | 3.152 | -1.379 |
| Current expenditure (YPGV) | -0.028 | 0.578 | 2.212 | -0.916 |
| Government Investment (IGAAV) | 0.875 | 1.244 | 4.510 | -1.142 |
| Total expenditure (YPGTV) | 0.000 | 0.818 | 3.320 | -0.854 |
| Cyclically adjusted current transfers (TCTAV) | -0.050 | 0.773 | 3.182 | -1.124 |
| Cyclically adjusted current expenditure (YPGAV) | 0.001 | 0.536 | 2.224 | -0.631 |
| Cyclically adjusted total expenditure (YPGTAV) | 0.040 | 0.778 | 3.333 | -0.993 |

Note: (1) Explanatory variables are GDP (real gross domestic product) and the lagged values of GDP. (2) All variables are expressed in the first difference of the log of real terms. (3) The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

These results are consistent with the correlation analysis of section 3.3.1 and the existing literature (Ilzetzki, 2011; Lane, 2003; Galí and Perotti, 2003; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003), even though the absolute values of coefficients are larger than those of the correlation analysis. One can also see from Table 2.11 that government spending generally becomes less countercyclical when the cyclical component, which is affected by the automatic stabilizers, is excluded.

Table 2.12 presents the coefficient of GDP growth across three different groups of countries according to the type of fiscal rules which each country has introduced. One can see from the results that the fiscal policy of OECD countries seems to be procyclical from the viewpoint of some spending categories, which are consistent with the correlation analysis of section 3.3.1. Government investment, especially, appears to be the most procyclical across all county groups, which is consistent with the existing literature (Ilzetzki, 2011; Lane, 2003; Galí and Perotti, 2003; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003). Lane (2003) emphasizes the

effect of government investment which has more than unitary output elasticity[42], and Ilzetzki (2011) also shows more than unitary output elasticity. This could be because government investment is the main spending category which policymakers control discretionarily regardless of economic situation. Policymakers can adjust the amount of capital stock across periods by government investment. This characteristic could give the opposite impacts on the level of procyclicality, but our results could be interpreted as that the behaviour of government investment in recessions[43] is overwhelmed by the procyclical behaviour of government investment in booms.

The results also indicate that the countries which introduce annual fiscal rules generally show a procyclical pattern across all spending categories except interest payments (GGINTPV), while the countries which introduce multi-year fiscal rules show a countercyclical pattern across all spending categories except government consumption (CGAAV) and investment (IGAAV) which are functioned as the main tools of spending adjustment. We can see from the results that fiscal spending generally shows a more countercyclical or less procyclical pattern in the countries with multi-year fiscal rules than in the countries with annual fiscal rules.

42. Tornell and Lane (1999, pp.85-86) suggest the "voracity effect" as the reason for this effect. If multiple political groups compete for government resource under the lack of strong legal and political institutions, expenditure increases more-than-proportionate increase in revenue respond to revenue shock.

43. Governments tend to focus on an increase in government investment when they conduct fiscal stimulus package (Padoan, 2009).

Table 2.12 Fiscal procyclicality of OECD countries across the type of rules

| Rule | country | (1) CGAAV | (2) GGINTPV | (3) TCTV | (4) YPGV | (5) IGAAV | (6) YPGTV |
|---|---|---|---|---|---|---|---|
| Annual rules (9) | Austria | 0.449 | -0.133 | -0.027 | 0.190 | 0.171 | 0.148 |
| | Belgium | -0.027 | -0.017 | -0.255 | -0.131 | -0.295 | -0.331 |
| | Canada | -0.281 | 0.353 | -0.788 | -0.380 | -0.456 | -0.487 |
| | Greece | 0.036 | -1.156 | 0.379 | -0.022 | 1.972 | -0.008 |
| | Ireland | 0.075 | -0.769 | -0.406 | -0.297 | 0.767 | -0.233 |
| | Hungary | 3.091 | -3.106 | 3.152 | 2.212 | 3.672 | 3.320 |
| | Italy | 0.315 | 1.114 | -0.366 | 0.088 | 0.041 | 0.012 |
| | Portugal | 0.983 | -1.398 | -0.306 | 0.139 | 0.850 | 0.336 |
| | Slovakia | 2.003 | -1.624 | -0.053 | 0.867 | 4.510 | 1.171 |
| | Mean | 0.738 | -0.749 | 0.148 | 0.296 | 1.248 | 0.436 |
| Multi-year rules (14) | Australia | -0.124 | 0.561 | -1.379 | -0.462 | -0.233 | -0.278 |
| | Denmark | -0.193 | 1.176 | -0.385 | -0.182 | 1.071 | -0.306 |
| | France | 0.105 | -3.304 | -0.124 | -0.108 | 0.638 | -0.280 |
| | Finland | -0.359 | -1.476 | -0.749 | -0.635 | 0.718 | -0.686 |
| | Germany | 0.314 | 1.246 | -0.037 | 0.186 | 1.990 | -0.589 |
| | Iceland | 0.448 | -1.829 | -0.616 | -0.042 | 1.341 | -0.388 |
| | Luxembourg | -0.098 | 0.326 | 0.239 | 0.094 | -1.142 | 0.078 |
| | Netherlands | -0.042 | -0.447 | -0.244 | -0.180 | -0.165 | -0.342 |
| | Norway | 0.153 | -0.438 | -0.091 | 0.118 | 0.063 | 0.071 |
| | New Zealand | 0.237 | 0.290 | -0.312 | 0.164 | 0.333 | 0.958 |
| | Spain | 0.221 | -2.486 | -0.636 | -0.410 | 0.938 | -0.654 |
| | Sweden | -0.081 | -1.365 | -0.412 | -0.322 | 0.218 | -0.854 |
| | Switzerland | -0.348 | -1.455 | -1.235 | -0.916 | 1.558 | -0.112 |
| | UK | -0.176 | -0.149 | -1.154 | -0.576 | 2.089 | -0.512 |
| | Mean | 0.004 | -0.668 | -0.510 | -0.234 | 0.673 | -0.278 |
| No rules (3) | Japan | 0.241 | 2.016 | 0.027 | 0.312 | 1.373 | 0.206 |
| | Korea | -0.214 | -0.615 | -0.087 | -0.201 | 0.466 | -0.010 |
| | USA | -0.087 | 0.327 | -0.502 | -0.233 | 0.251 | -0.230 |
| | Mean | -0.020 | 0.576 | -0.187 | -0.041 | 0.697 | -0.011 |
| All (26) | Mean | 0.255 | -0.552 | -0.245 | -0.028 | 0.875 | 0.000 |
| | S.D. | 0.752 | 1.336 | 0.813 | 0.578 | 1.244 | 0.818 |
| | MAX | 3.091 | 2.016 | 3.152 | 2.212 | 4.510 | 3.320 |
| | MIN | -0.359 | -3.304 | -1.379 | -0.916 | -1.142 | -0.854 |

Note : (1) CGAAV is government consumption, GGINTPV is interest payments, TCTV is current transfers, YPGV is current expenditure, IGAAV is government investment, and YPGTV is total expenditure. (2) Explanatory variables are GDP (real gross domestic product) and the lagged values of GDP. (3) All variables are expressed in the first difference of log real terms. (4) The sample period is 1970–2008.
Source: OECD Economic Outlook Database No.86.

### (2) The trend of fiscal procyclicality across country

Next, this subsection explores the trend of fiscal procyclicality across spending categories making the use of a rolling window estimation following Aghion and Marinescu (2007), Alberola and Montero (2007), and Alberola, Mínguez, Hernández de Cos, and Marqueés (2003)[44]. The trend of fiscal procyclicality of government consumption and investment in each countries can be seen in Graphs 2.3 and 2.4. One can see from the figures that the trend of fiscal procyclicality of government consumption is a reasonably stable fluctuation[45] even though that of some countries, such as Norway, have a deceasing trend. The trend of fiscal procyclicality of government investment, however, is quite volatile. This could be because government investment is the main spending category which policymakers adjust as already argued in this subsection. Also, it appears to become more procyclical since the end of the 1990s in a number of countries such as Austrailia, Austria, Belgium, Greece, and New Zealand, while it appears to become more countercyclical in other countries such as Netherlands and Norway.

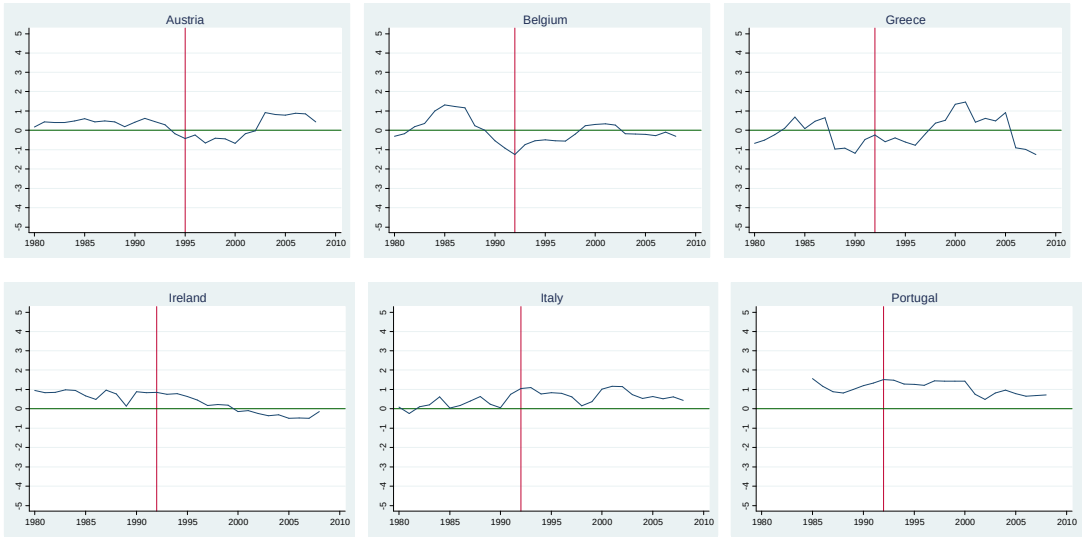
The existing literature also does not suggest consistent empirical evidence about the trend of fiscal procyclicality. Galí and Perotti (2003) show that there is a global trend towards more countercyclical fiscal policy. However, Aghion and Marinescu (2007), and Marinheiro (2007) show that fiscal policy of EMU countries became less countercyclical since 1980s, and Alberola, Mínguez, Hernández de Cos, and Marqueés (2003) show that the government investment of 14 EU countries became more procyclical since late 1980s. On the other hand, Frankel, Végh, and Vuletin (2011) show that fiscal policy of advanced countries has become less countercyclical since 2000 while that of emerging market countries has become more countercyclical because of the improvement of institutional quality.

44. Rolling window estimation can be utilized to check how the estimated coefficients change over time. The window period is set as 10 years, so the first regression covers 1971 to 1980, the second covers 1972 to 1981, and so on. Four countries (Germany, Hungary, Slovakia, and Switzerland) are excluded in the rolling estimation because of the data availability.

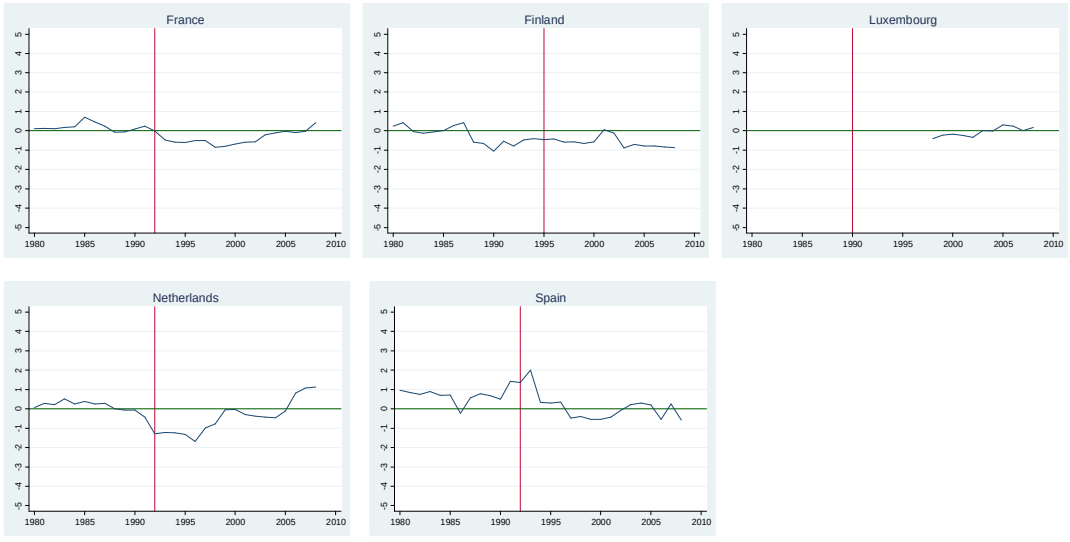
45. The trends of fiscal procyclicality of current transfers, total expenditure, and cyclically adjusted spending also show a similar pattern even though the level of procyclicality is different across spending categories, as you can be seen from Appendix 2. Graph 2A.1 and 2A.2.

Graph 2.3 The trend of fiscal procyclicality of government consumption

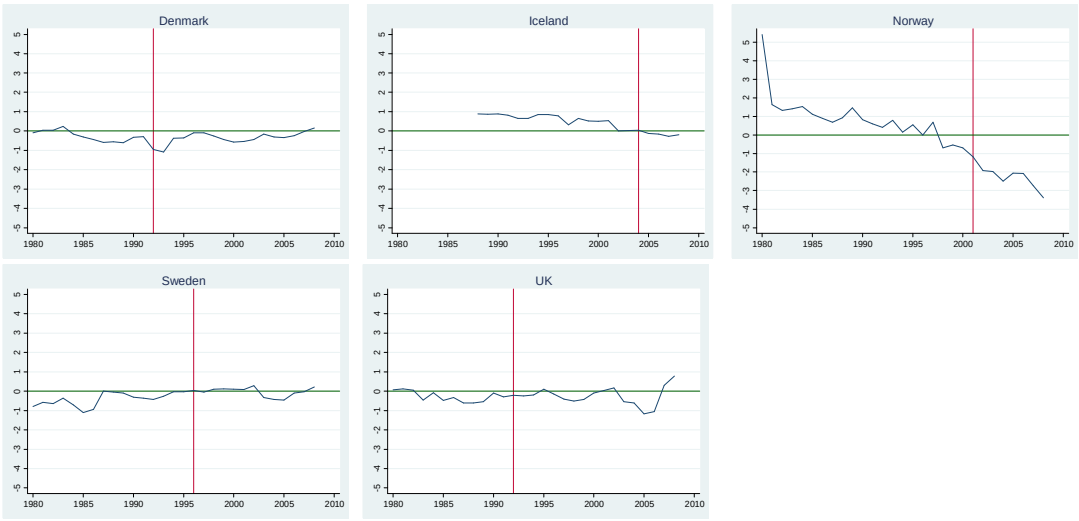
A. EMU countries – Annual fiscal rules




B. EMU countries – Multi-year fiscal rules

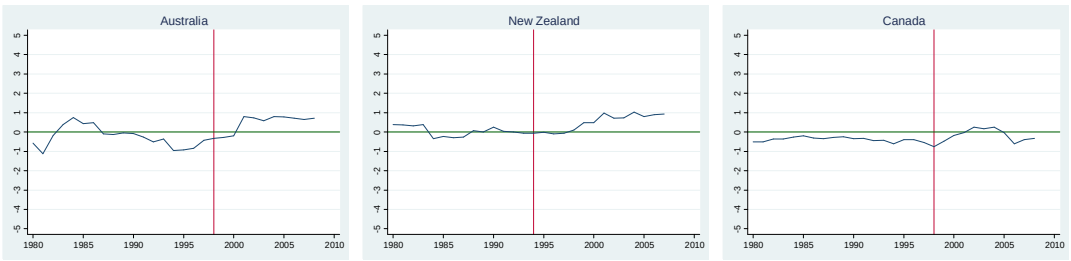


C. Other advanced European countries– Multi-year fiscal rules




D. Other advanced non-European countries

[ Multi-year fiscal rules ] [ Annual fiscal rules ]

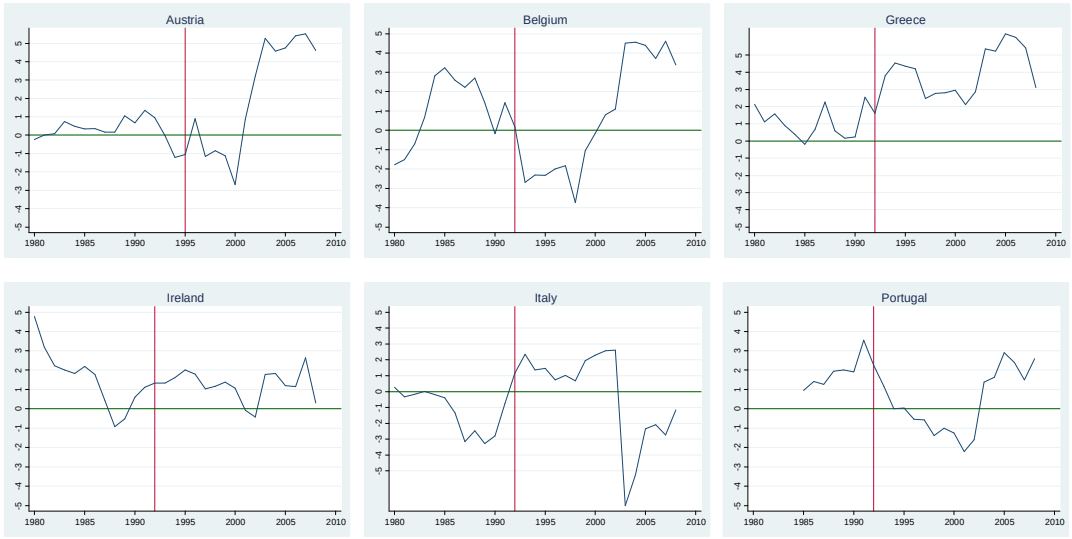



[ No fiscal rules ]

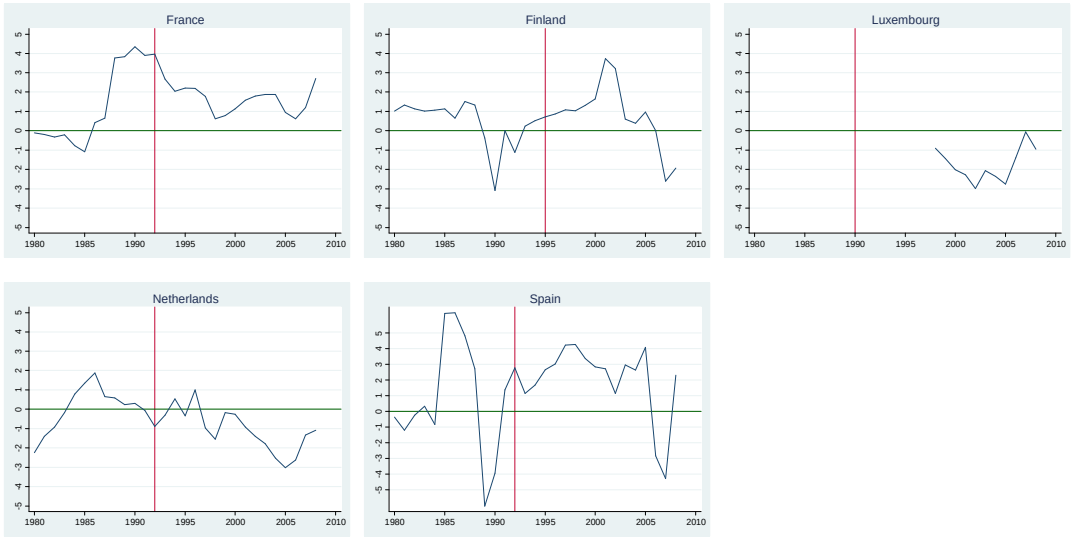

Note: The vertical line represents the year when fiscal rules were adopted. In case of EMU countries, it is the same as the year when the SGP rules were adopted.

Graph 2.4 The trend of fiscal procyclicality of government investment

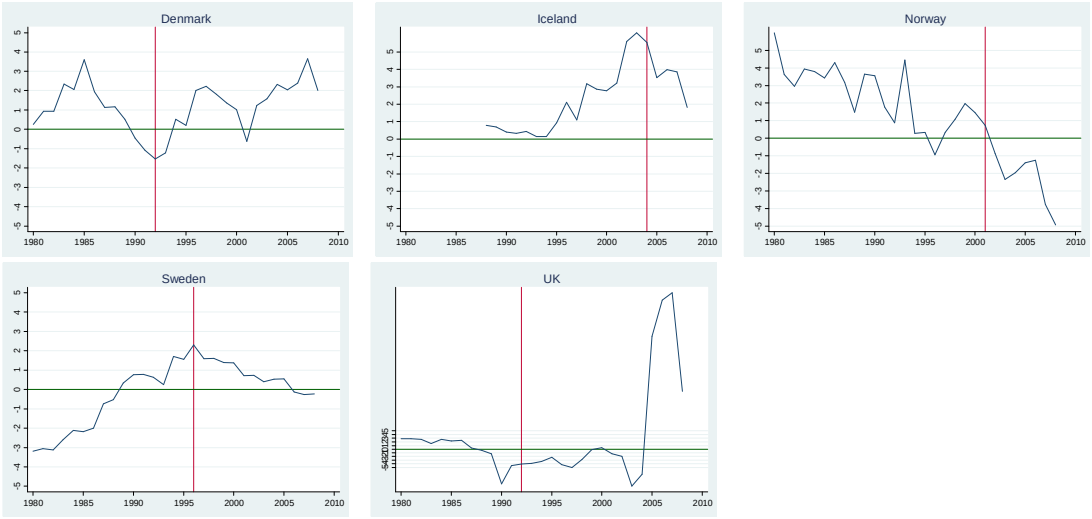
A. EMU countries – Annual fiscal rules




B. EMU countries – Multi-year fiscal rules

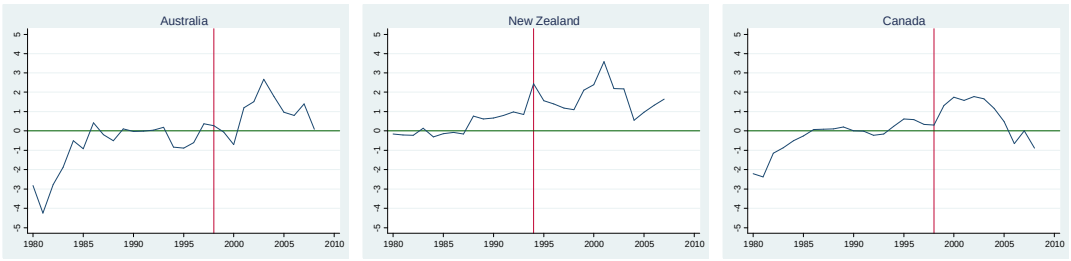


C. Other advanced European countries– Multi-year fiscal rules

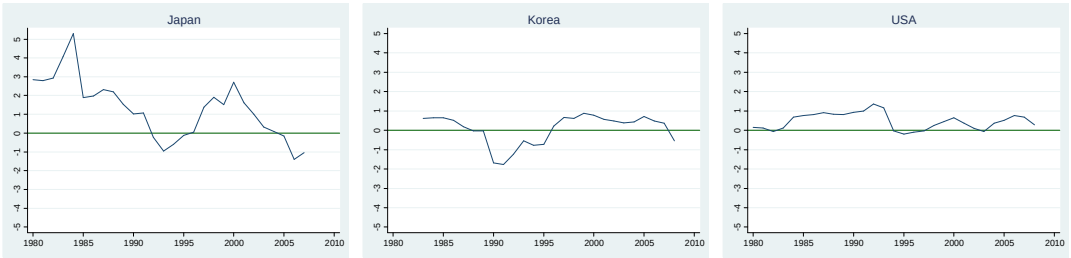



D. Other advanced non-European countries

[ Multi-year fiscal rules ] [ Annual fiscal rules ]




[ No fiscal rule ]




Note: The vertical line represents the year when fiscal rules were adopted. In case of EMU countries, it is the same as the year when the SGP rules were adopted. The reason why the procyclicality of investment in the UK is severely volatile is that government investment is volatile in spite of stable GDP growth. It decreased by 70% in 2005 and returned back to normal level in 2006.

### (3) The cyclical properties of fiscal policy of OECD countries

This subsection also explores the cyclical properties of fiscal policy in OECD countries collectively by panel data model. Estimation is based on the application of a Fixed effects model to consider the heterogeneity of each country[46]. The results from Table 2.13 show that the government investment of OECD countries demonstrates a procyclical pattern, while current transfers and interest payments a countercyclical pattern. Current GDP ($GDP_t$) is positively associated with government consumption and investment, while it is negatively associated with interest payments and current transfers[47]. The coefficients of GDP growth are significant in explaining interest payments, current transfers, and government investment. Government investment is estimated to increase by 0.74 percentage points on average, while current transfers and interest payments are estimated to decrease by 0.24 and 0.56 percentage points respectively, for every one percentage point increase in current GDP. These results are consistent with the correlation analysis of section 3.3.1, country by country analysis of this section, and the recent literature (Ilzetzki, 2011; Lane, 2003; Galí and Perotti, 2003; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003)[48]. One can also see from the results that the GDP growth from previous periods is positively associated with spending growth in general. These results could be rationalized considering the fact that actual fiscal policy is affected by past economic growth in practice because a considerable portion of tax revenues is determined by past economic performances (e.g., corporate tax).

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46. This chapter employs country fixed effects to consider country distinctive features which cannot be observed in the model. Also it is reasonable to consider error terms, which represent individual effects, to be group specific constant term rather than group specific random element because our data set includes almost of all OECD countries. The Hausman test also suggests that a fixed effects model is more efficient than a random effects model.

47. When one considers time fixed effects, the result shows that government consumption and investment are significantly positively associated with GDP, while interest payments are significantly negatively associated with GDP as can be seen from Appendix 2. Table 2A.3. However, one cannot rely on these results because the F-statistic cannot be calculated because of small degree of freedom. If we employ GDP gap instead of GDP growth following Alesina, Campante, and Tabellini (2008), the results show a large similarity with our results. The differences are below: (1) the coefficient of the GDP gap in explaining government consumption becomes significant. (2) the coefficient of the GDP gap in explaining current expenditure moves from negative to positive.

48. We additionally examine the cyclical properties of budget balance by regressing the primary budget balance on the GDP gap following some of the existing literature (Huart, 2011; Aghion and Marinescu, 2007; Mackiewicz, 2008; Alesina, Campante, and Tabellini, 2008). The results show that the primary budget balance is positively associated with the GDP gap, which indicates a countercyclical pattern of the primary budget balance as can be seen from Appendix 2. Table 2A.4. These results are consistent with the existing literature.

Table 2.13 The cyclical properties of fiscal policy of OECD countries

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.115 | -0.558** | -0.244** | -0.102 | 0.736*** | -0.104 |
| | (1.54) | (-2.29) | (-2.38) | (-1.58) | (3.44) | (-1.37) |
| $GDP_{t-1}$ | 0.281*** | 0.184 | -0.035 | 0.130* | 0.580* | 0.258*** |
| | (4.57) | (0.80) | (-0.37) | (1.98) | (1.90) | (3.04) |
| $GDP_{t-2}$ | 0.322*** | -0.894* | 0.365*** | 0.289*** | 0.461* | 0.284*** |
| | (3.93) | (-1.94) | (4.93) | (4.58) | (1.97) | (3.56) |
| F- statistics | 52.67*** | 5.84*** | 9.79*** | 18.79*** | 18.00*** | 11.58*** |
| $R^2$ | 0.190 | 0.011 | 0.058 | 0.125 | 0.055 | 0.105 |
| No.of Obs. | 820 | 799 | 798 | 804 | 816 | 795 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008.
(2) Regression methods are Fixed effects model with robust standard errors.
(3) t-statistics are in parentheses. * indicates significance at the 10% level. ** 5% level. *** 1% level.
Source: OECD Economic Outlook Database No.86.

The same regressions are run with cyclically adjusted government spending to remove the effect of automatic stabilizers in budget systems. Table 2.14 shows that government spending generally becomes less countercyclical when the cyclical component is excluded. The coefficients on GDP growth are larger than corresponding coefficients when the cyclical component is included in Table 2.13, and therefore the effect of GDP growth in explaining current transfers becomes insignificant. These results are consistent with the correlation analysis of section 3.3.1 and the existing literature (Galí and Perotti, 2003; Braun, 2001).

Table 2.14 The cyclical properties of fiscal policy of OECD countries (Cyclically adjusted spending)

| Dependent Variable : Difference in log of real government spending | | | |
|---|---|---|---|
| | (1) Current Transfers | (2) Current Expenditure | (3) Total Expenditure |
| $GDP_t$ | -0.146 | -0.030 | -0.049 |
| | (-1.34) | (-0.44) | (-0.52) |
| $GDP_{t-1}$ | 0.052 | 0.156* | 0.280** |
| | (0.47) | (1.88) | (2.59) |
| $GDP_{t-2}$ | 0.314*** | 0.272*** | 0.267*** |
| | (3.60) | (3.70) | (3.15) |
| F- Statistics | 7.628*** | 13.310*** | 9.624*** |
| $R^2$ | 0.043 | 0.082 | 0.073 |
| No.of Observations | 715 | 715 | 715 |
| No.of Groups | 24 | 24 | 24 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Fixed effects model with robust standard errors.
(3) t-statistics are in parentheses. * indicates significance at the 10% level. ** 5% level. *** 1% level.
Source: OECD Economic Outlook Database No.86.

To check the robustness of our results, we include the lagged value of government spending as an independent variable and run the same regressions utilizing the Generalised Method of Moments (GMM)[49] following some existing literature (Lledó, Yackovlev, and Gadenne, 2009; Mackiewicz, 2008; Candelon, Muysken, and Vermeulen, 2010). The results generally confirm our baseline results. Table 2.15 shows that the current GDP growth is significantly positively associated with government investment while it is significantly negatively associated with current transfers. These results are not different with the baseline analysis of Table 2.13 except the fact that the coefficient of GDP growth in explaining current expenditure becomes significant and that of GDP growth in explaining interest payments becomes insignificant. When we conduct the same regressions with cyclically adjusted government spending, the results generally confirm that of Table 2.14. If we run the same estimations using the system GMM methods as a further robustness check, the results show a large degree of similarity with the difference GMM estimation in Table 2.15. Appendix 2. Table 2A.5 shows that government consumption and investment of OECD countries appear to be procyclical.

Table 2.15 The cyclical properties of fiscal policy of OECD countries (GMM)

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.115 | -0.392 | -0.261** | -0.110** | 0.779*** | -0.111 |
| | (1.45) | (-1.61) | (-2.41) | (-2.07) | (4.15) | (-1.58) |
| $GDP_{t-1}$ | 0.262*** | 0.229 | 0.019 | 0.161*** | 0.673** | 0.261*** |
| | (4.40) | (1.08) | (0.19) | (2.61) | (2.28) | (3.24) |
| $GDP_{t-2}$ | 0.277*** | -0.948*** | 0.336*** | 0.206*** | 0.566** | 0.263*** |
| | (3.60) | (-2.69) | (4.99) | (3.48) | (2.57) | (3.39) |
| dependent $_{t-1}$ | 0.164*** | 0.419*** | 0.210*** | 0.346*** | -0.139** | 0.060 |
| | (2.91) | (7.49) | (3.42) | (7.41) | (-2.15) | (1.01) |
| Wald $chi^2$ | 238.62*** | 185.66*** | 37.17*** | 104.38*** | 77.73*** | 36.17*** |
| Hansen $chi^2$ | 22.76 | 18.08 | 23.63 | 24.44 | 21.22 | 24.78 |
| No.of Obs. | 790 | 767 | 766 | 773 | 785 | 762 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Generalised Method of Moments (GMM) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
(4) A statistics for Hansen test for overidentifying restrictions are accepted in all specifications, which suggests that the instruments used are all valid.
Source: OECD Economic Outlook Database No.86.

49. This section employs the GMM approach of Arellano and Bond (1991) which employs lagged values of the regressors as instrumental variables. It is known that GMM could be more efficient than the Fixed effect model in the case of dynamic panel data model since the Fixed effects estimator is typically inconsistent when the time period is finite (finite sample bias) (Cameron and Trivedi, 2005).

This section conducts the same analysis utilizing instrumental variables to deal with the endogeneity problem which can arise from several reasons such as omitted variables, measurement errors, and simultaneity. We focus on the simultaneity that fiscal policy and output growth have an effect on each other. Most existing literature has ignored the endogeneity problem even though Keynesians argue that fiscal policy have an effect on economic growth at least short term. Some studies (Huart 2011; Ilzetzki and Végh, 2008; Galí and Perotti, 2003; Lane, 2003) deal with the endogeneity of output and show that the results will not change even when this problem is considered[50]. To the best of our knowledge, only Jaimovichny and Panizza (2007) argue that the results of fiscal procyclicality tests will be changed if this endogeneity problem is considered. They show that the fiscal procyclicality of developing countries disappears when the endogeneity problem is controlled for.

This section employs two stage least squares (2SLS) estimation utilizing the growth in GDP of the USA as the instrument of the growth in GDP [51] following the existing literature (Candelon, Muysken, and Vermeulen, 2010; Galí and Perotti, 2003) because the lagged value of GDP growth is already included in our estimation. Table 2.16 shows that current GDP is significantly negatively associated with government spending except interest payments in column (2) and government investment in column (5). The results of the Hausman test[52] imply that one needs to consider the potential endogeneity problem in explaining government consumption, current transfers, current expenditure, and total expenditure. One can also see from the result that the coefficients of 2SLS estimations are smaller than those of Fixed effects estimations. These results are consistent with the existing literature (Lledó, Yackovlev, and Gadenne, 2009) which shows that the reverse causality effect of fiscal policy on output growth is positive in advanced countries. To sum up, government consumption can be countercyclical if one considers endogeneity problem, and in turn current expenditure and total expenditure can be

50. Huart (2011) shows that both OLS and IV estimations provide similar results. Ilzetzki and Végh (2008) show that the fiscal policies of developing countries are procyclical regardless of whether one considers the endogeneity problem. Lane (2003) argues that there is no strong reason to consider the endogeneity problem. The author also shows that the results for political determinants improved when this problem is considered.

51. With regard to the USA, we utilize the average GDP growth of other countries as instrument.

52. Hausman (1978) suggests the test for endogeneity of an explanatory variable by comparing the estimates of OLS and 2SLS directly. If the null hypothesis of an exogeneous explanatory variable is rejected, then we have to consider the potential endogeneity problem since it indicates 2SLS estimates are consistent.

countercyclical [53]. These results could be interpreted as that the level of procyclicality of government consumption can lessen if we consider the reverse causality effect of fiscal policy on economic growth. These results are consistent with our country by country analysis and the existing literature (Ilzetzki, 2011; Lane, 2003; Galí and Perotti, 2003; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003). Our country by country analysis of Table 2.12 shows that about half of OECD countries appear to have countercyclical government consumption while half appear to have procyclical government consumption. The existing literature shows a clear picture of procyclical government investment, but it does not suggest a consistent picture of procyclical government consumption.

Table 2.16 The cyclical properties of fiscal policy of OECD countries (FE 2SLS)

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | -0.844*** | -0.519 | -0.996*** | -0.865*** | -0.190 | -0.916*** |
| | (-4.58) | (-0.85) | (-4.44) | (-5.22) | (-0.28) | (-4.30) |
| $GDP_{t-1}$ | 0.588*** | 0.170 | 0.234** | 0.396*** | 0.882*** | 0.548*** |
| | (6.74) | (0.56) | (2.11) | (4.79) | (2.71) | (5.17) |
| $GDP_{t-2}$ | 0.262*** | -0.891*** | 0.303*** | 0.230*** | 0.399* | 0.216*** |
| | (4.06) | (-4.14) | (3.88) | (3.85) | (1.67) | (2.88) |
| Wald | 761.61*** | 96.53*** | 688.52*** | 1020.41*** | 39.52*** | 607.21*** |
| $R^2$ | 0.015 | 0.011 | 0.013 | 0.010 | 0.034 | 0.017 |
| Hausman $chi^2$ | 29.68*** | 0.00 | 12.57*** | 23.49*** | 2.05 | 16.17*** |
| No.of Obs. | 820 | 799 | 798 | 804 | 816 | 795 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008.
(2) Regression methods are Fixed effects 2SLS Instrumental variables estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

To conclude, our empirical findings suggest that the current transfers of OECD countries seem to be countercyclical on average due to the existence of automatic stabilizers, while government investment appears to be procyclical on average. However, we cannot confirm the cyclical properties of government consumption and interest payments considering the causality effect of government spending on economic growth.

53. When one runs the same regressions with cyclically adjusted government spending to remove the effect of automatic stabilizers, the results show that government spending generally becomes less countercyclical when the cyclical component is excluded as can be seen from Appendix 2. Table 2A.6. The results also show that cyclically adjusted current expenditure and total expenditure can be countercyclical if one considers the endogeneity problem.

### (4) The effect of introducing fiscal rules on fiscal procyclicality

Next, this subsection analyses the effect of introducing fiscal rules on the level of fiscal procyclicality across spending categories. We include a dummy variable for fiscal rules which is the form of an interaction variable into the estimation equation, following the existing literature[54]. This is because the coefficient of the interaction term measures the change in the coefficient of fiscal procyclicality when fiscal rules are introduced (Preacher, 2003). In other words, it indicates the effect of fiscal rules on the level of fiscal procyclicality[55].

Table 2.17 shows that the introduction of fiscal rules could mitigate the level of procyclicality or fortify the level of countercyclicality. The coefficients on the interaction variables for fiscal rules and GDP growth are significantly negative except in explaining government investment in column (5)[56]. The introduction of fiscal rules causes an additional decrease in spending growth of 0.18~0.40 percentage points on average, for every one percentage point increase of current GDP[57]. This result is consistent with Manasse (2006) who shows that fiscal rules could enhance countercyclical fiscal policy. What one should note is that fiscal rules do not play any role in mitigating the procyclicality of government investment. We can think of the characteristics of government investment as the reason for this result. Government investment is the main spending category which policymakers control discretionarily regardless of economic situation as already argued in section 3.3.2. The discretionary fiscal policy is mainly carried out by the adjustment of government investment (Padoan, 2009). Therefore, the procyclicality of government investment is not affected by the introduction of fiscal rules compared to the other spending categories.

54. The literature on the determinants of fiscal procylicality generally does not include control variables themselves as separate regressors (see, for example, Alesina, 2008; Diallo, 2009).
55. The coefficient of control variables means the effect of each control variable on the change in government spending, not the level of fiscal procyclicality itself. If we include RULE as a separate regressor, we cannot find the effect of control variable on procyclicality properly because of collinearity of two variables.
56. The change in correlation between government spending and GDP after introducing fiscal rules is also smallest in explaining government investment, as can be seen from Table 2.10.
57. The coefficient of the interaction term for control variables and GDP growth denotes the change in the level of fiscal procyclicality (the coefficient of $GDP_t$) when the control variable changes by one unit.

Table 2.17 also shows that the government investment of OECD countries seems to be procyclical while current transfers and interest payments show countercyclical patterns, which are consistent with baseline results of Table 2.13. The marginal effects of GDP growth on government spending growth have the same sign as the coefficient of GDP growth of Table 2.13 and show similar sizes.

Table 2.17 The effect of fiscal rules on fiscal procyclicality

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.166* | 0.062 | -0.160* | 0.022 | 0.657*** | -0.008 |
| | (1.87) | (0.21) | (-1.74) | (0.31) | (2.85) | (-0.11) |
| $GDP_{t-1}$ | 0.292*** | 0.302 | -0.019 | 0.152** | 0.563* | 0.274*** |
| | (4.64) | (1.32) | (-0.20) | (2.27) | (1.87) | (3.18) |
| $GDP_{t-2}$ | 0.332*** | -0.785 | 0.380*** | 0.310*** | 0.447* | 0.301*** |
| | (3.92) | (-1.71) | (5.01) | (4.67) | (1.91) | (3.64) |
| RULE *$GDP_t$ | -0.184*** | -2.081*** | -0.283** | -0.404*** | 0.281 | -0.307*** |
| | (-3.07) | (-5.38) | (-2.65) | (-5.39) | (1.13) | (-3.79) |
| *marginal | 0.100 | -0.692 | -0.262 | -0.125 | 0.758 | -0.119 |
| ($F_{GDP}$ ) | 3.00* | 38.77*** | 9.21*** | 20.74*** | 6.14*** | 8.82*** |
| F- Statistics | 38.09*** | 13.83*** | 7.58*** | 17.21*** | 16.16*** | 13.37 *** |
| $R^2$ | 0.199 | 0.105 | 0.087 | 0.187 | 0.056 | 0.131 |
| No.of Obs. | 820 | 799 | 798 | 804 | 816 | 795 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product and RULE is the dummy variable for the fiscal rules. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008.
(2) Regression methods are Fixed effects model (FE) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
(4) $F_{GDP}$ is for testing joint significance of $GDP_t$ and interaction variable for $GDP_t$ and RULE.
Sources: OECD Economic Outlook Database No.86 and IMF fiscal rules database (2009).

To check robustness of these results, we include five additional control variables which are commonly employed in the existing literature. Table 2.18 also shows that fiscal rules could be one of main determinants of fiscal procyclicality. The results show a large similarity with Table 2.17 that all coefficients of the interaction for fiscal rules and GDP growth have the same signs in spite of the different levels of statistical significance. The coefficients associated with interest payments and current transfers are significantly negatively. The introduction of fiscal rules decreases interest payments by 1.56 percentage points and current transfers by 0.38 percentage points, on average, for every one percentage point increase in GDP. However, the coefficients of interaction for fiscal rules and GDP growth in explaining government consumption and total expenditure become

insignificant, and the coefficient of interaction for fiscal rules and GDP growth in explaining government investment becomes significant when other control variables are included. This could be because the effect of fiscal rules is less precisely estimated here than in the baseline estimation of Table 2.17 because of the possible collinearity with fiscal rules and other control variables[58].

Table 2.18 also shows that the government investment of OECD countries seems to be procyclical, while other spending categories show a countercyclical pattern. The marginal effects[59] of GDP growth on government spending growth are all negative except for government investment, and significant jointly. These results are generally consistent with the baseline results of Table 2.13 except that government consumption is countercyclical. The other five control variables generally show the expected sign in line with the existing literature, and some of them seem to play a significant role in determining fiscal procyclicality of some spending categories, especially government consumption and investment even though the statistical significances of coefficients are low. Income per capita (GDPPC) and government the debt ratio (DEBTRATIO) generally play a role in reducing the level of fiscal procyclicality.

Trade openness (OPEN) shows a significantly negative effect in explaining government investment. A one percentage point increase of trade openness, which is measured by the ratio of exports and imports with respect to GDP, could lead to a decrease in the level of procyclicality of government investment (coefficient of GDP growth) of 0.007 on average, holding other variables constant. This coefficient indicates that a one percentage point increase in trade openness could additionally reduce government investment by 0.007 percentage points for every one percentage point increase in GDP. However, there are contradictive arguments about the interpretation of trade openness. Some studies argue that high openness makes fiscal policy less procyclical since it indicates high access to international capital (Woo, 2009) [60], but others argue that high openness could make fiscal policy more

58. When the same estimations are run excluding the interaction for two variables (income per capita and the debt ratio) and GDP growth, the coefficients of the interaction for fiscal rules and GDP growth become similar with those of the baseline estimations in Table 2.17.
59. The marginal effect can be obtained by calculating the sum of the coefficients of GDP growth and Σ(estimated coefficient*average value of control variable).
60. Woo (2009) could not confirm his argument empirically since the coefficient was not significant.

procyclical since it leads to an increase in the cost of financing from the international market, especially during recessions (Aghion and Marinescu, 2007; Lane, 2003) [61]. Our results show that the effect of trade openness is not certain according to the spending categories, which could be consistent with the contradictive empirical evidence of the existing literature.

Table 2.18 The effect of fiscal rules on fiscal procyclicality
(additional control variables)

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 2.215 | -0.075 | 0.165 | 1.465 | 3.839 | 1.565 |
| | (1.48) | (-0.02) | (0.06) | (0.85) | (1.10) | (0.99) |
| $GDP_{t-1}$ | 0.134*** | 0.165 | -0.209*** | 0.008 | 0.559*** | 0.168* |
| | (2.99) | (0.73) | (-2.91) | (0.16) | (3.02) | (1.75) |
| $GDP_{t-2}$ | 0.402*** | -0.914 | 0.395*** | 0.327*** | 0.567*** | 0.281*** |
| | (7.33) | (-1.55) | (4.22) | (5.32) | (3.28) | (2.88) |
| $OPEN*GDP_t$ | 0.001 | -0.002 | 0.003 | 0.002 | -0.007* | 0.000 |
| | (0.78) | (-0.22) | (1.56) | (0.95) | (-1.82) | (0.15) |
| $POLCON*GDP_t$ | 0.762 | -2.547 | 0.154 | 0.124 | 1.859 | 0.130 |
| | (1.40) | (-0.95) | (0.18) | (0.17) | (1.05) | (0.16) |
| $GDPPC*GDP_t$ | -0.291* | 0.203 | -0.031 | -0.165 | -0.529 | -0.160 |
| | (-1.72) | (0.54) | (-0.10) | (-0.93) | (-1.13) | (-0.99) |
| $GOVSIZE*GDP_t$ | 0.014 | 0.007 | 0.004 | 0.009 | 0.052 | 0.009 |
| | (1.68) | (0.16) | (0.34) | (0.79) | (1.55) | (0.69) |
| $DEBTRT*GDP_t$ | -0.006** | -0.017 | -0.010*** | -0.009** | -0.012 | -0.011*** |
| | (-2.38) | (-1.35) | (-2.83) | (-2.63) | (-1.52) | (-3.11) |
| $RULE*GDP_t$ | -0.073 | -1.560*** | -0.383** | -0.332** | 0.728** | -0.172 |
| | (-0.64) | (-3.04) | (-2.54) | (-2.76) | (2.13) | (-1.25) |
| *marginal effect | -0.028 | -0.597 | -0.456 | -0.252 | 0.869 | -0.313 |
| ($F_{GDP}$ ) | 2.76** | 20.48*** | 6.89*** | 8.61*** | 5.11*** | 11.56*** |
| F-statistics | 17.80*** | 35.10*** | 19.44*** | 16.21*** | 18.62*** | 13.42*** |
| $R^2$ | 0.212 | 0.135 | 0.133 | 0.223 | 0.086 | 0.160 |
| No.of Obs. | 636 | 635 | 635 | 636 | 635 | 634 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product, OPEN is trade openness, POLCON is a political power dispersion index, GDPPC is the log of income per capita, GOVSIZE is the size of public sector, DEBTRT is the government debt to GDP ratio, and RULE is a dummy variable for the fiscal rules. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008.
(2) Regression methods are Fixed effects model (FE) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
(4) $F_{GDP}$ is for testing joint significance of $GDP_t$ and interaction variables with $GDP_t$ .
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, Henisz database (2010), and IMF fiscal rules database (2009).

61. Mackiewicz (2008) argues that the two effects work in the opposite direction and shows that the coefficient is negative, but it is insignificant.

Political power dispersion (POLCON) shows a positive effect in general, which implies that more dispersed political power leads to a more procyclical pattern of government spending. A 0.1 unit increase of political power dispersion index, which ranges from zero to one, could lead to an increase in the level of fiscal procyclicality by 0.076 in explaining government consumption and by 0.186 in explaining government investment on average. However, all coefficients are insignificant. There is also contradictive empirical evidence about the effect of political power dispersion. Lane (2003) shows that power dispersion could worsen fiscal procyclicality, whereas Woo (2009) shows that it could mitigate the level of fiscal procyclicality by reducing harmful effects on fiscal behaviour of social polarization through checks and balances[62].

Income per capita (GDPPC) shows a significantly negative effect in explaining government consumption, which indicates that the developing countries are more likely to run procyclical fiscal policy. The level of procyclicality of government consumption is estimated to be decreased by 0.291 for every one percent increase in income per capita. This result is consistent with the existing literature (Lane, 2003; Çiçek and Elgin, 2011) [63].

Government size (GOVSIZE) shows a positive effect, which implies that the countries with bigger public sectors tend to operate a more procyclical fiscal policy. However, all coefficients are insignificant. The existing literature presents different empirical evidence. Lane (2003) shows that the effect of government size, which indicates the power of government employees on fiscal policy making, is different across spending categories. Woo (2009) shows that government size is negatively associated with fiscal procyclicality since it indicates the strength of the automatic stabilizers, while Mackiewicz (2008) shows that it does not play any role in fiscal procyclicality.

The government debt ratio (DEBTRT) generally shows a significantly negative effect, and a one percentage point increase in the government debt ratio reduces

62. Mackiewicz (2008) also assumes that political power dispersion could contribute to reducing fiscal procyclicality because dispersed power implies lower probability of policy change. However, the author could not confirm the hypothesis empirically since the coefficient was not significant.
63. Mackiewicz (2008) also suggest the negative effect of income per capita on the level of fiscal procyclicality, but it is not significant.

government spending by 0.006~0.017 percentage points for every one percentage point increase in current GDP growth. This result is not consistent with the existing literature (Mackiewicz, 2008) which argues that high debt could arouse a financial constraint. However, high debt could reduce the incentive on an increase in spending by arousing the concern about fiscal sustainability in practice, namely high debt could provide "debt stabilization motive" in fiscal policy (Huart, 2011, p.411; Guichard, Kennedy, Wurzel, and André, 2007), so it could reduce the level of procyclicality, especially in booms.

One issue we have to consider is that we should interpret the size of coefficients carefully. This is because each variable has different measurement units and a different distibution, so the size of the coefficient does not mean the real effect on fiscal procyclicality. Table 2.19 presents the change in government spending growth for every one percentage point increase in GDP when each control variables change by one standard deviation of that variable, in other words, the variation of the level of procyclicality across control variables. The results show that the discrepancy among the size of the real effects of control variables on government spending is not as big as the discrepancy among the size of coefficients in Table 2.18.

Table 2.19 The additional change in the level of procyclicality across control variables

| | Mean | Standard Deviation | Change in spending growth | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5)Investment | (6) Total Expenditure |
| OPEN | 58.824 | 42.404 | 0.059 | -0.078 | 0.132 | 0.077 | -0.286 | 0.010 |
| POLCON | 0.468 | 0.094 | 0.071 | -0.238 | 0.014 | 0.012 | 0.174 | 0.012 |
| GDPPC | 9.974 | 0.400 | -0.116 | 0.081 | -0.012 | -0.066 | -0.212 | -0.064 |
| GOVSIZE | 43.553 | 9.563 | 0.135 | 0.063 | 0.037 | 0.084 | 0.501 | 0.082 |
| DEBTRT | 57.818 | 0.481 | -0.003 | -0.008 | -0.005 | -0.004 | -0.006 | -0.006 |
| RULE | 0.362 | 0.481 | -0.035 | -0.750 | -0.184 | -0.160 | 0.350 | -0.083 |

Note: OPEN is trade openness, POLCON is a political power dispersion index, GDPPC is the log of income per capita, GOVSIZE is the size of public sector, DEBTRT is the government debt to GDP ratio, and RULE is a dummy variable for the fiscal rules.

The correlation analysis of section 3.3.1 shows that the effect of annual fiscal rules and multi-year fiscal rules on the level of fiscal procyclicality could be

different. To verify this result, this section analyses the effect of annual fiscal rules and multi-year fiscal rules respectively[64].

Table 2.20 The effect of annual and multi-year fiscal rules on fiscal procyclicality

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| <Anuual fiscal rules> | | | | | | |
| RULE *$GDP_t$ | -0.169** | -2.296*** | -0.179 | -0.416*** | 0.031 | -0.335*** |
| | (-2.36) | (-4.90) | (-1.36) | (-4.43) | (0.09) | (-2.98) |
| F-statistics | 29.08*** | 10.30*** | 8.59*** | 14.61*** | 11.00*** | 11.15*** |
| $R^2$ | 0.201 | 0.093 | 0.078 | 0.175 | 0.071 | 0.138 |
| No.of Obs. | 654 | 634 | 633 | 638 | 650 | 629 |
| No.of Groups | 24 | 24 | 24 | 24 | 24 | 24 |
| <Multi-year fiscal rules> | | | | | | |
| RULE *$GDP_t$ | -0.213*** | -1.503** | -0.417*** | -0.362*** | 0.543 | -0.261** |
| | (-2.84) | (-2.64) | (-2.85) | (-3.17) | (1.64) | (-2.16) |
| F-statistics | 27.37*** | 4.98*** | 7.29*** | 14.71*** | 9.73*** | 10.17*** |
| $R^2$ | 0.199 | 0.056 | 0.079 | 0.169 | 0.044 | 0.115 |
| No.of Obs. | 671 | 652 | 651 | 655 | 667 | 646 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) All regressions include $GDP_t$ (real gross domestic product) and the lagged values of $GDP_t$ as independent variables. All spending variables are expressed in the first difference of the log real terms. RULE is the dummy variable for the fiscal rules
(2) The sample period is 1970–2008.
(3) Regression methods are Fixed effects model (FE) with robust standard errors.
(4) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86 and IMF fiscal rules database (2009).

Table 2.20 presents the results for the effect of introducing annual fiscal rules and multi-year fiscal rules on the level of fiscal procyclicality across spending categories. The coefficients of interaction for fiscal rules and GDP growth are all negative except in explaining government investment in both types of rules. With regard to government consumption, the size of coefficients in multi-year fiscal rules are smaller than that of annual fiscal rules, which indicates that the effects of multi-year fiscal rules are bigger than annual fiscal rules. The introduction of annual fiscal rules and multi-year fiscal rules decrease government consumption additionally by 0.169 percentage points and 0.213 percentage points, for every one percentage point increase in current GDP. With regard to current transfers, the coefficient for multi-year fiscal rules is significant while that of annual fiscal rules is insignificant. These

64. We conduct regressions separately because to estimate a regression including a dummy variable for both annual and multi-year fiscal rules together will cause multicollinearity bias since they are strongly correlated.

results imply that multi-year fiscal rules are more efficient to mitigate the procyclicality of government consumption and current transfers, but both do not seem to play any role in reducing procyclicality of government investment[65].

To conclude, one can see that introducing fiscal rules can help governments operate fiscal policy in a less procyclical way and that multi-year fiscal rules tend to be more effective in reducing the level of procyclicality of government consumption and current transfers compared with annual fiscal rules. These results are generally consistent with those of correlation analysis of section 3.3.1.

### (5) The effect of the SGP rules

Lastly, this subsection explores the effect of introducing the SGP rules on fiscal procyclicality. This subsection analyses the 16 EU countries[66] that have adopted the SGP rules. The cyclical properties of fiscal policy in the 16 EU countries are similar to those of baseline analysis in the 26 OECD countries, in spite of different levels of significance. Government investment of 16 EU countries appears to be procyclical as can be seen from Appendix 2. Table 2A.7[67]. Table 2.21 presents the coefficients of interaction for various kinds of fiscal rules and GDP growth respectively. To allow for a comparison with the results of the effect of fiscal rules in OECD countries, we present those results of Table 2.17 in the bottom of Table 2.21. The results show that the effect of fiscal rules and the SGP rules in the 16 EU countries

65. We additionally examine the cyclical properties of the budget balance by regressing the primary budget balance on the output gap, following some existing literature (Huart, 2011; Aghion and Marinescu, 2007; Mackiewicz, 2008; Alesina, Campante, and Tabellini, 2008). The results show that the coefficients of interaction for fiscal rules and the output gap are significantly positive in both annual fiscal rules and multi-year fiscal rules, and they also show that the effect of multi-year fiscal rules are bigger than that of annual fiscal rules, as can be seen from Appendix 2. Table 2A.4. These results are generally consistent with our results.

66. Twelve EMU countries and four other advanced European countries (Denmark, Slovakia, Sweden, and the UK).

67. The only difference with the results of 26 OECD countries is the coefficient of GDP growth in explaining current transfers becomes insignificant and that of GDP growth in explaining total expenditure becomes significant. This could be because the share of EU countries which introduced annual fiscal rules is bigger than that of OECD countries. The ratio of countries which introduced only annual fiscal rules is 43.8% in EMU countries (seven out of 16 countries) and 38.5% (nine out of 26 countries) in all OECD countries. The countries with annual fiscal rules generally operate less countercyclical current transfers than in the countries with multi-year fiscal rules, as can be seen from the results of Table 2.21.

are generally similar to the effect of fiscal rules in the 26 OECD countries. However, one cannot be certain that this effect in the 16 EU countries is due to entirely the function of the SGP rules. This is because a large number of EU countries adopted their own national fiscal rules as well as the SGP rules.

Table 2.21 The effect of the SGP rules on fiscal procyclicality

Dependent Variable : Difference in log of real government spending

| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
|---|---|---|---|---|---|---|
| Fiscal rules | -0.223*** | -2.561*** | -0.308** | -0.477*** | 0.042 | -0.357*** |
| Annual rules | -0.217** | -2.405*** | -0.206 | -0.447*** | -0.057 | -0.321** |
| Multi-year rules | -0.269** | -2.249*** | -0.517** | -0.487*** | 0.098 | -0.395** |
| SGP rules | -0.206*** | -2.523*** | -0.342** | -0.486*** | 0.027 | -0.377*** |
| SGP rules only | -0.205** | -2.362*** | -0.180 | -0.429*** | -0.039 | -0.299** |
| * Fiscal rules(OECD) | -0.184*** | -2.081*** | -0.283** | -0.404*** | 0.281 | -0.307*** |

Note: (1) All regressions include $GDP_t$ (real gross domestic product) and lagged values of $GDP_t$ as independent variables. All spending variables are expressed in the first difference of the log real terms. RULE is a dummy variable for the fiscal rules (2) The sample period is 1970–2008.
(3) Regression methods are Fixed effects model (FE) with robust standard errors.
(4) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86 and IMF fiscal rules database (2009).

Therefore, one should differentiate the effect of the SGP rules and that of own initiative fiscal rules to assess the exact effect of the SGP rules. One can see the effect of the SGP rules from the fifth row of Table 2.21 where we exclude the period during which national rules were operated[68]. The coefficients of the SGP rules have a large similarity with those of when the effects of national rules are included in the fourth row of Table 2.21. However, one can see from the results that the size of coefficients becomes smaller and less significant, which indicates that the effect of the SGP rules becomes less when the effect of national fiscal rules is excluded. This could be because the types of national rules are mainly multi-year rules. Nine countries out of 11 EU countries, which have adopted both SGP rules and national fiscal rules, operate multi-year fiscal rules. This explanation can be confirmed by the results of Table 2.21 that the coefficients of the SGP rules, when national rules are excluded in the fifth row, are similar to those of annual fiscal rules in the second

68. Eleven countries (Austria, since 1999; Denmark, since 1992; Finland, since 1999; France, since 1998); Germany, since 1982; Luxembourg, since 1992; Netherlands, since 1994; Portugal, since 2002; Spain, since 2003; Sweden, since 1996; the UK, since 1997) operate their own initiative fiscal rules as well as the SGP rules. On the other hand, five countries (Belgium, Greece, Ireland, Italy, and Slovakia) operate only the SGP rules.

row while they are larger than those of multi-year rules in the third row. These results imply that the effect of the SGP rules is similar to that of annual fiscal rules and that the SGP rules are less effective in mitigating the level of fiscal procyclicality than multi-year fiscal rules.

## 4. Conclusion and policy implications

Our main findings from both the correlation and regression analyses could be summarized as follows. First, we find that a large number of OECD countries seem to operate their fiscal policy in a procyclical way, especially in government consumption and investment, in line with recent literature. These findings suggest that discretionary fiscal policy is mainly carried out by the adjustment of government consumption and investment. Second, one can see that some control variables which were commonly introduced in the existing literature seem to play a certain role in determining the level of the procyclicality of government spending. Income per capita and the government debt ratio play a role in reducing the level of fiscal procyclicality. Finally, introducing multi-year fiscal rules could reduce the level of procyclicality of fiscal policy or make fiscal policy more countercyclical, which is consistent with our theoretical explanation of section 2.3. Correlation analysis shows that multi-year fiscal rules could be an efficient policy tool in reducing fiscal procyclicality while the effect of introducing annual fiscal rules on fiscal cyclicality is not certain. Regression analysis also shows that annual fiscal rules as well as multi-year fiscal rules could help reduce fiscal procyclicality, but the effect of the former does not seem to be as efficient as the latter.

These findings imply that the level of fiscal procyclicality could be affected by the time horizon of fiscal policy. If government operates fiscal policy from the short-term perspective, the level of procyclicality might not be mitigated. If government operates fiscal policy from the long-term perspective, the degree of

procyclicality will be mitigated clearly. Policymakers can operate fiscal policy from the long-term perspective by introducing multi-year fiscal rules, and they in turn could help policymakers operate fiscal policy in a more countercyclical way. In addition, policymakers should make an effort to find another mechanism to mitigate the level of fiscal procyclicality. They, therefore, should operate fiscal policy from the long-term perspective, and countercyclical fiscal policy measures should be accompanied by when it is needed[69].

First, policymakers should operate fiscal policy from the long-term perspective. Fiscal rules might be helpful to maintain a countercyclical fiscal policy (Manasse, 2006). One thing we should remember is that they should be designed in a way that induces fiscal policy into mid- and long-term perspective rather than short-term perspective[70]. The representative policy instrument to introduce fiscal rules might be the multi–year fiscal plan. OECD (2002) suggests in the Best Practices for Budget Transparency that governments should report the forecast of budget outcomes including the current year and at least the following two years. Second, countercyclical policy measures should be supplemented in the short-term. Rainy day funds could be helpful to operate fiscal policy in a countercyclical way. Hou (2006) shows that budget stabilization funds raised state spending during recessions by analysing a sample of 50 states in the USA. Raising the ratio of automatic stabilizers might be one of alternatives for successful fiscal policy (Eskesen, 2009; Carmignani, 2010). An automatic drop in government revenue or an automatic rise in government spending, such as social benefits, could alleviate procyclical behaviour. Finally, policymakers should make an effort to solve practical problems which arise in the process of fiscal policy making and budget execution. The most urgent problem might be to reduce the gap between budget plan and actual outcomes. Enhancing government's ability to forecast economic variables could make this gap smaller (He, 2003; Carmignani, 2010). Governments can also adjust their plans about revenue, spending, and borrowing during the fiscal year by introducing a mid-

69. Hou (2006, p.737) emphasizes that a multi-year budget without countercyclical fiscal policy measures is "an unreliable journey".

70. For example, Chile introduced structural surplus rule by the Fiscal Responsibility Law in 2006, and this concept reflects the medium-term fiscal outlook. The introduction of the structural balance rule enables the Chilean government to operate a countercyclical fiscal policy because fiscal rules reduce the fluctuation and uncertainty of the economy in terms of medium-term performance (Jorge Rodríguez, Carla Tokman, and Alejandra Vega, 2007).

term budget reviews to reduce this gap. The institutional arrangements, which could prevent forecasting from estimating optimistically due to political pressures, could make fiscal policy more countercyclical (Frankel, 2011b). Also, governments should reduce implementation time lags to respond to the business cycle in a more efficient way. For example, governments can respond to business cycle more timely and quickly by reducing the share of nonflexible spending items.

The contributions of this chapter are two folds. First, this chapter comfirms the results of recent literature on fiscal cyclicality that the fiscal policy of advanced countries has been procyclical at times[71]. The existing literature mainly focuses on the fiscal procyclicality of emerging market countries showing the fiscal policy of these countries tend to be procyclical, while that of developed countries not. However, this chapter focuses on analysing the cyclical properties of fiscal policy of OECD countries across spending categories [72] and shows that government consumption and investment of developed countries appear to be procyclical. Second, this chapter could provide the basis of research that could assess the effect of introducing fiscal rules more comprehensively by analysing the effect of the time coverage of fiscal rules for the first time. Previous studies analyse the effect of fiscal rules on fiscal policy without considering the type of fiscal rules, or they mainly focus on the theoretical explanation on the effect of fiscal rules without being sufficiently supported by empirical evidence. Our empirical findings suggest that the effect of fiscal rules on fiscal procyclicality could be different depending on the time coverage of fiscal rules. Therefore, our findings could imply that the existing studies about the effect of the SGP rules on fiscal cyclicality could be misleading since they do not differentiate the effect of national fiscal rules which each country adopted on their own initiative. The effect of the SGP rules will be lessened if one excludes the

71. Only a small number of studies suggest the possibility that fiscal policy of some developed countries is procyclical (see, for example, Lane, 2003; Manasse, 2006; Mackiewicz, 2008; Ilzetzki, 2009). Lane (2003) shows that government consumption and investment of some OECD countries appear to be procyclical. Manasse (2006) shows that fiscal policies of developed countries are procyclical in good times and more procyclical in developed countries than in developing countries. Mackiewicz (2008) shows that the fiscal policies of developed countries could be procyclical when it has weak institutions or a high debt-to-GDP ratio. Ilzetzki (2009) shows that government consumption and investment of high-income countries is procyclical.

72. Some literature focuses on the case of OECD countries. Lane (2003) analyses the data of 22 traditional members of OECD countries, Aghion and Marinescu (2007) analyse 19 OECD countries, Mackiewicz (2008) analyses 30 OECD countries and nine recently joined EU countries, and Huart (2011) analyses 20 OECD countries.

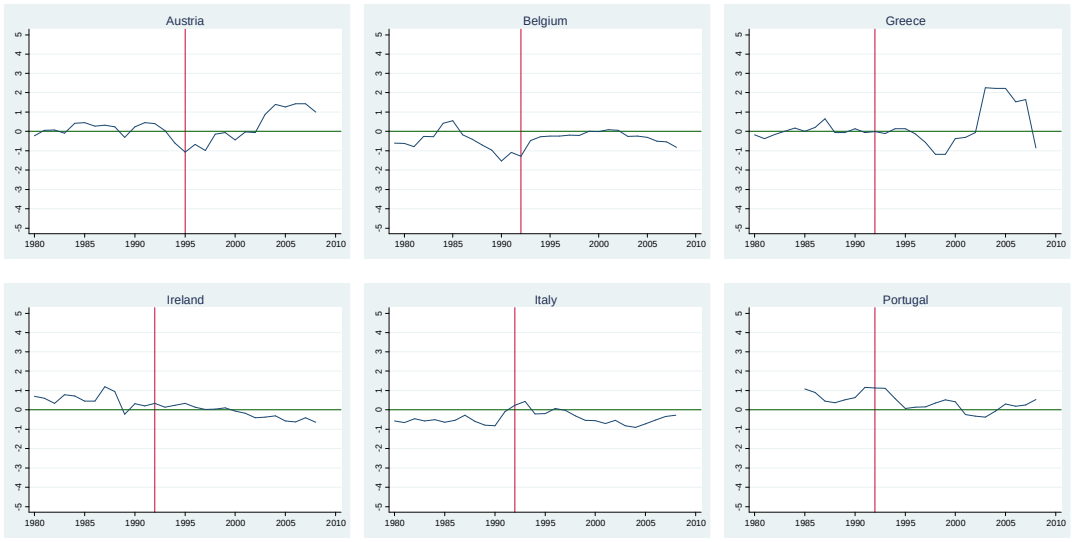
effect of national fiscal rules because national fiscal rules, which generally take multi-year fiscal rules, are more efficient than the SGP rules, which are annual fiscal rules, in stimulating countercylcical fiscal policy.

However, our analysis also has several limitations. First, the analysis in this chapter does not deal with other fiscal institutions beyond fiscal rules. A variety of other factors could be important in shaping fiscal policy. For example, the type of budget system and fiscal transparency might have an effect on fiscal stance. Forecasting ability and implementation time lags that we mentioned in section 2.1 could also play a key role in determining fiscal stance. However, these variables are not easy to define and measure, especially in developing and underdeveloped countries. Second, this chapter analyses only the case of OECD countries mainly due to the availability and reliability issues regarding fiscal data. Future research needs to extend samples to developing countries to explore whether the negative effect of multi-year fiscal rules on fiscal procyclicality also applies in emerging market countries where the quality of institutions may not be particularly high.

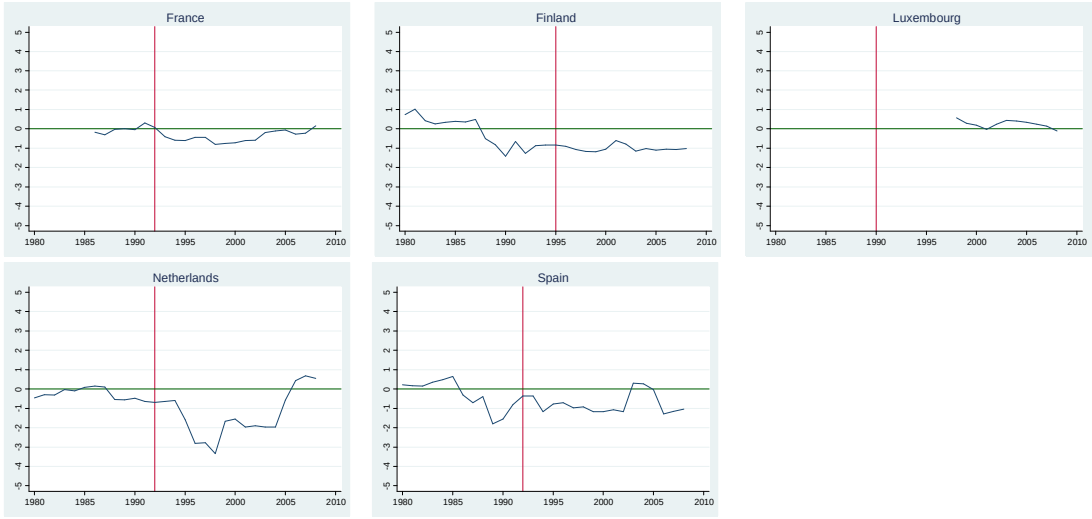
# Appendix 2

Graph 2A.1 The trend of fiscal procyclicality of total expenditure

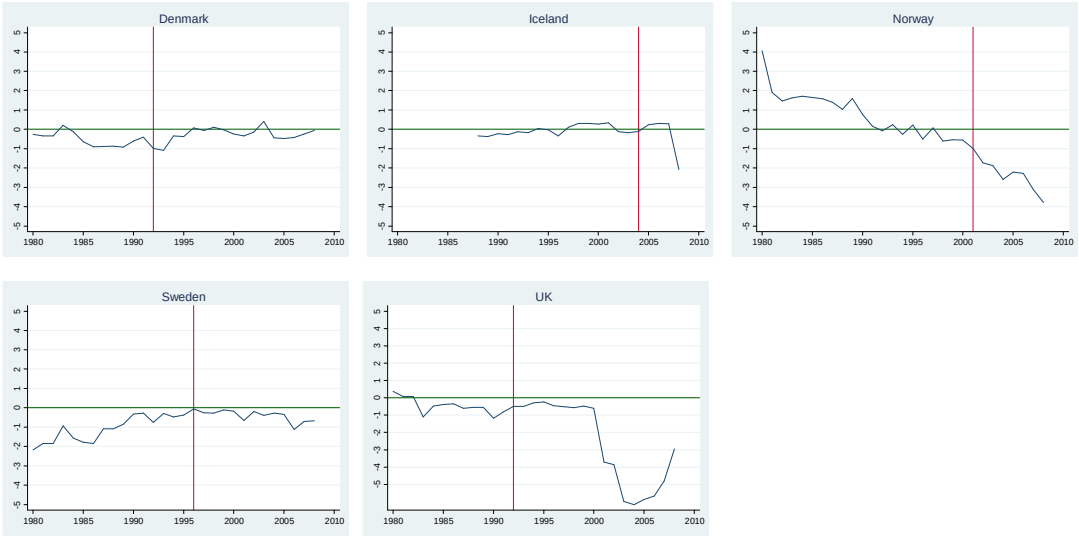
A. EMU countries – Annual fiscal rules




B. EMU countries – Multi-year fiscal rules



C. Other advanced European countries– Multi-year fiscal rules




D. Other advanced non-European countries

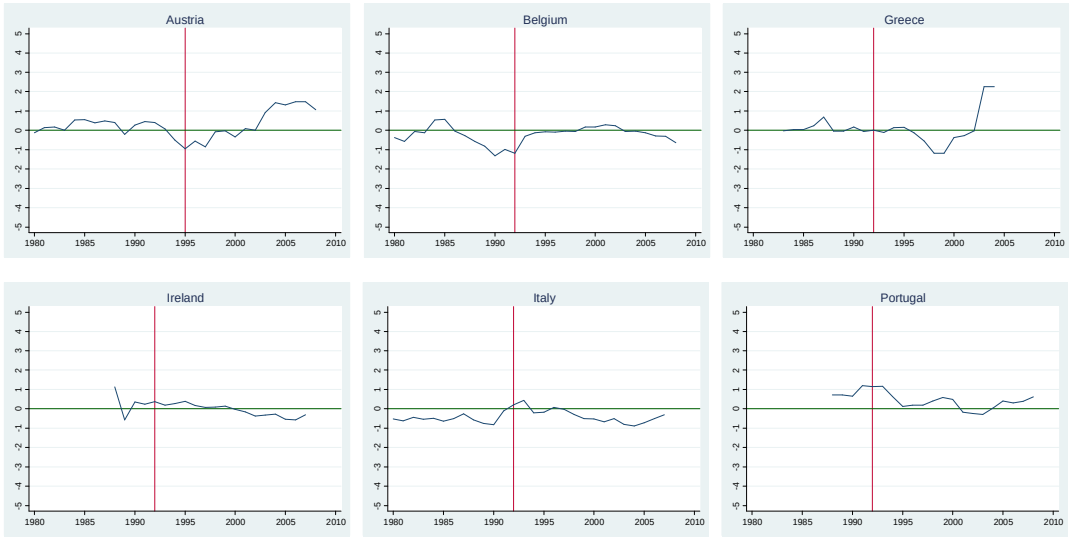
[ Multi-year fiscal rules ] [ Annual fiscal rules ]


[ No fiscal rules ]

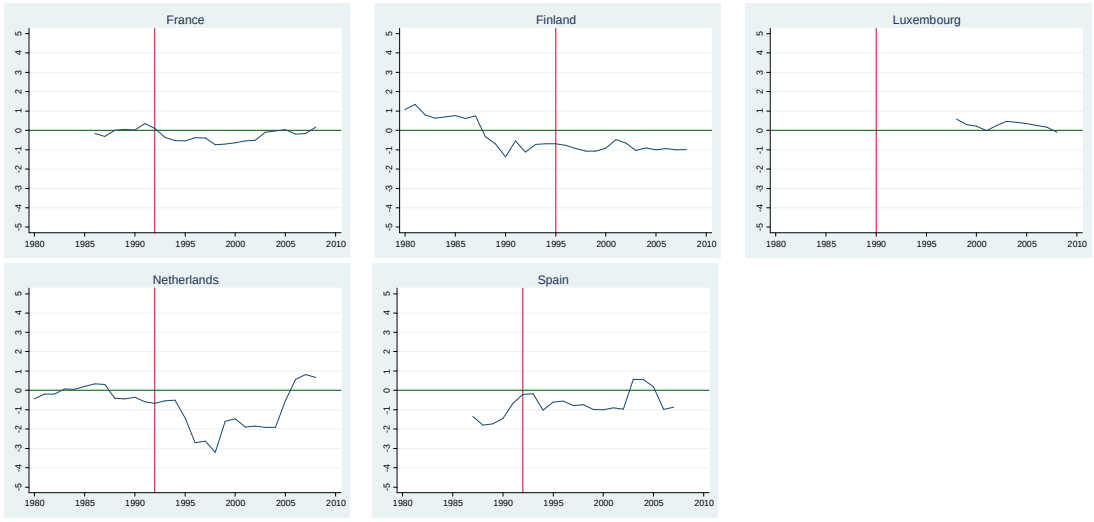

Note: The vertical line represents the year when fiscal rules were adopted. In case of EMU countries, it is the same as the year when the SGP rules were adopted.

Graph 2A.2 The trend of fiscal procyclicality of cyclically adjusted total expenditure

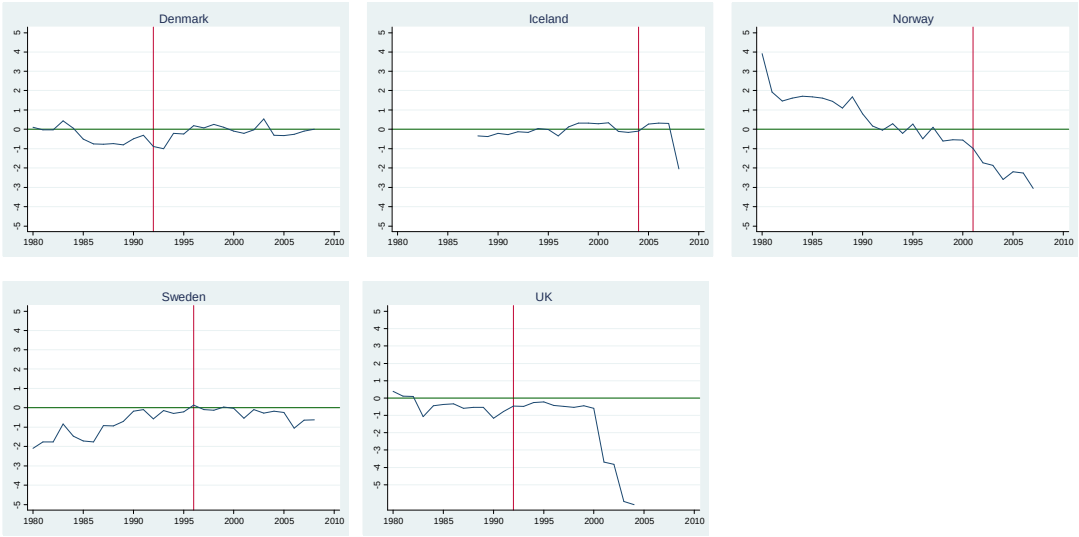
A. EMU countries – Annual fiscal rules




B. EMU countries – Multi-year fiscal rules



C. Other advanced European countries– Multi-year fiscal rules




D. Other advanced non-European countries

[ Multi-year fiscal rules ] [ Annual fiscal rules ]


[ No fiscal rules ]


Note: The vertical line represents the year when fiscal rules were adopted. In case of EMU countries, it is the same as the year when the SGP rules were adopted.

Table 2A.1 Comparison among the existing literature

| | Main reason for procyclicality | Regression equation | |
|---|---|---|---|
| | | Dependent variable | Independent variables |
| Gavin and Perotti (1997) | borrowing constraints | the change in the general government budget balance (spending, consumption) to GDP ratio | real GDP growth<br>percent change in terms of trade<br>lagged fiscal balance |
| Tornell and Lane (1999) | voracity effect | - | - |
| Arreaza, Sorensen, and Yosha (1999) | the design of fiscal institutions | - | - |
| Lane (2003) | output volatility, power dispersion | log government expenditure (total expenditure, consumption, investment) | Step 1: log GDP<br>Step 2 : output volatility, power dispersion index, per capita output, trade openness, public sector size |
| Kaminsky, Reinhart, and Végh (2004) | availability of international capital | To compare difference between government spending in good and bad times | |
| Riascoc and Végh (2004) | imperfect capital markets | Correlation of government consumption (total revenue, share of government consumption) with GDP | |
| Talvi and Végh (2005) | political distortion | Correlation of real government consumption with real GDP | |
| Manasse (2006) | different policy reaction | general government primary balance | output gap<br>total general government public debt<br>fiscal rules (dummy)<br>institutional variables |
| Aghion and Marinescu (2007) | low financial development, higher openness | real budget balance/GDP | GDP gap<br>financial development<br>average years of education over 25<br>openness<br>population growth<br>government share of GDP<br>invest share of GDP<br>inflation targeting (dummy) |
| Alesina, Campante, and Tabellini (2008) | corruption | change in central government budget surplus or government consumption | output gap<br>lag of central government budget surplus or government consumption<br>initial GDP per capita<br>corruption index<br>credit ratings<br>the spread of sovereign debt over the US debt |
| Ilzetzki and Végh (2008) | - | real central government spending or consumption | change in log real GDP |

| | | | |
|---|---|---|---|
| Mackiewicz (2008) | weak institutions, high debt ratio | log general government primary surplus / GDP | log output gap<br>institutional quality<br>political constraints<br>corruption<br>gini coefficient<br>level of development<br>openness of economy<br>public debt/GDP |
| Woo (2009) | social inequality, political instability | change in log real general government consumption | Step 1: change in log real GDP<br>Step 2: government size, income inequality, educational inequality, trade openness, multimensional aspect |
| Lledó, Yackovlev, and Gadenne (2009) | fiscal space, financing restriction | growth in real central government expenditures | real GDP growth<br>terms of trade growth<br>lagged growth in government spending<br>political institutions<br>financing restrictions<br>fiscal space<br>growth in oil price |
| Diallo (2009) | the existence of democratic institutions | real government total expenditure minus interest payments/<br>real government current expenditure | terms of trade shock<br>political rights index<br>civil liberty index<br>democratic institution index<br>presidential electoral dummy<br>lagged government expenditure |
| lzetzki (2011) | political friction | Correlation of HP-filtered cyclical components of total real central government expenditures or consumption with real GDP | |
| Frankel, Végh, and Vuletin (2011 ) | institutional quality | real government expenditure | foreign liabilities/GDP<br>liguid liabilities/GDP<br>output volatility<br>political check and balance<br>institutional quality |
| Çiçek and Elgin (2011) | the size of shadow economy | budget balance/GDP | Step 1: de-trended GDP<br>Step 2 : output volatility<br>financial development<br>financial risk<br>corruption<br>political stability<br>GDP per capita<br>level of democracy |
| Badinger (2012) | - | change in log real government consumption | change in log real GDP |

Table 2A.2 The correlation between government spending and GDP

| | All countries | Annual rules | Multi-year rules | No rules |
|---|---|---|---|---|
| Government consumption (CGAAV) | 0.255*** | 0.263*** | 0.184*** | 0.283*** |
| Interest payments (GGINTPV) | -0.054 | -0.173*** | -0.108** | 0.156 |
| Current transfers (TCTV) | 0.030 | 0.064 | -0.128*** | 0.141 |
| Current expenditure (YPGV) | 0.144*** | 0.112* | -0.001 | 0.299*** |
| Government Investment (IGAAV) | 0.177*** | 0.159*** | 0.153*** | 0.413*** |
| Total expenditure (YPGTV) | 0.126*** | 0.119** | -0.008 | 0.301*** |

Note : (1) All variables are expressed in the first difference of log real terms. The sample period is 1970–2008.
(2) * indicates significance at the 10% level. ** 5% level. *** 1% level.
Source: OECD Economic Outlook Database No.86.

Table 2A.3 The cyclical properties of fiscal policy of OECD countries with time fixed effects

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.292*** | -0.506** | -0.071 | 0.054 | 1.137*** | 0.100 |
| | (2.94) | (-2.35) | (-0.74) | (0.80) | (5.44) | (1.36) |
| $GDP_{t-1}$ | 0.212*** | 0.166 | 0.010 | 0.145** | 0.662** | 0.279*** |
| | (3.91) | (0.56) | (0.10) | (2.33) | (2.50) | (3.75) |
| $GDP_{t-2}$ | 0.128* | -0.993* | 0.148** | 0.096 | 0.119 | 0.134 |
| | (1.86) | (-1.80) | (2.18) | (1.61) | (0.44) | (1.50) |
| F - statistics (time) | 23.70*** | 45.65*** | 28.46*** | 125.46*** | 6.54*** | 23.35*** |
| $R^2$ | 0.319 | 0.314 | 0.206 | 0.352 | 0.109 | 0.255 |
| No.of Observations | 820 | 799 | 798 | 804 | 816 | 795 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Fixed effects model (FE) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
(4) F- statistics (time) tests the joint significance of time effects.
Source: OECD Economic Outlook Database No.86.

## Table 2A.4 The cyclical properties of fiscal policy of OECD countries (Output gap)

| Dependent Variable : primary budget balance | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $GAP_t$ | 0.515*** | 0.275** | 0.306** | 0.394*** |
| | (5.20) | (2.49) | (2.57) | (4.52) |
| $GAP_{t-1}$ | 0.096 | 0.253*** | 0.188*** | 0.215*** |
| | (1.68) | (5.09) | (3.24) | (3.76) |
| $GAP_{t-2}$ | -0.130* | -0.122* | -0.134 | -0.150* |
| | (-1.83) | (-1.73 ) | (-1.71) | (-2.01) |
| RULE* $GAP_t$ | | 58.493*** | | |
| | | (5.53) | | |
| Annul Rule* $GAP_t$ | | | 51.804*** | |
| | | | (3.04) | |
| Multi Rule* $GAP_t$ | | | | 58.198*** |
| | | | | (5.91) |
| F- Statistics | 32.29*** | 50.12*** | 24.63*** | 27.75*** |
| $R^2$ | 0.123 | 0.202 | 0.144 | 0.251 |
| No.of Observations | 718 | 718 | 561 | 575 |
| No.of Groups | 25 | 25 | 23 | 25 |

Note: (1) GAP is output gap and RULE is a dummy variable for fiscal rules. The sample period is 1970–2008.
(2) Regression methods are Fixed effects model (FE) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86 and IMF fiscal rules database (2009).

## Table 2A.5 The cyclical properties of fiscal policy of OECD countries (system GMM)

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.130** | -0.202 | -0.157 | -0.062 | 0.783*** | -0.049 |
| | (2.24) | (-0.88) | (-1.21) | (-1.42) | (3.58) | (-0.66) |
| $GDP_{t-1}$ | 0.272*** | 0.412** | 0.080 | 0.196*** | 0.649** | 0.295*** |
| | (3.97) | (2.20) | (0.91) | (2.71) | (2.28) | (3.33) |
| $GDP_{t-2}$ | 0.286*** | -0.681*** | 0.416*** | 0.239*** | 0.515** | 0.302*** |
| | (4.04) | (-3.21) | (5.06) | (4.56) | (2.57) | (4.84) |
| $dependent_{t-1}$ | 0.194*** | 0.453*** | 0.269*** | 0.405*** | -0.103 | 0.118** |
| | (3.55) | (10.08) | (4.93) | (9.60) | (-1.43) | (2.35) |
| Wald $chi^2$ | 280.28*** | 224.32*** | 84.78*** | 161.54*** | 121.08*** | 96.33*** |
| Hansen $chi^2$ | 22.10 | 12.54 | 24.11 | 21.20 | 18.94 | 23.34 |
| No.of Obs. | 816 | 793 | 792 | 799 | 811 | 788 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Generalised Method of Moments (GMM) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

## Table 2A.6 The cyclical properties of fiscal policy of OECD countries – FE 2SLS (Cyclically adjusted spending)

| Dependent Variable : Difference in log of real government spending | | | |
|---|---|---|---|
| | (1) Current Transfers | (2) Current Expenditure | (3) Total Expenditure |
| $GDP_t$ | -0.597*** | -0.521*** | -0.665*** |
| | (-2.84) | (-3.31) | (-3.29) |
| $GDP_{t-1}$ | 0.241** | 0.361*** | 0.538*** |
| | (2.03) | (4.07) | (4.72) |
| $GDP_{t-2}$ | 0.268*** | 0.222*** | 0.204*** |
| | (3.33) | (3.70) | (2.64) |
| F- Statistics | 610.51*** | 954.09*** | 545.45*** |
| $R^2$ | 0.020 | 0.031 | 0.029 |
| Hausman $chi^2$ | 5.35 | 11.24** | 10.76** |
| No.of Observations | 715 | 715 | 715 |
| No.of Groups | 24 | 24 | 24 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Fixed effects 2SLS Instrumental variables estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

## Table 2A.7 The cyclical properties of fiscal policy in 16 EU countries

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $GDP_t$ | 0.140 | -0.836*** | -0.226 | -0.127 | 1.004*** | -0.178* |
| | (1.50) | (-3.08) | (-1.59) | (-1.44) | (3.09) | (-1.82) |
| ** $GDP_t$ (OECD coutries) | 0.115 | -0.558** | -0.244** | -0.102 | 0.736*** | -0.104 |
| $GDP_{t-1}$ | 0.192*** | 0.071 | -0.046 | 0.069 | 0.400 | 0.171* |
| | (4.33) | (0.22) | (-0.48) | (0.97) | (1.14) | (1.95) |
| $GDP_{t-2}$ | 0.449*** | -0.666 | 0.353*** | 0.334*** | 0.442 | 0.333*** |
| | (5.93) | (-1.72) | (3.48) | (5.20) | (1.27) | (3.29) |
| F- Statistics | 34.45*** | 5.50*** | 4.20** | 9.75*** | 10.32*** | 8.54*** |
| $R^2$ | 0.178 | 0.032 | 0.058 | 0.097 | 0.060 | 0.080 |
| No.of Obs. | 509 | 507 | 507 | 509 | 509 | 503 |
| No.of Groups | 16 | 16 | 16 | 16 | 16 | 16 |

Note: (1) GDP is real gross domestic product. All variables are expressed in the first difference of the log real terms. The sample period is 1970–2008
(2) Regression methods are Fixed effects model (FE) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

# Chapter 3

# The main determinants of fiscal sustainability

# 1. Introduction

There is an increasing concern about the sustainability of fiscal finances which had been ignored since 1990s when fiscal sustainability temporarily improved[73] (Fatás, 2010). This is because unsustainable fiscal finances have become considered to be one of crucial factors which triggered economic crisis. A number of EU countries including Greece, Ireland, Italy, Portugal, and Spain[74] are suffering from economic crisis which were caused by fiscal crisis even though they have made an effort on reducing the level of government debt (Wren-Lewis, 2011).

In addition, the importance of fiscal policy as an economic policy tool has increased following the global financial crisis which started in 2007. Consequently, there is revival of interest in the effectiveness of countercyclical fiscal policy in the recent literature (Wren-Lewis, 2011; Feldstein, 2009; Auerbach, 2009)[75]. This is mainly because other economic policy tools such as monetary policy and exchange rate policy cannot be controlled any more by policymakers, especially in small open economies, as the global economy has become increasingly integrated and liberalized (Carmignani, 2010). Furthermore, monetary policy cannot be utilized as a stabilization tool in the EMU member countries since national monetary policy independence has been lost (Huart, 2011; Wren-Lewis, 2011). However, this discretionary fiscal policy is inevitably accompanied by the deterioration of fiscal sustainability (Escario, Gadea, and Sabaté, 2012; Padoan, 2009; Freedman, Kumhof, Laxton, Muir, and Mursula, 2009). As a result, whether the current fiscal finances are sustainable has been one of the most critical issues for policymakers because the answer indicates the scope of fiscal policy which can be utilized.

73. The government debt of EU countries had been declining owing to the efforts to abide by the Maastricht Treaty (Greiner, Köllert, and Semmler, 2007).

74. These countries belong to the PIIGS countries of which debt sustainability has been questioned due to the large deficit and debt (Fincke and Greiner, 2012).

75. Auerbach (2009) points out three main factors as the reasons for the effectiveness of countercyclical fiscal policy: the first is that the effect of automatic stabilizers have been weaken, the second is that Lucas's critique does not have any effect in imperfect markets, and the third is that monetary policy faces unusual challenges by being bounded by the zero-minimal interest rate.

Therefore, the issues on fiscal sustainability have been widely explored. The existing literature mainly focuses on the measurement of fiscal sustainability, but little is known about the determinants of fiscal sustainability as stated by Menguy (2008), even though these determinants could provide policy implications for the government to maintain their fiscal finances in a more sustainable way.

This chapter attempts to explore the main determinants of fiscal sustainability utilizing a sample of OECD countries. We identify these main determinants of fiscal sustainability by comprehensively surveying the existing theoretical and empirical literature, and examining the role of each factor in determining fiscal sustainability in our empirical analysis. We also explore the role of the Stability and Growth Pact (SGP) rules in determining fiscal sustainability in a sample of EMU countries. Our findings from empirical analyses point to a number of factors that play an important role in determining fiscal sustainability. The growth rate has a positive effect on fiscal sustainability while aging populations have a negative effect. The advanced countries are more likely to have sustainable fiscal finances. Our findings also show that the SGP rules appear to have helped policymakers maintain fiscal sustainability in EMU countries while other fiscal rules do not seem to play any role in the fiscal sustainability of OECD countries.

The remainder of this chapter is organized as follows: Section 2 provides a discussion on the theoretical issues on fiscal sustainability and the determinants of fiscal sustainability which are identified in the existing literature. Section 3 contains empirical analysis on the level of fiscal sustainability of OECD countries and the main determinants of fiscal sustainability. Finally, this chapter ends with some concluding remarks and policy implications.

# 2. The theoretical issues on fiscal sustainability

## 2.1. The concept and measurement of fiscal sustainability

There is a general consensus on the definition of fiscal sustainability in the existing literature although there are a few controversies[76]. Fiscal sustainability refers to the future implications of current fiscal policies, in other words, the question of whether the government can maintain its current fiscal policies in the future without endangering its solvency (Croce and Juan-Ramón, 2003). This policy might be either one in which the debt ratio does not increase (Tanner and Samake, 2008) or one in which the debt ratio increases when the dynamics of debt are under control (Pasinetti, 2000)[77].

Also, it is generally agreed that it is difficult to measure the level of fiscal sustainability. The existing literature has adopted two approaches. One approach performs sustainability tests based on the intertemporal government budget constraints, and the other approach focuses on a set of sustainability indicators. Studies utilizing the first approach, in turn, can be divided into three groups: studies using the stationarity of debt process, studies using the cointegration relationship between fiscal variables, and studies using the reaction function between the budget deficit and government debt.

The problem of fiscal sustainability could be interpreted as an investigation of the trend of the debt to GDP ratio considering the government budgetary constraint (see, for example, Fincke and Greiner, 2012; Byrne, Fiess and MacDonald, 2011; Stoian and Cámpeanu, 2010; Polito and Wickens, 2005; Bohn, 1998). Equation (3.1) specifies the evolution of the debt-GDP ratio.

$$d_t = g_t - t_t + (1 + r_t - \theta_t)d_{t-1} = -s_t + (1 + \gamma_t)d_{t-1} \qquad (3.1)$$

76. For example, Pasinetti (2000) and Harck (2000) debate on whether the concept of fiscal sustainability should require a desirable level of the final debt ratio.

77. Debt sustainability is considered to be the same concept as fiscal sustainability in a great deal of the existing literature.

in which $d_t$ is the debt-GDP ratio, $g_t$ is the expenditure exclusive of interest payments-GDP ratio, $t_t$ is the revenue-GDP ratio, $r_t$ is a real interest rate, and $\theta_t$ is the growth rate in GDP. Therefore, $s_t$ indicates the ratio of primary budget balance to GDP, and a discount rate $\gamma_t$ indicates the real interest rate minus growth rate. This equation shows that a certain amount of primary surplus is required to maintain the certain level of the debt-GDP ratio in dynamically efficient economy where the real interest rate is higher than the real growth rate. Equation (3.1) can be transformed as equation (3.2) by successive substitution.

$$d_t = \frac{1}{(1+\gamma)^n} E_t(d_{t+n}) + \sum_{i=1}^{n} \frac{E_t(s_{t+i})}{(1+\gamma)^i} \tag{3.2}$$

Early literature focused on testing the question of whether the current fiscal policy could satisfy an intertemporal budget constraint historically. It is generally agreed in much of the literature that the intertemporal budget constraint holds if the current government debt can be offset by the present value of primary surplus, as below equation (3.3) when the present-value real debt (the first part of RHS in equation (3.2)) should go to be zero in the limit[78]: in other words, an increase in the real debt-GDP ratio should be below an increase in the real interest rate (see, for example, Hamilton and Flavin, 1986; Bohn, 1998; Wilcox, 1989; Uctum and Wickens, 2000). Then, fiscal policy will be sustainable when the debt-GDP ratio can grow at the rate equal to the primary surplus-GDP ratio.

$$d_t = \sum_{i=1}^{n} \frac{E_t(s_{t+i})}{(1+\gamma)^i} \tag{3.3}$$

Some studies find that the intertemporal budget constraint holds if the debt process, which is correspondent with $d_t$ in equation (3.2), is stationary (Hamilton and Flavin, 1986; Wilcox, 1989; Uctum and Wickens, 2000). Others utilize the cointegration relation between fiscal variables such as government expenditure and revenue, and they show that the intertemporal budget constraint holds if fiscal variables are cointegrated (Trehan and Walsh, 1988; Hakkio and Rush, 1991; Ahmed and Rogers, 1995; Bravo and Silvestre, 2002). These early approaches have the

78. This condition is called 'the transversality condition'. Wilcox (1989) calls this the present-value budget constraint.

advantage in performing sustainability tests easily by the simple econometric model from a long-term perspective. However, these approaches assume economic environments as exogenous and constant (Berenger and Llorca, 2007), for example, a constant interest rate, so they have difficulty in providing appropriate policy implications responding to future changes in the policy environment such as aging populations and a change in interest rate. Also, the weak power of unit root tests might be another critical weakness when the stationarity of fiscal variables are tested[79].

Bohn (1998, 2005, 2007) [80] utilizes the reaction function between budget deficit and government debt to overcome the weaknesses of earlier studies. The author examines how governments respond to an increase in government debt. According to his framework, the primary budget balance is a function of government debt. Equation (3.1) can be rearranged to equation (3.4) assuming $d_t = d_{t-1}$ in the long run (Byrne, Fiess, and MacDonald, 2011).

$$s_t = \gamma_t \, d_{t-1} \tag{3.4}$$

Bohn (1998, 2005, 2007) provide direct evidence on the corrective actions by examining the response of the primary budget balance to changes in the debt-GDP ratio after removing the effect of temporary increases in government expenditure (GVAR) and temporary variations in the business cycle (YVAR), using the US data by estimating equation (3.5).

$$s_t = \alpha + \beta d_{t-1} + \gamma GVAR_t + \lambda \, YVAR_t + u_t \tag{3.5}$$

If the debt-GDP ratio increases, then the government would raise primary budget surpluses to respond to debt accumulation and to satisfy the intertemporal budget constraint. The main strength of this approach is that it does not require any assumption about the discount rate, and therefore one can rule out the misleading results which are caused by an inadequate choice of the discount rate. However, this

79. The use of too many lags, compared to genuine lags, leads to lack of power while the use of too few lags results in the incorrect size of test (Wooldridge, 2006).

80. A large number of studies have employed Bohn's response function to explore fiscal sustainability (see, for example, Fincke and Greiner, 2012; Fincke and Greiner, 2011; Stoian and Cámpeanu, 2010; Berenger and Llorca, 2007; Greiner, Köllert and Semmler, 2007; Redžepagić and Llorca, 2007; Valderrama, 2005).

approach focuses on the long-term relationship between deficit and debt, and therefore it still has a drawback in providing short-term policy implications.

The second approach focuses on finding appropriate sustainability indicators (see, for example, Buiter, 1985; Blanchard, 1990; Uctum and Wickens, 2000; Croce and Juan-Ramón, 2003; Polito and Wickens, 2005). They derive fiscal sustainability indicators which could testify whether the current fiscal policy will be sustainable in the future. They consider the budget deficit to be sustainable if the debt-GDP ratio is maintained at a certain target level, and they measure how much deficit is deviated from the sustainable deficit. These indicators are simple and transparent, and therefore they could clearly provide the guideline for fiscal policy to both policymakers and taxpayers, but it is difficult to find an optimal debt level (Wyplosz, 2005) or to achieve consensus about the target level of debt. This problem might be more serious in emerging market countries because they tend to give priority to short-term economic growth and the expansion of a social safety net instead of long-term fiscal sustainability.

## 2.2. The main determinants of fiscal sustainability

As mentioned above, there does not appear to be any directly comparable literature on the determinants of fiscal sustainability, although there is increasing interest about fiscal sustainability. The existing literature mainly attempts to find out the effect of specific factors on fiscal sustainability, but it generally analyses the effect of individual factors on the budget balance or debt rather than fiscal sustainability *per se*. Some studies focus on the main factors underlying successful fiscal consolidation, but they do not deal with the determinants of fiscal sustainability *per se*. This section examines the main determinants of fiscal sustainability from the existing theoretical and empirical literature in three groups: budget and borrowing constraints, political constraints, and fiscal institutions.

## 2.2.1. Budget and borrowing constraints

A number of studies examine the relationship between some economic variables and fiscal sustainability through intertemporal government budget constraints, an overlapping generations model, and borrowing constraints.

This literature is based on the premise that the condition of fiscal sustainability is to satisfy the intertemporal government budget constraint (equation (3.3)). Hall and Sargent (2010) show that the growth rate and interest payments could play a crucial role in determining the level of sustainable debt. They examine the contributions of these factors on the evolution of the debt-GDP ratio by analysing the US data after the Second World War, and show that interest payments have had more effect than growth rates since the 1970s. Menguy (2008) argues that the discrepancy between growth rates and interest rates has an important role in determining fiscal sustainability, even though the forecast of these future variables is difficult[81]. Sakuragawa and Hosono (2011) argue that growth rates could have a crucial effect on the fiscal sustainability. They show that a higher projected growth rate contributes to stabilize the debt-GDP ratio in the future by conducting the simulation of fiscal sustainability of Japan. Aspromourgos, Rees, and White (2010) present a theoretical explanation on the role of the interest rate. They show that nominal interest rates paid on debt and nominal growth rates have a crucial role in determining the size of the sustainable budget balance[82], and that low interest rates will help the government obtain a sustainable budget balance more easily by introducing the fact that monetary policy could choose interest rate. Fullwiler (2007) also argues that the interest rate could play an important role in determining fiscal sustainability through examining the US case. The author argues that interest rates on national debt are a matter of monetary policy, mostly affected by the current and expected interest rates set by the Federal Reserve Board, rather than fiscal policy. Therefore, the author suggests that monetary policy, which is operated through adjusting the interest rate, has much to do with fiscal sustainability.

81. The author, therefore, suggests a new deficit rule combining the growth rate and debt to consider the long-term sustainability of fiscal finances and different situation of countries to overcome the problem of the SGP rules which focused on short-term deficit criterion.

82. sustainable budget balance $_{t+1} = \frac{\text{interest rate} - \text{growth rate}}{1+\text{growth rate}} * \text{debt}_t$

A number of studies examine fiscal sustainability within a general equilibrium framework using an overlapping generations model. For example, Chalk (2000) employs an overlapping generations model and identifies three factors - the gap between growth rate and interest rate, the size of primary deficit, and initial debt - as determinants of fiscal sustainability. They argue that initial public debt above a critical level may harm the sustainability of a fiscal program even though the growth rate exceeds the interest rate. Yakita (2008) examines the effect of public capital formation on the sustainability of debt by also employing an overlapping generations model. The author argues that initial debt which is smaller than the threshold of initial debt for a given stock of public capital could lead to a sustainable fiscal policy. The author argues that this initial debt threshold is positively related to the stock of public capital, which implies that the countries which have a large stock of public capital could maintain high debt levels[83].

Other studies point to borrowing constraints, which is linked to the accessibility to capital markets, as a potential determinant of fiscal sustainability in emerging market countries. Byrne, Fiess, and MacDonald (2011) explore the effect of global capital market's shock on fiscal sustainability by analysing a sample of 15 industrial countries and 27 emerging market countries empirically. They show that the US interest rate, which is a proxy for the liquidity in global credit markets, and fiscal sustainability are closely associated in emerging market countries because they finance debt from the international capital market. This result indicates that credit constraints in global markets could be one of main determinants of fiscal sustainability for emerging market countries. Hauner and Kumar (2005) argue that the easier capital market access through the recent financial globalization could help strengthen fiscal sustainability in emerging market countries by reducing the cost of external financing by showing that the fiscal savings due to the deepening of financial globalization has increased over recent years in emerging market countries. Drelichman and Voth (2008) explore the role of fiscal repression accompanied by low interest rates by examining the case of 18$^{th}$ century Britain and 16$^{th}$ century Spain. They argue that common sustainability tests cannot establish the real features of fiscal sustainability, and suggest that the accessibility to domestic savings by a

83. The author argues that a low public investment ratio and deficit finance rate for public investment could strengthen fiscal sustainability by raising the threshold.

low cost of borrowing is the main reason for sustainable fiscal finances of 18th century Britain. Izquierdo (2002) argues that sudden stops in capital flows could worsen fiscal sustainability due to a rise in the interest rate and a fall in growth rate, as was in the case of Argentina.

A separate line of research considers the role of population aging on the sustainability of fiscal finances. Faruqee and Mühleisen (2003) assess the effect of demographic changes on Japan's public finances. They argue that population aging causes slow economic growth and high debt, and therefore they suggest that further fiscal adjustments are needed in the pension and health systems to make fiscal finances sustainable. European Commission (2009) also emphasizes the role of population aging in the Sustainability Report 2009. It argues that aging populations have an effect on the labour market and economic growth, and will increase ageing-related expenditure. It calculates the sustainability indicator considering infinite horizon to include the concern about additional expenditure arising from ageing populations, and it shows that all EU countries should implement reforms endangering the risk of the budgetary challenge over the long-term. Greiner, Köllert, and Semmler (2007) include social surplus ratios[84] into Bohn's (1998) response function to assess the effect of a social insurance system on fiscal sustainability of four European countries. They point out that fast population aging should be considered not to misinterpret the result of sustainability tests.

### 2.2.2. Political constraints

Political constraints could also have important implications for fiscal sustainability. Berenger and Llorca (2007), and Redžepagić and Llorca (2007) examine the role of political determinants of fiscal sustainability by employing political factors, such as the electoral budget cycle, the partisan cycle, and government fragmentation, into Bohn's (1998) reaction function. Berenger and Llorca (2007) analyse the USA and five European countries (the UK, Germany, Greece, France, and Italy), and they show that the fiscal policy of all countries

84. Social surplus is defined as social benefit paid by the government net of social security contribution received by the government.

except Germany is sustainable and that the electoral and partisan cycle affect fiscal policy in the Mediterranean countries (France, Greece, Italy). Redžepagić and Llorca (2007) analyse seven Central and Eastern European Countries (Czech Republic, Estonia, Latvia, Lithuania, Poland, Slovenia and Slovakia) and show the presence of a budget electoral cycle and a partisan cycle in Poland which is a comparatively big country. However, they analyse the effect of these variables on the primary budget balance, not fiscal sustainability *per se*.

Kontopoulos and Perotti (1999) argue that government fragmentation could play a key role in determining fiscal outcomes. They show that the higher number of decision makers in the fiscal policy making process, such as the number of parties in a coalition government and the number of spending ministers, could result in higher expenditure and a higher deficit, utilizing a sample of 20 OECD countries for the period 1960-1995.

### 2.2.3. Fiscal institutions - Fiscal rules

The existing literature generally shows that better fiscal institutions are positively associated with fiscal sustainability. Fatás (2010) summarizes the empirical evidence on the role of fiscal institutions on fiscal outcomes[85]. The author reports that fiscal rules are generally positively associated with fiscal sustainability by producing a less volatile fiscal policy. Rose (2010) synthesizes a variety of the existing studies on the relationship between fiscal institutions and fiscal sustainability in the US state governments. The author summarizes the empirical effect of various fiscal rules such as balanced budget rules, debt limits, tax and expenditure limits on the fiscal sustainability of the US state governments, and shows that fiscal rules seem to be effective in improving fiscal sustainability by leading to a lower deficit, lower debt, lower borrowing costs, rapid adjustment to fiscal shocks, and less political distortion on budget. Bi and Leeper (2010) argue that the adoption of fiscal rules such as an expenditure ceiling could raise the

85. The author identifies transparency, the role of legislature, and the degree of centralization of the budget processes as an example of the budget processes and institutions. The author suggests fiscal rules as a narrower set of institutions.

economy's maximum sustainable debt and reduce the risk premium of sovereign debt. They analyse the fiscal data of Sweden for the period 1980-2007 by simulating the economic consequence of different fiscal policies through a policy experiment based on a dynamic stochastic general equilibrium model. OECD (2002) suggests that well-designed fiscal rules could help attain a sustainable fiscal position even though their effect has become weakened since latter part of the 1990s because they did not respond adequately to unpredicted unfavourable fiscal situations and political pressures, especially in booms. On the other hand, Debrun and Kumar (2008) argue that this positive effect of fiscal rules could be elusive. They show that fiscal rules could be used as an important commitment tool for the improvement of fiscal performance in some countries while they do not seem to play any role in other countries by analysing a sample of 15 EU countries[86].

Fiscal rules have also been considered as a main determinant of successful fiscal consolidation which is identified as one of the policy tools to improve fiscal sustainability **(**IMF, 2009). Guichard, Kennedy, Wurzel, and André (2007) explore key determinants of the different dimensions[87]of fiscal consolidation episodes by analysing 85 fiscal consolidation episodes of OECD countries since the late 1970s. They show that fiscal rules are positively associated with a successful fiscal consolidation, in other words, the existence of fiscal rules is associated with larger and longer fiscal adjustments, and higher success rates. European Commission (2007) and Larch and Turrini (2008) also examine the determinants of successful fiscal consolidation by analysing episodes of 27 EU countries since 1970. They provide the empirical evidence that the coverage and strength of fiscal rules are positively associated with the possibility of starting and success of fiscal consolidation.

86. Debrun and Kumar (2008, p.500) even argue that the introduction of fiscal rules could bring about the incentive that governments circumvent their genuine fiscal status by creating off-budget account ("Smokescreen hypothesis").
87. Three dimensions are the size and intensity of adjustment, the duration of the episode, and the probability of success.

## 3. Empirical analysis

This chapter focuses on analysing the main determinants of fiscal sustainability. We examine the role of each factor, which we identified as a potential determinant in section 2.2, in determining fiscal sustainability utilizing a panel data model. We also explore the role of the Stability and Growth Pact (SGP) rules in determining fiscal sustainability in a sample of EMU countries, and examine fiscal sustainability utilizing a net debt variable to check the robustness.

## 3.1. Data description

The sample consists of 26 OECD countries, and we employ annual data for the period 1970–2008[88]. Four OECD countries (Czech Republic, Hungary, Mexico, and Turkey) are excluded due to the unavailability of uninterrupted data series we employ for these countries.

With regard to the data for the main variables, the primary budget balance-GDP ratio ($s_t$) and the debt-GDP ratio ($d_t$) are taken from OECD Economic Outlook No.86, and the temporary increase in government expenditure (GVAR) and the temporary variation in the business cycle (YVAR) are calculated following Bohn (1998) as will be seen in section 3.2.

With regard to the control variables, this chapter assesses the role of three groups of variables in determining fiscal sustainability. Eleven main variables are employed following the existing literature both theoretical and empirical.

First, to examine the role of budget and borrowing constraints, we introduce nine economic variables: the growth rate, the interest rate, the gap between growth rate and interest rate, trade openness, initial debt, average debt, the average primary balance, income per capita, and the old-age dependency ratio.

88. The estimation period is different across countries due to the availability of debt statistics (see Appendix 3. Table 3A.1).

The growth rate (GROWTH), the interest rate (IRL), and the gap between growth rate and interest rate (GAP) are included to assess the effect of budget constraints following the argument of Sakuragawa and Hosono (2011), Aspromourgos, Rees, and White (2010), Hall and Sargent (2010), Menguy (2008), Fullwiler (2007), and Chalk (2000). These variables are all nominal and are taken from OECD Economic Outlook database No.86. With regard to the interest rate, the long-term interest rate which is generally represented by 10-year government bonds is utilized.

Trade openness (OPEN) is included to assess the effect of borrowing constraints following Byrne, Fiess, and MacDonald (2011), Hauner and Kumar (2005), and Drelichman and Voth (2008). This variable is commonly utilized as a proxy for the accessibility to the capital market in several papers in the literature concerned with fiscal procyclicality (Lane, 2003; Aghion and Marinescu, 2007; Mackiewicz, 2008; Woo, 2009). This variable is taken from the Penn World Tables 6.3 and is defined as the sum of exports and imports over GDP.

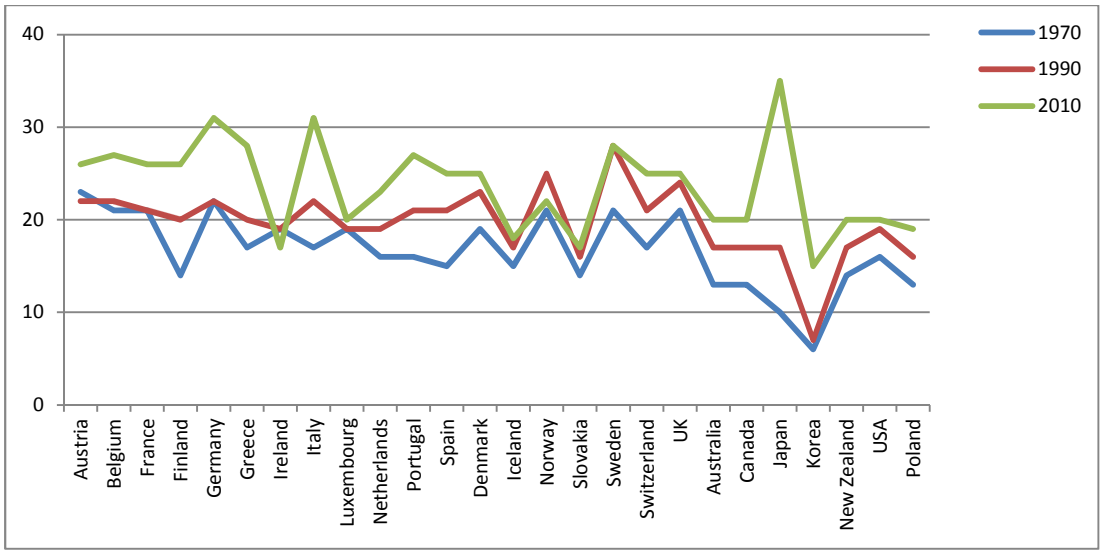
Initial debt (INIDEBT), average debt (AVEDEBT), and the average primary balance (AVEBANANCE) are included to assess the effect of fiscal space following Chalk (2000) and Yakita (2008). These variables are taken from the OECD Economic Outlook database No.86 and are defined as the ratio relative to GDP.

Income per capita (GDPPC) is included to assess the effect of the stock of public capital following Yakita (2008). This variable is commonly utilized as a proxy for the level of development which is the result of the accumulation of public capital. This variable is in PPP (Purchasing Power Parity) terms taken from the Penn World Tables 6.3 and is defined as the log of GDP per capita.

The old-age dependency ratio (OLD) is included to assess whether aging populations have an effect on fiscal sustainability following the suggestion of Faruqee and Mühleisen (2003) and European Commission (2009) and is taken from World Population Prospects (The 2010 revision). This ratio is defined as the ratio of elderly (65 years old or over) relative to the working age population (15–64 years old). One can see from Graph 3.1 that this variable shows a steep increase in most OECD countries except some countries (Luxembourg, Iceland, Ireland, Norway,

Slovakia, the UK, and the USA) which show less than a 5% increase. The average of the old-age dependency ratio in 26 OECD countries moved from 16.65% in 1970 to 23.69% in 2010.

Graph 3.1 The trend of the old-age dependency ratio




Note: The old-age dependency ratio is defined as the ratio of elderly (65 years old or over) relative to the working age population (15–64 years old). The average is 16.65% (1970) → 19.69% (1990) → 23.69% (2010).
Source : World Population Prospects (The 2010 revision).

Second, one political variable is included to find out the role of political constraints. Power dispersion index (POLCON)[89] is included to explore the effect of government fragmentation and is taken from Henisz database (2010). The existing literature on the political budgetary cycle theory generally shows that budgetary performances are affected by electoral cycles and government fragmentation (Berenger and Llorca, 2007). However, the electoral cycle could have an effect on the budget deficit cycle rather than fiscal sustainability, and therefore we include political power dispersion index to assess the government fragmentation[90].

89. This index measures political power dispersion by considering the number of independent branches of government with veto power over policy change, and the distribution of preference across branches of government and within each legislative branch. It measures the dispersion of political power range from zero when it is most concentrated to one when it is most disperse.

90. Several groups' participating in the fiscal policy decision-making process gives rise to fragmentation (Kontopoulos and Perotti, 1999). Therefore, fragmentation of the government can be assessed by the level of dispersion of power that controls the executive and the legislative. Berenger and Llorca (2007) employ a dummy for government coalition to measure this variable. Kontopoulos and Perotti (1999) employ the number of decision makers such as the number of parties in coalition government and the number of spending ministers.

Finally, a dummy variable for fiscal rules (RULE) is included to assess the effect of introducing fiscal rules following the argument of Fatás (2010), Rose (2010), and OECD (2002), and it is taken from IMF fiscal rules database (2009). All OECD countries except three (Korea, Turkey, and the USA) have adopted various types of fiscal rules. The summary statistics of variables are explained in Table 3.1.

Table 3.1 Summary statistics of variables

| | No. of countries | No. of observations | Mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|---|
| $s_t$ | 26 | 683 | 0. 397% | 3.355 | -14.069 | 16.135 |
| $d_t$ | 26 | 680 | 57.864% | 29.476 | 4.980 | 175.274 |
| GROWTH | 26 | 667 | 7.838% | 5.178 | -4.388 | 37.727 |
| IRL | 26 | 664 | 7.731% | 3.382 | 1.003 | 21.725 |
| GAP | 26 | 653 | -0.242% | 3.976 | -16.099 | 16.871 |
| INIDEBT | 26 | 680 | 42.270% | 20.669 | 8.742 | 101.101 |
| AVEDEBT | 26 | 680 | 57.864% | 22.848 | 9.175 | 107.918 |
| AVEBALANCE | 26 | 680 | 0.395% | 1.659 | -4.375 | 4.151 |
| GDPPC | 26 | 669 | $24,524 | 8,589 | 4,066 | 71,209 |
| OPEN | 26 | 669 | 61.346 | 41.162 | 10.193 | 289.095 |
| OLD | 26 | 680 | 20.176% | 4.575 | 6 | 30 |
| POLCON | 26 | 669 | 0.480 | 0.093 | 0.152 | 0.718 |
| RULE | 26 | 680 | 0.417 | 0.493 | 0 | 1 |

Note: $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between the growth rate and interest rate, OPEN is trade openness, INIDEBT is initial debt, AVEDEBT is average debt, AVEBANANCE is the average primary balance, GDPPC is income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, UN World Population Prospects (The 2010 revision), Henisz database (2010), and IMF fiscal rules database (2009).

## 3.2. Empirical methodology

This chapter employs the panel data model as the baseline analysis. We utilize the similar method which has been employed in the literature concerned with the analysis of fiscal procyclicality (see, for example, Alesina, Campante and Tabellini, 2008; Mackiewicz, 2008; Lledó, Yackovlev and Gadenne, 2009; Diallo, 2009). The level of fiscal sustainability is estimated individually and collectively using both a time series and a panel data model, and then the determinants will be explored using a panel data model.

At first, in order to obtain measures of fiscal sustainability both individually and collectively, we estimate country-by-country regressions of the form (3.6) and the panel data model of the form (3.7) on the basis of Bohn's model (1998).

$$s_{it} = \alpha_i + \beta_i d_{i,t-1} + \gamma_i GVAR_{it} + \lambda_i YVAR_{it} + \theta_i s_{i,t-1} + u_{it} \quad (3.6)$$

$$s_{it} = \alpha_i + \beta\, d_{i,t-1} + \gamma\, GVAR_{it} + \lambda\, YVAR_{it} + \theta\, s_{i,t-1} + u_{it} \quad (3.7)$$

in which $s_{it}$ is the primary budget balance-GDP ratio and $d_{it}$ is the debt-GDP ratio. If β is positive, then government responds to an increase in debt by raising the primary budget surplus, which indicates that the government is maintaining a sustainable fiscal policy. We additionally include the lagged primary budget balance-GDP ratio ($s_{i,t-1}$) into Bohn's original model (equation (3.5)) to take into account the inertial process of fiscal policy.

Bohn (1998, 2005, 2007) introduce two non-debt determinants, which are taken from Barro (1986), into the regression equation to exclude the effect of outliers. GVAR is temporary government expenditure, such as unusual expenditure by war, which is constructed by dividing the deviation of real government expenditure net of interest payments (G) from its trend (G*) by real GDP ((G–G*)/GDP). YVAR accounts for the fluctuations in revenues due to the proportional short fall of output, which is constructed by multiplying the deviation of real GDP and its trend (1-GDP/GDP*) by the trend of government expenditure relative to real GDP (G*/GDP)[91]. Two variables are expected to be negatively related to the primary budget balance-GDP ratio.

Secondly, to find out the determinants of fiscal sustainability, this chapter estimates the panel data model in the regression of the form:

$$s_{it} = \alpha_i + \beta d_{i,t-1} + \gamma GVAR_{it} + \lambda YVAR_{it} + \theta\, s_{i,t-1} + \sum_{j=1}^{n} \delta_j Z_{it} \times d_{i,t-1} + u_{it} \quad (3.8)$$

in which $Z_{it}$ is a set of control variables. We employ Bohn's equation (3.5) by including several control variables: the growth rate (GROWTH), the interest rate (IRL), the gap between growth rate and interest rate (GAP), trade openness (OPEN),

91. The trends of variables are calculated using the Hodrick-Prescott filtering.

initial debt (INIDEBT), average debt (AVEDEBT), the average primary balance (AVEBALANCE), income per capita (GDPPC), the old-age dependency ratio (OLD), the political power dispersion (POLCON), and the dummy variable for fiscal rules (RULE). All variables are included as the form of interaction variables to estimate the effect of these variables on fiscal sustainability. The coefficient of interaction term measures the change in the coefficient β when each control variable changes by one unit (Preacher, 2003). In other words, it indicates the effect of each control variable on the level of fiscal sustainability.

## 3.3. Estimation results

### 3.3.1. Baseline analysis

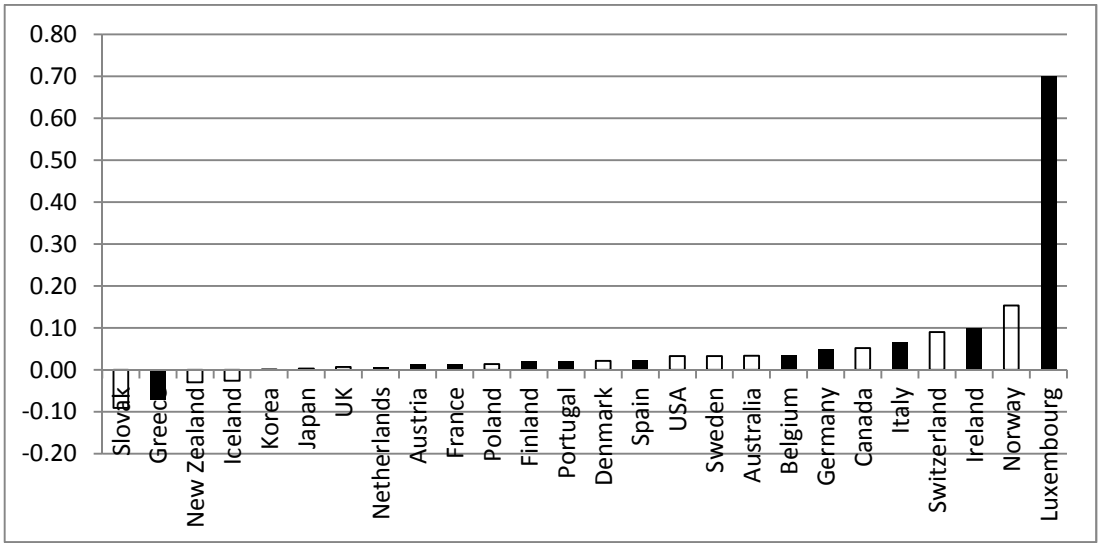
This section presents the estimates of fiscal sustainability indicators in 26 OECD countries both individually and collectively using Bohn's (1998) model. We then examine the trend of fiscal sustainability using recursive estimation and rolling window estimation. Finally, we attempt to uncover the main factors which play an important role in determining fiscal sustainability using panel data of OECD countries.

#### (1) The fiscal sustainability of OECD countries

Table 3.2 and Graph 3.2 present the level of fiscal sustainability of 26 OECD countries for the period 1970-2008. The results show that the coefficients of the debt-GDP ratio are generally positive in most OECD countries even though it is insignificant in many countries. This indicates that most OECD countries have responded to an increase in the debt-GDP ratio by raising the primary balance-GDP ratio, with the exception of some countries. These results could be interpreted that

the fiscal finances of most OECD countries is sustainable for the period which we estimated, while some countries which are suffering from fiscal crisis (such as Greece, Iceland, New Zealand, and Slovakia) seem to have operated fiscal policy in a unsustainable way. OECD countries have responded to one percentage point increase in the debt-GDP ratio by increasing the primary balance-GDP ratio by 0.05 percentage points on average. When one compares the level of sustainability across the group of countries, all three groups show similar levels of sustainability on average[92]. These results are consistent with the current fiscal situation of each country and the existing empirical evidence (see, for example, Fincke and Greiner, 2012; Fincke and Greiner, 2011; Greiner, Köllert, and Semmler, 2007)[93].

Graph 3.2 The fiscal sustainability of OECD countries across countries




Note: (1) Black bars are EMU countries and white bars are not.
(2) The height of bar graphs represents the coefficients of debt-GDP ratio in the regression equation (3.6).
(3) The average of coefficients is 0.05.
(4) The average debt-GDP ratio for the period 1995-2005 of Luxembourg was the smallest (9.2%) in the OECD countries, but the average primary budget balance was 1.49% during that period.

92. The average coefficient of the debt-GDP ratio of EMU countries is 0.02 when Luxembourg is excluded.
93. Fincke and Greiner (2012) explore the fiscal sustainability of six EMU countries (Austria, France, Germany, Italy, Netherlands, and Portugal) for the period from the early 1970s to the late 2000s, and they show that all countries have been maintaining sustainable fiscal finances. Fincke and Greiner (2011) examine the fiscal sustainability of seven EMU countries (France, Germany, Greece, Ireland, Italy, Portugal, and Spain) for the period from mid-1970s to late 2000s, and they show that all countries except Greece have been maintaining sustainable fiscal finances. Greiner, Köllert, and Semmler (2007) explore the fiscal sustainability of four EMU countries (Italy, France, Germany, and Portugal) which have either a high debt-GDP ratio or budget deficit, and they show that the fiscal policy for the above countries has been sustainable although recently the budget deficit has been violating the three percent rule of the Maastricht Treaty.

When the same regressions are run by a reweighted least squares (RWLS) procedure[94] to reduce the effect of outliers, the results confirms our baseline analysis of Table 3.2. Appendix 3. Table 3A.2 shows that there is a large degree of similarity between the baseline estimations and robust estimations, which confirms that our baseline estimations are generally not affected by the outliers although it employs OLS estimation[95]. The sign and size of coefficients of the debt-GDP ratio is generally consistent with our baseline estimations in most countries except Iceland.

GVAR variables are generally negatively associated with the primary balance-GDP ratio in almost all countries. A one unit increase in GVAR, namely a one percentage point increase in the temporary expenditure-GDP ratio, reduces the primary budget balance-GDP ratio by approximately 1.2 percentage points on average. This result implies that the primary budget balance could worsen more than the proportional increase in the temporary government expenditure. YVAR variables also show a negative effect on the primary balance-GDP ratio even though the significance of coefficient is low in many countries. A one unit increase in YVAR, namely a one percentage point decreae in the revenue-GDP ratio due to the propotional short fall of output, reduces the primary budget balance-GDP ratio by about 0.8 percentage points on average. This result implies that the change in the primary budget balance is smaller than the change in government revenue due to business cycle fluctuations. These results are consistent with theory and the existing empirical literature[96].

94. At first, outliers are dropped out of samples, and then weight is given to each observation. The observations with small residuals get a weight of one, and observations with large residuals are down-weighted (Stata Data Analysis Examples, 2012)

95. Only four countries have outliers in robust estimations. Number of outliers is three in Ireland and one in Iceland, Portugal, and Spain. The results also show that the existence of outliers does not have any effect on estimation result in three countries (Ireland, Portugal and Spain) while the coefficient of the debt-GDP ratio of Iceland moves from negative to positive although it is not significant.

96. Some of the literature shows that the results could be different depending on the types of countries. Byrne, Fiess, and MacDonald (2011) show that GVAR and YVAR are not significant in emerging market countries, while Mendoza and Ostry (2007) show that GVAR and YVAR are significant in both industrial countries and emerging markets, although the size of the effect is greatly reduced for emerging market countries.

Table 3.2 The fiscal sustainability of OECD countries across countries

| | Debt ratio $_{t-1}$ | t | GVAR | t | YVAR | t | Balance $_{t-1}$ | t | Obs. | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **EMU countries (12)** | | | | | | | | | | |
| Austria | 0.01* | 1.71 | -1.10*** | -6.64 | -0.79** | -2.68 | 0.63*** | 6.76 | 38 | 0.76 |
| Belgium | 0.04*** | 5.76 | -1.40*** | -8.32 | 0.08 | 0.26 | 0.74*** | 12.65 | 38 | 0.96 |
| France | 0.01* | 1.88 | -1.42*** | -4.46 | -0.41 | -1.07 | 0.44*** | 3.69 | 30 | 0.71 |
| Finland | 0.02 | 1.08 | -1.17 | -1.28 | -0.45 | -0.61 | 0.76*** | 7.19 | 33 | 0.77 |
| Germany | 0.05** | 2.80 | -1.32*** | -14.74 | -1.48** | -3.02 | 0.14* | 1.82 | 15 | 0.90 |
| Greece | -0.07 | -1.24 | -0.50 | -1.92 | 1.08 | 0.60 | 0.42 | 1.78 | 9 | 0.95 |
| Ireland | 0.10*** | 7.51 | -1.81*** | -10.15 | -1.07** | -4.04 | 0.17* | 2.68 | 9 | 0.98 |
| Italy | 0.07*** | 4.19 | -0.96** | -2.57 | -0.26 | -0.52 | 0.62*** | 7.31 | 37 | 0.92 |
| Luxembourg | 0.70 | 1.90 | -1.08*** | -4.01 | -0.87 | -1.78 | 0.27** | 3.01 | 11 | 0.89 |
| Netherlands | 0.01 | 0.49 | -1.29*** | -6.74 | -0.29 | -0.69 | 0.51*** | 3.79 | 38 | 0.66 |
| Portugal | 0.02 | 0.05 | -2.07*** | -4.76 | -0.73 | -1.45 | 0.43*** | 4.15 | 13 | 0.82 |
| Spain | 0.02 | 0.02 | -0.79*** | -3.29 | -0.35 | -0.61 | 0.91*** | 10.69 | 20 | 0.89 |
| Mean | 0.08 | | -1.24 | | -0.46 | | 0.50 | | 24.3 | |
| S.D. | 0.20 | | 0.42 | | 0.64 | | 0.24 | | 12.5 | |
| **Other Advanced European countries (7)** | | | | | | | | | | |
| Denmark | 0.02 | 0.74 | -1.16** | -2.51 | -1.44** | -2.57 | 0.60*** | 5.31 | 26 | 0.84 |
| Iceland | -0.03 | -0.47 | -1.23*** | -20.92 | -2.00** | -3.76 | -0.20 | -1.08 | 10 | 0.98 |
| Norway | 0.15*** | 3.23 | -1.50*** | -3.31 | -0.39 | -0.50 | 0.75*** | 12.76 | 37 | 0.84 |
| Slovakia | -0.09 | -1.06 | -1.35*** | -6.45 | 0.76 | 0.75 | 0.20 | 1.26 | 13 | 0.79 |
| Sweden | 0.03** | 2.46 | -0.84** | -2.29 | -0.89** | -2.48 | 0.79*** | 11.28 | 38 | 0.82 |
| Switzerland | 0.09*** | 7.67 | -0.77*** | -4.10 | -1.83*** | -4.27 | 0.39*** | 3.65 | 17 | 0.88 |
| UK | 0.01 | 0.17 | -1.04*** | -3.01 | 0.01 | 0.01 | 0.55*** | 6.64 | 34 | 0.71 |
| Mean | 0.03 | | -1.13 | | -0.83 | | 0.44 | | 25.0 | |
| S.D. | 0.08 | | 0.26 | | 1.01 | | 0.35 | | 11.8 | |
| **Other Advanced non-European countries (6)** | | | | | | | | | | |
| Australia | 0.03 | 1.39 | -0.76 | -1.14 | -0.86 | -0.63 | 0.74*** | 6.32 | 20 | 0.76 |
| Canada | 0.05*** | 7.19 | -1.27*** | -7.88 | -0.52 | -1.38 | 0.71*** | 19.14 | 38 | 0.95 |
| Japan | 0.00 | 0.58 | -1.65*** | -5.27 | -0.99 | -1.44 | 0.85*** | 10.54 | 37 | 0.84 |
| Korea | 0.00 | 0.01 | -1.17*** | -11.02 | -0.76*** | -2.95 | 0.52*** | 6.33 | 32 | 0.76 |
| New Zealand | -0.03 | -1.50 | -1.28*** | -4.32 | -1.84** | -3.04 | 0.31* | 2.23 | 14 | 0.79 |
| USA | 0.03** | 2.35 | -1.72*** | -3.24 | -1.41*** | -5.59 | 0.58*** | 6.75 | 38 | 0.77 |
| Mean | 0.02 | | -1.31 | | -1.06 | | 0.62 | | 29.83 | |
| S.D. | 0.03 | | 0.35 | | 0.48 | | 0.19 | | 10.4 | |
| **Emerging Market countries (1)** | | | | | | | | | | |
| Poland | 0.01 | 0.14 | 0.25 | 0.39 | -2.21 | -1.11 | 0.11 | 0.14 | 12 | 0.69 |
| **All countries (26)** | | | | | | | | | | |
| Mean | 0.05 | | -1.17 | | -0.77 | | 0.50 | | 25.3 | |
| S.D. | 0.14 | | 0.45 | | 0.79 | | 0.27 | | 11.6 | |
| MAX | 0.70 | | 0.25 | | 1.08 | | 0.91 | | 38 | |
| MIN | -0.09 | | -2.07 | | -2.21 | | -0.20 | | 9 | |

Note: (1) Dependent variable is the primary budget balance to GDP ratio ($s_t$).
(2) Regression methods are OLS with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

With respect to the lag value of the primary balance-GDP ratio, Table 3.2 shows that the previous primary balance is positively associated with the current primary balance in most OECD countries[97]. These results could be interpreted as the

97. The coefficients of the lag value of the primary balance-GDP ratio ($s_{i,t-1}$) are significant in the 5% significance level in 19 countries out of 26 countries. When we run the same regressions without the lagged primary budget balance-GDP ratio like Bohn's original model (equation (3.5)), the results show differences with baseline results depending on the significance of the lag value of the primary balance-GDP ratio as can be seen from Appendix 3. Table 3A.3. With regard to the countries whose coefficient of the lagged primary budget balance-GDP ratio is significant, the results show much

inertia properties of fiscal policy, which means that fiscal policy tends to be non-flexible[98]. We could consider several factors as the reason. First, the habit of governments might be one important reason. In other words, governments will not change their fiscal stance, such as the amount of spending, immediately following a change in economic situation. Second, it might take time to adjust spending because a large number of spending items are non-flexible. Lastly, one could think possible time lags which are caused by political procedure. The current budget is generally decided in the end of the previous fiscal year through the review of the national assembly in most OECD countries.

A simple comparision of average coefficients of each group in Table 3.2 could be misleading due to the variation across countries within each group. Table 3.3 presents the level of fiscal sustainability of OECD countries collectively. Estimation is based on the application of a Fixed effects model (FE) to consider the heterogeneity of each country and Generalised Method of Moments (GMM) to check the robustness. The result of the FE estimation shows that the coefficient of the debt-GDP ratio ($d_{t-1}$) is positively related to the primary balance-GDP ratio ($s_t$). OECD countries have responded to one percentage point increase in the debt-GDP ratio by increasing the primary balance-GDP ratio by 0.02 percentage points on average. The result of the GMM estimation confirms the baseline results since there is a large similarity between FE and GMM estimations[99]. This result could be interpreted that the fiscal finances of OECD countries are sustainable for the period which we estimated (see Appendix 3. Table 3A.1) collectively. Our results also

differences with baseline analysis. The signs of coefficients of the debt-GDP ratio have opposite signs in seven out of 19 countries, and the values of $R^2$ are dropped. The average value of $R^2$ decreases from 0.82 to 0.52. With regard to the countries whose corresponding coefficient is not significant, the results show a large degree of similarity with baseline analysis. The signs of coefficients of the debt-GDP ratio are same except one country, and the values of $R^2$ are similar. The average value of $R^2$ is 0.87 and 0.85 respectively.

98. The values of $R^2$ in our results are higher than the existing literature (Fincke and Greiner, 2012 ; Fincke and Greiner, 2011 ; Greiner, Köllert, and Semmler, 2007) because our estimation captures the inertia properties of fiscal policy by including the lagged primary budget balance-GDP ratio in the estimation. The values of $R^2$ are considerably high in the existing literature also. The average value of $R^2$ of six EMU countries (Austria, France, Germany, Italy, Netherlands, and Portugal) in Fincke and Greiner (2012) is 0.69, that of seven EMU countries (France, Germany, Greece, Ireland, Italy, Portugal, and Spain) in Fincke and Greiner (2011) is 0.88, and that of four EMU countries (Italy, France, Germany, and Portugal) in Greiner, Köllert, and Semmler (2007) is 0.79.

99. This could be because there is no endogeneity problem in these estimations as will be argued in the next page considering GMM can be one of instrumental variable estimation. When we run the same estimation by the system GMM to check the robustness of our results, the results show a large degree of similarity with baseline results except in other European countries. Appendix 3. Table 3A.4 shows that EMU countries seem to maintain sustainable fiscal finances while other countries not.

show that the coefficients of estimates are highly significant, especially GVAR and YVAR variables. These results are consistent with the existing literature (Byrne, Fiess, and MacDonald, 2011; Mendoza and Ostry, 2007) who show that fiscal finances of advanced countries are sustainable collectively, and GVAR and YVAR variables are highly significant in advanced countries.

When one compares the level of fiscal sustainability across country groups, all three groups show a sustainable fiscal stance even though the coefficient of the debt-GDP ratio is not significant in other advanced non-European countries. GVAR and YVAR variables are significantly negatively associated with the primary balance-GDP ratio, and the lag value of the primary balance-GDP ratio has a significantly positive effect on the current primary balance-GDP ratio indicating the inertial effect of fiscal policy, which is consistent with baseline analysis and the existing literature.

Table 3.3 The fiscal sustainability of OECD countries across country groups

Dependent Variable : the primary budget balance to GDP ratio ($s_t$)

| | All countries | | EMU | | Other European | | Other non-European | |
|---|---|---|---|---|---|---|---|---|
| | (FE) | (GMM) | (FE) | (GMM) | (FE) | (GMM) | (FE) | (GMM) |
| $d_{t-1}$ | 0.020** | 0.027** | 0.029*** | 0.030*** | 0.039** | 0.039*** | 0.008 | 0.008 |
| | (2.28) | (2.50) | (4.78) | (5.27) | (2.31) | (2.53) | (1.05) | (1.17) |
| GVAR | -1.208*** | -1.248*** | -1.178*** | -1.171*** | -1.215*** | -1.215*** | -1.383*** | -1.383*** |
| | (-14.13) | (-17.47) | (-9.61) | (-10.28) | (-9.40) | (-10.27) | (-13.47) | (-14.92) |
| YVAR | -0.490*** | -0.510*** | -0.375*** | -0.379*** | -0.564** | -0.564*** | -0.762** | -0.762*** |
| | (-4.55) | (-4.61) | (-3.47) | (-3.64) | (-2.68) | (-2.93) | (-3.00) | (-3.33) |
| $s_{t-1}$ | 0.740*** | 0.730*** | 0.716*** | 0.713*** | 0.713*** | 0.713*** | 0.792*** | 0.792*** |
| | (22.09) | (22.30) | (17.92) | (18.4) | (10.72) | (11.71) | (16.51) | (18.29) |
| F (Wald) | 326.92*** | 1925.57*** | 309.08*** | 1317.03*** | 383.11*** | 1829.91*** | 419.17*** | 2058.26*** |
| $R^2$ | 0.768 | | 0.752 | | 0.733 | | 0.850 | |
| No. of Obs. | 657 | 631 | 291 | 279 | 175 | 168 | 179 | 173 |
| No.of Groups | 26 | 26 | 12 | 12 | 7 | 7 | 6 | 6 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GVAR is the temporary increase in government expenditure, and YVAR is the temporary variation in the business cycle.
(2) Regression methods are Fixed effects model (FE) with robust standard errors and Generalised Method of Moments (GMM) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

We conduct the same analysis using instrumental variables to deal with the endogeneity of the debt-GDP ratio. This section employs two-stage least squares (2SLS) estimation utilizing the lagged value of debt-GDP ratio as the instrument. Table 3.4 shows that the results are generally consistent with those of the FE estimation and GMM estimation except the coefficient of the debt-GDP ratio in other advanced non-European countries is significant, but one can also see from the result

of the Hausman test that one needs not consider the endogeneity problem in other advanced non-European countries. To sum up, our baseline estimation properly addresses the endogeneity issue although it employs OLS estimation. This could be because the lagged value of the debt ratio is utilized as independent variables instead of the current value of the debt ratio in our estimations. The current primary budget balance does not have any effect on the previous debt ratio, so we can avoid endogeneity problem (Fincke and Greiner, 2012).

Table 3.4 The fiscal sustainability of OECD countries (FE 2SLS)

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | |
|---|---|---|---|---|
| | All countries | EMU | Other European | Other non-European |
| $d_{t-1}$ | 0.021*** | 0.032*** | 0.044*** | 0.008** |
| | (7.12) | (7.9) | (3.37) | (2.35) |
| GVAR | -1.242*** | -1.237*** | -1.213*** | -1.390*** |
| | (-22.22) | (-15.03) | (-12.17) | (-10.15) |
| YVAR | -0.477*** | -0.376*** | -0.521** | -0.815*** |
| | (-4.19) | (-2.65) | (-1.95) | (-3.95) |
| $s_{t-1}$ | 0.734*** | 0.699*** | 0.717*** | 0.792*** |
| | (38.83) | (26.17) | (17.69) | (23.46) |
| Wald | 2575.97*** | 1391.10*** | 675.60*** | 765.02*** |
| $R^2$ | 0.768 | 0.752 | 0.731 | 0.852 |
| Hausman $chi^2$ | 16.77*** | - | - | 2.95 |
| No. of Obs. | 631 | 279 | 168 | 173 |
| No.of groups | 26 | 12 | 7 | 6 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GVAR is the temporary increase in government expenditure, and YVAR is the temporary variation in the business cycle.
(2) Regression methods are Fixed effects 2SLS Instrumental variables estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

### (2) The trend of fiscal sustainability

Next, we explore the trend of fiscal sustainability using recursive estimation[100], with special reference to the change by introducing fiscal rules. We examine 16 OECD countries since the size of their sample of the other 10 countries[101] is not enough to conduct this analysis. Graph 3.3 displays the trend of slope parameter of equation (3.6) in recursive estimations. The results show that the level of fiscal sustainability is generally very stable except in a few countries where the debt ratio

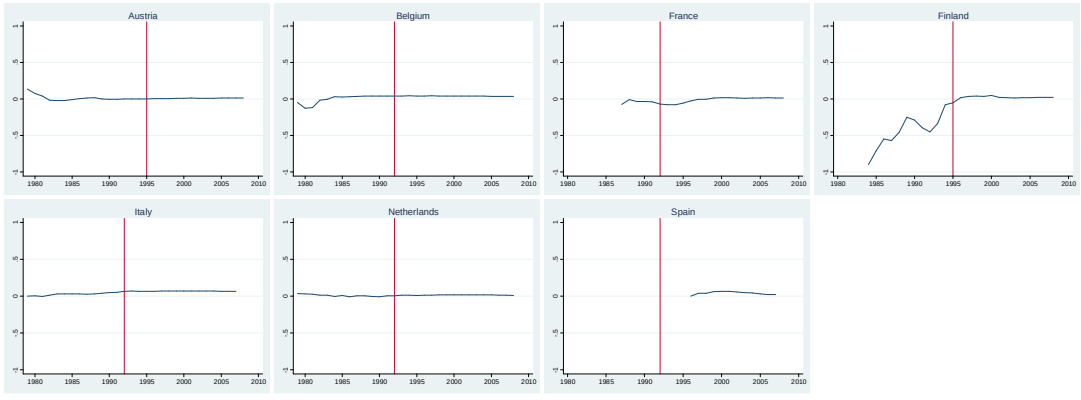
100. Recursive estimation can be utilized to check how the estimated coefficients change over time as new data become available. The initialization period is set as 10 years, and estimation starts with the period 1970-1979 and adding one observation at next estimation.
101. Germany, Greece, Ireland, Iceland, Luxembourg, New Zealand, Poland, Portugal, Slovakia, and Switzerland.

heavily fluctuates such as in Finland and Sweden. It moves in a very narrow range between -0.2 and 0.2.

The debt ratio of Finland dramatically increased from 8.0% in 1976 to 66.0% in 1996. Notwithstanding debt accumulation, the primary balance of Finland generally had been worsening, and deficit soared from 1991 to 1996 due to the worst recession in the OECD countries[102]. As such, these factors lead to unsustainable fiscal finances until the mid-1990s. After that the debt ratio decreased gradually due to fiscal consolidations for the period 1992-98, which were based mainly on tax increases (Perotti, 2011). Finally, the primary budget balance recovered back to surplus and the debt ratio stabilized to 40.7% in 2008. As a result, the fiscal finances of Finland became sustainable since 1996. The case of Sweden is more dramatic. The debt ratio of Sweden had increased rapidly from 26.1% in 1976 to 70.3% in 1985 but returned back to 46.3% in 1990 due to the economic boom. However, it started to increase again and peaked at 84.4% in 1996 due to the recession, and in turn the fiscal sustainability of Sweden, which had been very sound, deteriorated rapidly. After the effort of Swedish government, called "Consolidation Programme", to stabilize government debt since 1994 (Bi and Leeper, 2010, p.5), the debt ratio returned to a downward trend, and the trend of deterioration of fiscal sustainability has been stopped.

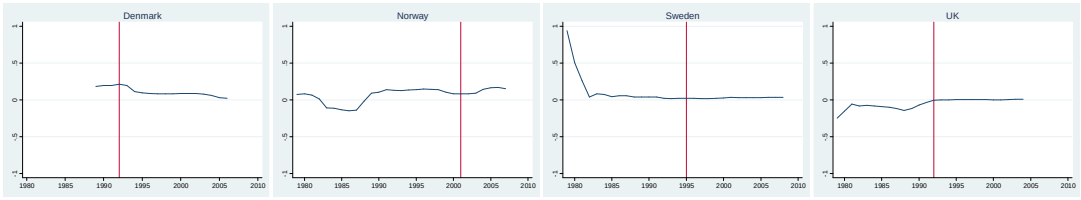
Graph 3.3 The trend of fiscal sustainability

[ EMU countries ]

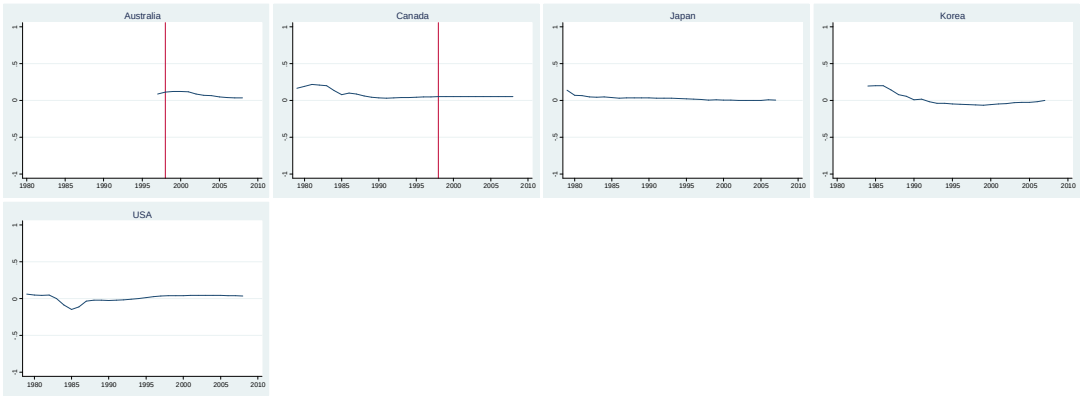



102. The GDP growth rate of Finland was minus for the period 1991-1993.

[ other advanced European countries ]




[ other advanced non-European countries ]



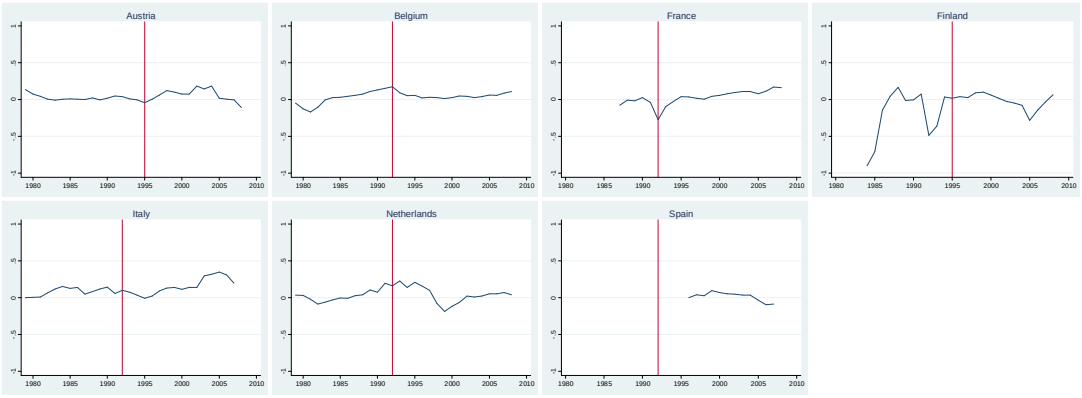

Note: The vertical line represents the year when fiscal rules were adopted. In the case of EMU countries, it is the same as the year when the SGP rules were adopted.

This phenomenon that the level of sustainability is generally stable becomes much clearer after fiscal rules were adopted as can be seen from Graph 3.3, but one cannot assure this fact as the evidence that the introduction of fiscal rules could guarantee fiscal sustainability. This is because these results could be interpreted as the inertial properties of fiscal policy, in other words, there is no sudden change in fiscal policy stance. In practice, the countries which operate fiscal policy in an unsustainable way in the past tend to maintain unsustainable fiscal stances in the future as well.

When one explores the short-term trend of fiscal sustainability utilizing a rolling window regression, it appears to be more volatile than the long-term trend of fiscal sustainability under the recursive estimation, but again it is relatively stable with the exception of a few countries, such as Finland and Sweden, as you can see from Graph 3.4. The graph also shows that the level of sustainability seems to have generally improved after introducing fiscal rules in some EMU countries such as Finland and Italy.

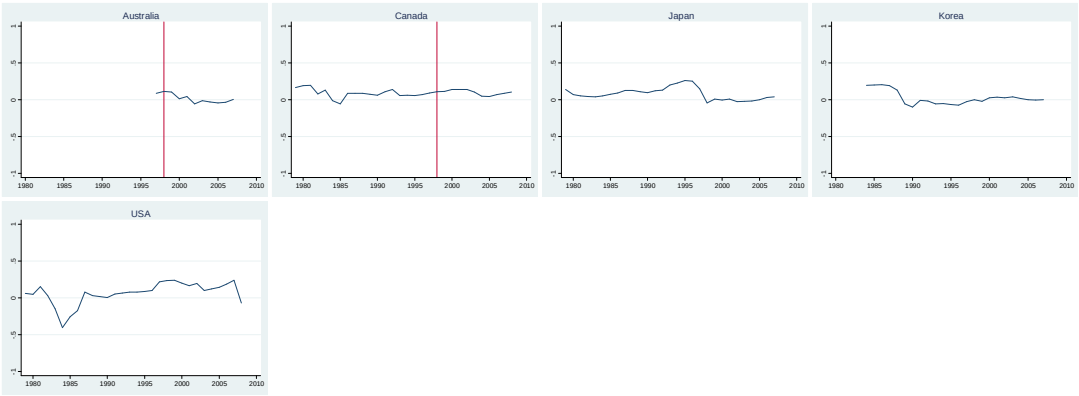
Graph 3.4 The trend of fiscal sustainability (Rolling window estimation)

[ EMU countries ]




[ other advanced European countries ]


[ other advanced non-European countries ]




Note: The vertical line represents the year when fiscal rules were adopted. In the case of EMU countries, it is the same as the year when the SGP rules were adopted.

These results are not consistent with the results of European Commission (2009) which points out that the sustainability of fiscal finances deteriorated compared with their 2006 analysis in 21 EU countries except four countries

(Hungary, Portugal, Italy, and Germany) by calculating the sustainability gap[103]. The difference in basic assumptions and measurement methods might be one of the reasons for different results between these two analyses. Our analysis, which is based on Bohn's response function, measures fiscal sustainability historically assuming that current fiscal policy will be maintained in the future, while European Commission's analysis, which is based on the sustainability indicator, measures a necessary amount of adjustment of the primary balance which should be conducted in the future. Therefore, we cannot conclude that our backward-looking analysis and European Commission's forward-looking analysis provide different implications. Our analysis does not refute the results of European Commission's analysis, the need for future fiscal adjustment, if one considers varying fiscal circumstances such as aging populations as will be argued in the next subsection in detail.

### (3) The main determinants of fiscal sustainability

This section explores the main determinants of fiscal sustainability employing Bohn's response function including 11 main control variables in the form of interaction variables following the methodology of chapter 2. This is because the coefficient of the interaction term for control variables and the lag value of the debt-GDP ratio denotes the change in the level of fiscal sustainability (the coefficient of the lag value of the debt-GDP ratio) for every one unit change in the control variable (Preacher, 2003). In other words, it indicates the effect of the control variables on the level of fiscal sustainability[104].

Regression (1) and (2) in Table 3.5, which are based on the application of the Fixed effects model (FE), show that the signs of coefficients of control variables are generally as expected and that some control variables seem to play a role in determining fiscal sustainability. The growth rate (GROWTH), the gap between

103. The average sustainability gap (the amount of adjustment in the primary balance which is need to satisfy infinite intertemporal budget constraint) of 25 EU countries has increased by 3.1%, from 3.4% of GDP on 2006 analysis to 6.5% of GDP in 2009 analysis.
104. The coefficient of control variables means the effect of each control variable on the change in primary budget balance-GDP ratio, not the level of fiscal sustainablity itself. If we include control variables themselves as separate regressors, we cannot find the effect of control variable on procyclicality properly because of collinearity of variables.

growth rate and interest rate (GAP), and income per capita (GDPPC) have a positive effect on fiscal sustainability, while the old-age dependency ratio (OLD) produces a negative effect. The results also show that the fiscal finances of 26 OECD countries appear to be sustainable collectively. The marginal effects[105] of the lag value of the debt-GDP ratio on the primary balance-GDP ratio are 0.026~0.027 which are similar to the corresponding coefficient when control variables were not included in Table 3.3 (0.020) and are significant jointly. GVAR and YVAR variables are negatively associated with the primary balance-GDP ratio, and the lag value of the primary balance has a significantly positive effect on the primary balance-GDP ratio indicating the inertial properties of fiscal policy, which are consistent with the results of baseline estimation of Table 3.3. These results could be generally confirmed by the results of GMM estimations (regression (3) and (4)) and FE 2SLS estimations (regression (5) and (6)) even though one needs not consider the potential endogeneity problem according to the result of the Hausman test.

The growth rate (GROWTH) and the gap between growth rate and interest rate (GAP) have a significantly positive effect on the sustainability of fiscal finances, which is consistent with the argument of the existing theoretical literature (Sakuragawa and Hosono, 2011; Aspromourgos, Rees, and White, 2010; Hall and Sargent, 2010; Menguy, 2008; Fullwiler, 2007; Chalk, 2000[106]). A one percentage point increase of GDP could lead to an increase in the level of fiscal sustainability (the coefficient of the lag value of debt-GDP ratio) of 0.002 on average. This suggests that governments respond to a one percentage point increase in the debt-GDP ratio by raising primary budget balance 0.002 percentage points on average for every one percentage point increase in GDP. A one percentage point increase in the gap between growth rate and interest rate brings about an increase in the level of fiscal sustainability of 0.001. These results could be explained as the following. Economic growth could lead to not only an increase in revenue by raising the income of taxpayers: both individuals and corporations, but also the reduction in spending

105. The marginal effect can be obtained by calculating the sum of coefficients of the lag values of the debt-GDP ratio and Σ(estimated coefficient*average value of control variable).
106. Chalk (2000) points out that a high growth economy could maintain a higher sustainable deficit and suggests that a two percentage point increase in the growth rate could give rise to triple the sustainable deficit by calibration of the post-war US data.

such as unemployment benefit, so it could result in the improvement of fiscal sustainability.

Table 3.5 The main determinants of fiscal sustainability

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) FE | (2) FE | (3) GMM | (4) GMM | (5) FE 2SLS | (6) FE 2SLS |
| $d_{t-1}$ | -0.444** | -0.397** | -0.504** | -0.399** | -0.212 | -0.179 |
| | (-2.20) | (-2.07) | (-2.48) | (-2.16) | (-0.40) | (-0.45) |
| *marginal effect | 0.027 | 0.026 | 0.033 | 0.031 | 0.032 | 0.031 |
| GVAR | -1.155*** | -1.160*** | -1.184*** | -1.190*** | -1.163*** | -1.165*** |
| | (-17.03) | (-17.34) | (-17.94) | (-18.54) | (-18.60) | (-18.48) |
| YVAR | -0.328** | -0.383*** | -0.322** | -0.406*** | -0.408* | -0.450*** |
| | (-2.18) | (-2.91) | (-2.12) | (-3.03) | (-1.87) | (-3.13) |
| $s_{t-1}$ | 0.642*** | 0.633*** | 0.644*** | 0.635*** | 0.651*** | 0.645*** |
| | (18.98) | (19.65) | (18.39) | (18.77) | (19.93) | (18.16) |
| GROWTH*$d_{t-1}$ | 0.002* | | 0.002* | | 0.001** | |
| | (1.87) | | (1.89) | | (2.30) | |
| IRL*$d_{t-1}$ | -0.001 | | -0.000 | | -0.001 | |
| | (-1.16) | | (-0.58) | | (-1.20) | |
| GAP*$d_{t-1}$ | | 0.001* | | 0.001* | | 0.001*** |
| | | (1.88) | | (1.69) | | (4.02) |
| INIDEBT*$d_{t-1}$ | 0.001* | 0.001** | 0.000 | 0.001* | 0.000* | 0.000** |
| | (1.94) | (2.54) | (1.55) | (1.85) | (1.90) | (2.07) |
| AVEDEBT*$d_{t-1}$ | 0.000* | 0.000* | 0.000 | 0.000 | 0.000 | 0.000 |
| | (1.80) | (1.93) | (1.47) | (1.63) | (1.21) | (1.21) |
| AVEBALANCE *$d_{t-1}$ | 0.006 | 0.007 | 0.006 | 0.007 | 0.005 | 0.005 |
| | (1.06) | (1.12) | (1.21) | (1.32) | (0.93) | (0.95) |
| GDPPC*$d_{t-1}$ | 0.045** | 0.041** | 0.051** | 0.042** | 0.023 | 0.02 |
| | (2.22) | (2.11) | (2.51) | (2.24) | (0.44) | (0.50) |
| OPEN*$d_{t-1}$ | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 |
| | (-0.66) | (-0.62) | (-0.58) | (-0.51) | (-0.07) | (-0.07) |
| OLD*$d_{t-1}$ | -0.001*** | -0.001*** | -0.001** | -0.002*** | -0.001* | -0.001 |
| | (-3.85) | (-3.96) | (-2.43) | (-2.79) | (-1.67) | (-1.63) |
| POLCON*$d_{t-1}$ | -0.023 | -0.021 | -0.022 | -0.020 | -0.027* | -0.024 |
| | (-1.04) | (-0.96) | (-0.95) | (-0.88) | (-1.80) | (-1.62) |
| RULE*$d_{t-1}$ | 0.006 | 0.005 | 0.006 | 0.004 | 0.008** | 0.007 |
| | (1.52) | (1.19) | (1.62) | (1.13) | (2.16) | (1.58) |
| F (Wald) | 2324.24*** | 613.58*** | 14321.43*** | 11027.55*** | 2847.08*** | 2843.23*** |
| $R^2$ | 0.628 | 0.623 | - | - | 0.645 | 0.644 |
| Hausman $chi^2$ | - | - | - | - | 4.71 | 3.70 |
| No. of Obs. | 623 | 623 | 597 | 597 | 600 | 600 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GVAR is the temporary increase in government expenditure, YVAR is the temporary variation in the business cycle, GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between growth rate and interest rate, OPEN is trade openness, INIDEBT is initial debt, AVEDEBT is average debt, AVEBANANCE is the average primary balance, GDPPC is the log of income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.
(2) Regression methods are Fixed effects model (FE) with robust standard errors in regression (1)-(2), Generalised Method of Moments (GMM) with robust standard errors in regression (3)-(4), and Fixed effects 2SLS Instrumental variables estimation (FE 2SLS) in regression (5)-(6).
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, UN World Population Prospects (The 2010 revision), Henisz database (2010), and IMF fiscal rules database (2009).

However, one cannot confirm the role of the interest rate which is emphasized in the existing literature (Aspromourgos, Rees, and White, 2010; Fullwiler, 2007). The result shows that the interest rate (IRL) is negatively associated with fiscal sustainability, but the coefficient is not statistically significant.

Initial debt (INIDEBT) and average debt (AVEDEBT) are positively related to the primary balance-GDP ratio in spite of relatively low statistical significance, but they become insignificant in GMM estimation. The level of fiscal sustainability is estimated to increase by 0.001 for every one percentage point increase in the initial debt-GDP ratio. High debt could reduce the incentive of an increase in spending by arousing the concern about fiscal sustainability in practice as is argued by Guichard, Kennedy, Wurzel, and André (2007), so it in turn could lead to fiscal consolidation. Huart (2011) also argues that high debt could trigger fiscal efforts to improve primary budget balance.

The average primary budget balance (AVEBALANCE) has a positive effect on fiscal sustainability, but the coefficient is not significant. A one percentage point increase in the average primary balance-GDP ratio will raise the level of sustainability by 0.006. This positive effect of the average primary budget balance is consistent with Chalk (2000) who argues that past fiscal policy plays an important role in determining current fiscal sustainability, and therefore the countries which have low performance in fiscal policy, such as large deficit, could have a greater likelihood of unsustainable fiscal position.

Income per capita (GDPPC) has a significantly positive effect on fiscal sustainability. The level of fiscal sustainability is estimated to increase by 0.045 for every one percent increase in GDP per capita. This positive effect of income per capita is consistent with the existing theoretical literature (Yakita, 2008) and empirical analysis (IMF, 2003). The countries with higher income per capita tend to have a larger stock of public capital facilitating sustainable fiscal policy. IMF (2003) shows that the level of fiscal sustainability could be higher in industrial countries than in emerging market countries, in other words, the former tend to increase sharply the primary surplus response to debt accumulation, while this feature is not prevalent in the latter.

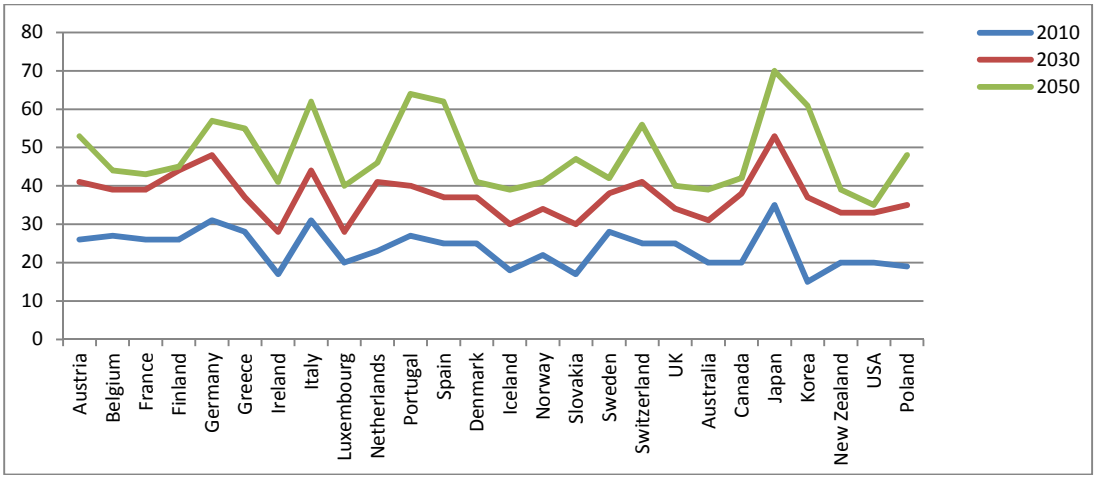
Trade openness (OPEN) has a negative effect on the level of sustainability, but the coefficient is small and insignificant. The negative effect of trade openness is not consistent with the literature (Byrne, Fiess, and MacDonald, 2011; Hauner and Kumar, 2005; Drelichman and Voth, 2008) which argue that borrowing constraints can be determinants of fiscal sustainability in emerging countries, but our results could be rationalized by the fact that our sample mainly consists of advanced countries. Our result could also be rationalized by the contradictive arguments about the interpretation of trade openness as already stated in chapter 2[107].

The old-age dependency ratio (OLD) is negatively associated with fiscal sustainability. The level of fiscal sustainability is estimated to decrease by 0.001 for every one percentage point increase in the old-age dependency ratio. This result could indicate that an aging society is likely to have difficulty in maintaining a sustainable fiscal policy. According to the World Population Prospects (The 2010 revision), the old-age dependency ratio will be doubled in 2050 compared with 2010 in most OECD countries as can be seen in Graph 3.5. The average of old-age dependency ratio in 26 OECD countries will move from 23.69% in 2010 to 48.15% in 2050. Our results imply that aging populations could lead to the additional decrease in the level of fiscal sustainability of 0.029 in 2050 compared with 2010. This indicates that governments will respond to a one percentage point increase in debt-GDP ratio by reducing primary budget balance additionally by 0.029 percentage points when the old-age dependency ratio changes from 23.69% to 48.15%. In other words, governments should increase the primary budget balance 0.029 percentage points additionally for every one percentage point increase of the debt-GDP ratio to avoid the deterioration of fiscal sustainability due to aging populations[108]. This implies that fiscal sustainability will worsen if governments maintain the current fiscal stance, so the government's action to adjust spending will be essential for maintaining fiscal sustainability in the future.

107. Some literature argues that high openness means high access to international capital (Woo, 2009), but others argue that high openness leads to increase of cost of financing from international market, especially during recessions (Aghion and Marinescu, 2007; Lane, 2003).

108. These results are generally consistent with Balassone, Pavot, Cunha, Prammer, Langenus, Tommasino, and Manzke (2009) who show that the budget balance for the period 2010-2050 of 11 EMU countries will worsen about 5.3% point on average due to the aging population related spending.

Graph 3.5 The forecast of the old-age dependency ratio




Note: The old-age dependency ratio is defined as the ratio of elderly (65 years old or over) relative to the working age population (15–64 years old). The average is 23.69% (2010) → 37.31% (2030) → 48.15% (2050).
Source : World Population Prospects (The 2010 revision).

Political power dispersion (POLCON) has a negative effect on the level of sustainability, but it is not significant. The level of fiscal sustainability is estimated to decrease by 0.002 for every 0.1 unit increase in power dispersion index. This result indicates that the more disperse the political power within the government, the less the level of fiscal sustainability. The negative effect of political power dispersion is consistent with the political budgetary cycle theory (Berenger and Llorca, 2007). More fragmented governments, which have a number of decision makers within them, are likely to experience more unsustainable fiscal finances because governments have to satisfy the demand for spending of different interest groups.

Fiscal rules do not seem to play any role in determining the level of fiscal sustainability. The coefficients of introducing fiscal rules are positively associated with fiscal sustainability, but this effect is not statistically significant[109]. This result indicates that the effect of fiscal rules is not certain because fiscal rules are prevalently violated in practice although fiscal rules could improve the level of fiscal sustainability theoretically by restricting policymaker's decision on fiscal stance.

109. Also, the effect of fiscal rules on fiscal sustainability does not show a consistent picture when we explore it country by country. The effect of fiscal rules is likely to vary across countries, which is consistent with Debrun and Kumar (2008). The coefficients of interaction for fiscal rules and GDP growth are significantly positive in nine countries (Australia, Austria, Belgium, Canada, Netherlands, Norway, Poland, Spain, and Switzerland) while they are significantly negative in one country (France). By contrast, they are insignificant in eight countries.

Japan adopted fiscal rules in 1947, but the Japanese government waived this rule since 1975 except the period 1990-1993 (IMF, 2009). Also, the concern about waiving the SGP rules has increased (OECD, 2002), and many countries have violated the rules by permitting more than 3% of the budget deficit-GDP ratio. The ratio of the breaches of the SGP rules was 25.4% (45 out of 177 possible cases) for the period 1999-2007 (Calmfors and Wren-Lewis, 2011). These results are consistent with Wyplosz (2012) who argues that fiscal rules are not sufficient to ensure fiscal sustainability.

One can consider different effects of fiscal rules on fiscal sustainability depending on the time coverage of fiscal rules. This section estimates the effect of fiscal rules on fiscal sustainability by distinguishing between multi-year fiscal rules and annual fiscal rules as we employed in chapter 2.

Table 3.6 The effect of annual fiscal rules and multi-year fiscal rules on fiscal sustainabiliy

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) FE | (2) FE | (3) GMM | (4) GMM | (5) FE 2SLS | (6) FE 2SLS |
| RULE*d $_{t-1}$ | 0.006 | 0.005 | 0.006 | 0.004 | 0.008** | 0.007 |
| | (1.52) | (1.19) | (1.62) | (1.13) | (2.16) | (1.58) |
| Hausman chi$^2$ | | | | | 4.71 | 3.70 |
| No. of Obs. | 623 | 623 | 597 | 597 | 600 | 600 |
| No.of Groups | 26 | 26 | 26 | 26 | 26 | 26 |
| Annual RULE*d $_{t-1}$ | 0.009** | 0.008** | 0.006** | 0.005 | 0.026 | 0.020** |
| | (2.47) | (2.29) | (1.99) | (1.55) | (0.86) | (1.98) |
| Hausman chi$^2$ | | | | | 0.34 | 1.89 |
| No. of Obs. | 478 | 448 | 454 | 454 | 459 | 459 |
| No.of Groups | 23 | 23 | 23 | 23 | 23 | 23 |
| Multi-year RULE*d $_{t-1}$ | -0.000 | -0.001 | 0.002 | -0.000 | 0.005 | 0.004 |
| | (-0.01) | (-0.19) | (0.22) | (-0.00) | (0.78) | (0.63) |
| Hausman chi$^2$ | | | | | 6.93 | 4.84 |
| No. of Obs. | 502 | 502 | 473 | 473 | 481 | 481 |
| No.of Groups | 23 | 23 | 23 | 23 | 23 | 23 |

Note: (1) Other independent variables are $s_{t-1}$ (the lag value of the primary budget balance-GDP ratio), $d_{t-1}$ (the lag value of the debt-GDP ratio), GVAR (the temporary increase in government expenditure), YVAR (the temporary variation in the business cycle), GROWTH (the growth rate), IRL (the interest rate), GAP (the gap between growth rate and interest rate), OPEN (trade openness), INIDEBT (initial debt), AVEDEBT (average debt), AVEBANANCE (the average primary balance), GDPPC (log of income per capita), OLD (the old-age dependency ratio) and POLCON (a power dispersion index).
(2) RULE is the dummy variable for fiscal rules, Annual RULE is the dummy for annual fiscal rules, and Multi-year RULE is the dummy for multi-year fiscal rules.
(3) Regression methods are the Fixed effects model (FE) with robust standard errors in regression (1)-(2), Generalised Method of Moments (GMM) with robust standard errors in regression (3)-(4), and Fixed effects 2SLS Instrumental variables estimation (FE 2SLS) in regression (5)-(6).
(4) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, UN World Population Prospects (The 2010 revision), Henisz database (2010), and IMF fiscal rules database (2009).

Table 3.6 shows that the coefficients of interaction term for multi-year fiscal rules and the debt-GDP ratio are insignificant, while corresponding coefficients of annual fiscal rules are significantly positive. And the coefficients of interaction term for annual fiscal rules are larger than the corresponding coefficients of multi-year fiscal rules. This could be because most countries which adopt annual fiscal rules are also adopting the SGP rules[110]. Fiscal rules are basically functioned as a restriction on fiscal policy by giving governments the numerical targets on budget or debt over certain periods to improve fiscal sustainability. Therefore, whether fiscal rules have enforceability affects fiscal sustainability as will be seen in section 3.3.2[111].

One could examine the long term effect of each of the control variables since estimation equations are dynamic such that they include the lag value of the dependent variable. One can see from Table 3.7 that the long-term effect of each of the control variables is about 2.8 times more than short term effect[112].

Table 3.7 Long term effect of control variables

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) FE | (2) FE | (3) GMM | (4) GMM | (5) FE 2SLS | (6) FE 2SLS |
| GROWTH | 0.005 | | 0.005 | | 0.004 | |
| IRL | -0.002 | | -0.001 | | -0.002 | |
| GAP | | 0.004 | | 0.004 | | 0.004 |
| INIDEBT | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| AVEDEBT | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| AVEBALANCE | 0.017 | 0.018 | 0.018 | 0.020 | 0.014 | 0.015 |
| GDPPC | 0.126 | 0.111 | 0.144 | 0.115 | 0.065 | 0.056 |
| OPEN | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| OLD | -0.003 | -0.004 | -0.003 | -0.004 | -0.003 | -0.003 |
| POLCON | -0.063 | -0.056 | -0.062 | -0.056 | -0.077 | -0.068 |
| RULE | 0.017 | 0.013 | 0.016 | 0.011 | 0.022 | 0.019 |

Note: GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between growth rate and interest rate, OPEN is trade openness, INIDEBT is initial debt, AVEDEBT is average debt, AVEBANANCE is the average primary balance, GDPPC is log of income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.

110. Six countries out of 10 countries which adopt annual fiscal rules have the SGP rules also. When we run same regression of a sample of 12 EMU countries, the effect of the SGP rules are significantly positive, and the size of coefficients are similar with those of annual fiscal rules as can be seen from Table 3.12.

111. When we run same regression excluding the samples when the SGP rules is adopting, the coefficients of interaction for fiscal rules and the debt-GDP ratio become smaller. This result implies that the effect of fiscal rules becomes weak if the effect of the SGP rules is excluded.

112. The long term effect can be obtained by dividing estimated coefficient by (1- coefficient of the lag value of debt-GDP ratio).

One thing we have to consider is that we should interpret the size of coefficients carefully. This is because each variable has a different measurement unit and different distribution, so the size of each coefficient does not mean the real effect on fiscal sustainability in practice, as already explained in chapter 2. Table 3.8 presents the variation of the level of fiscal sustainability across control variables, which indicates the change in the primary balance-GDP ratio responds to a one percentage point increase in the debt-GDP ratio when each control variables change by one standard diviation of that variable. These results show that the effects of the growth rate (GROWTH), the initial debt-GDP ratio (INIDEBT), the average debt-GDP ratio (AVEDEBT), the average budget balance (AVEBALANCE), and income per capita (GDPPC) are relatively bigger than those of other variables.

Table 3.8 The variation of the level of fiscal sustainability across control variables

| | coefficient | Mean | Standard Deviation | Change in the primary balance-GDP ratio |
|---|---|---|---|---|
| GROWTH | 0.002 | 7.84% | 5.18 | 0.009%p |
| IRL | -0.001 | 7.73% | 3.38 | -0.003%p |
| GAP | 0.001 | -0.24% | 3.98 | 0.006%p |
| INIDEBT | 0.001 | 42.27% | 20.67 | 0.011%p |
| AVEDEBT | 0.000 | 57.86% | 22.85 | 0.011%p |
| AVEBALANCE | 0.006 | 0.39% | 1.66 | 0.010%p |
| GDPPC | 0.045 | 10.05 | 0.37 | 0.016%p |
| OPEN | 0.000 | 61.35 | 41.16 | -0.004%p |
| OLD | -0.001 | 20.18% | 4.58 | -0.005%p |
| POLCON | -0.023 | 0.48 | 0.09 | -0.002%p |
| RULE | 0.006 | 0.42 | 0.49 | 0.003%p |

Note: (1) GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between growth rate and interest rate, OPEN is trade openness, INIDEBT is initial debt, AVEDEBT is average debt, AVEBANANCE is the average primary balance, GDPPC is log of income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.

To conclude, our results imply that governments could operate their fiscal finances in a sustainable way even under continuous budget deficits and debt accumulation, if the economy could maintain a growth rate above the interest rate. And one can see from the results that advanced countries are more likely to maintain sustainable fiscal finances. Also, these results suggest that governments should operate fiscal policy in a way that alleviates the spending pressures, especially ageing population related spending.

## 3.3.2. Additional robustness checks

This section presents the additional robustness checks of the baseline analysis using a net debt variable and a sample of EMU countries.

### (1) Net debt

A number of studies argue that net debt rather than gross debt should be utilized to assess fiscal sustainability properly, even though they do not conduct empirical analysis (Milesi-Ferreti and Moriyama, 2006[113]; Coeure and Pisani-Ferry, 2005; Buiter and Grafe, 2004; OECD, 2002). This section makes use of general government net financial liabilities as net debt variable. We exclude two countries (Luxembourg and Switzerland) and adjust the sample period of two countries (Austria and Norway) because of data availability.

Table 3.9 presents the level of fiscal sustainability of 24 OECD countries utilizing the net debt variable. The fiscal sustainability coefficients of each country shows a few differences from the corresponding coefficients when gross debt is utilized in Table 3.2 of section 3.3.1.

The average coefficient of the debt-GDP ratio decreases by 0.03 from 0.05 to 0.02, but it is the same if one excludes Luxembourg and Switzerland from the samples of using gross debt to allow for a fair comparison between both results. One thing we should note is that the number of countries whose fiscal finances are unsustainable increase from Four countries (Greece, Iceland, New Zealand, and Slovakia) to five countries. Three countries (Norway, Korea, and Portugal) are included and two countries (Iceland and Slovakia) are excluded when one concisiders net debt rather than gross debt[114].

113. Milesi-Ferreti and Moriyama (2006) suggest their own valuation of non-financial assets based on the 2001 Government Financial Statistics Manual, and they show that decreases in gross debt in EU countries has been accompanied by asset sale.

114. The level of fiscal sustainability of Iceland improved from -0.03 to 0.00, and that of Slovakia improved from -0.09 to 0.07. On the other hand, that of Norway decreased from 0.15 to -0.05, that of Korea from 0.00 to -0.03, and that of Portugal from 0.02 to -0.02. However, the net debt-GDP ratio

Table 3.9 The fiscal sustainability of OECD countries across countries (utilizing net debt)

| | Net debt ratio $_{t-1}$ | t | GVAR | t | YVAR | t | Balance $_{t-1}$ | t | Obs. | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **EMU countries (11)** | | | | | | | | | | |
| Austria | 0.06*** | 2.73 | -0.98*** | -6.84 | -0.70** | -2.47 | 0.50*** | 3.69 | 28 | 0.76 |
| Belgium | 0.04*** | 6.22 | -1.38*** | -8.64 | 0.09 | 0.29 | 0.71*** | 12.43 | 38 | 0.96 |
| France | 0.01 | 1.49 | -1.41*** | -4.36 | -0.38 | -0.96 | 0.46*** | 3.89 | 30 | 0.70 |
| Finland | 0.00 | 0.09 | -1.21 | -1.27 | -0.51 | -0.68 | 0.71*** | 6.49 | 33 | 0.76 |
| Germany | 0.04** | 2.81 | -1.33*** | -14.70 | -1.56*** | -3.21 | 0.15* | 1.83 | 15 | 0.90 |
| Greece | -0.07 | -1.62 | -0.60** | -4.20 | 1.24 | 0.81 | 0.27 | 1.08 | 9 | 0.96 |
| Ireland | 0.08*** | 7.07 | -1.86*** | -10.62 | -1.36*** | -4.68 | 0.19* | 2.45 | 9 | 0.98 |
| Italy | 0.05*** | 4.26 | -0.99*** | -3.54 | -0.35 | -0.73 | 0.64*** | 7.05 | 37 | 0.92 |
| Netherlands | 0.05** | 2.73 | -1.22*** | -5.23 | -0.62 | -1.47 | 0.42*** | 3.64 | 38 | 0.72 |
| Portugal | -0.02 | -1.08 | -2.02*** | -5.27 | -0.58 | -1.48 | 0.31*** | 3.64 | 13 | 0.83 |
| Spain | 0.02 | 1.30 | -0.81*** | -3.41 | -0.34 | -0.58 | 0.92*** | 10.78 | 20 | 0.89 |
| Mean | 0.02 | | -1.25 | | -0.46 | | 0.48 | | 24.6 | |
| S.D. | 0.04 | | 0.42 | | 0.73 | | 0.24 | | 11.7 | |
| **Other Advanced European countries (6)** | | | | | | | | | | |
| Denmark | 0.02 | 0.35 | -1.17** | -2.32 | -1.49** | -2.70 | 0.59** | 4.91 | 26 | 0.84 |
| Iceland | 0.00 | 0.03 | -1.24*** | -17.53 | -1.83** | -3.00 | -0.10 | -0.41 | 10 | 0.98 |
| Norway | -0.05** | -2.51 | -1.63*** | -4.12 | -0.64 | -0.72 | 0.64*** | 5.08 | 28 | 0.85 |
| Slovakia | 0.07** | 2.45 | -1.15*** | -5.65 | -1.20 | -1.44 | 0.36** | 2.49 | 13 | 0.82 |
| Sweden | 0.03*** | 2.76 | -0.83** | -2.25 | -0.88** | -2.41 | 0.78*** | 11.10 | 38 | 0.81 |
| UK | 0.01 | 0.54 | -1.04*** | -3.01 | -0.01 | -0.02 | 0.55*** | 6.57 | 34 | 0.72 |
| Mean | 0.02 | | -1.18 | | -1.01 | | 0.47 | | 24.8 | |
| S.D. | 0.04 | | 0.26 | | 0.65 | | 0.31 | | 11.2 | |
| **Other Advanced non-European countries (6)** | | | | | | | | | | |
| Australia | 0.00 | 0.03 | -0.90 | -1.31 | -1.04 | -0.72 | 0.65*** | 4.25 | 20 | 0.75 |
| Canada | 0.04*** | 6.24 | -1.28** | -7.28 | -1.28 | -1.14 | 0.76*** | 20.21 | 38 | 0.94 |
| Japan | 0.01 | 1.00 | -1.66*** | -5.50 | -0.98 | -1.44 | 0.88*** | 10.10 | 37 | 0.85 |
| Korea | -0.03*** | -3.49 | -1.11*** | -10.81 | -0.85*** | -3.73 | 0.36*** | 5.45 | 32 | 0.82 |
| New Zealand | -0.02 | -1.39 | -1.27*** | -4.22 | -1.65** | -2.61 | 0.30* | 2.01 | 14 | 0.79 |
| USA | 0.04*** | 3.12 | -1.70*** | -3.27 | -1.39*** | -5.60 | 0.59*** | 6.84 | 38 | 0.78 |
| Mean | 0.01 | | -1.32 | | -1.20 | | 0.59 | | 29.8 | |
| S.D. | 0.03 | | 0.31 | | 0.30 | | 0.22 | | 10.4 | |
| **Emerging Market countries (1)** | | | | | | | | | | |
| Poland | 0.01 | 0.18 | 0.34 | 0.71 | -2.42 | -1.59 | 0.05 | 0.10 | 12 | 0.69 |
| **All countries (24)** | | | | | | | | | | |
| Mean | 0.02 | | -1.18 | | -0.86 | | 0.49 | | 25.4 | |
| S.D. | 0.04 | | 0.47 | | 0.75 | | 0.26 | | 11.1 | |
| MAX | 0.08 | | 0.34 | | 1.24 | | 0.92 | | 38 | |
| MIN | -0.07 | | -2.02 | | -2.42 | | -0.10 | | 9 | |

Note: (1) Dependent variable is the primary budget balance to GDP ratio ($s_t$).
(2) Regression methods are OLS with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

Table 3.10 presents the level of fiscal sustainability of 24 OECD countries collectively utilizing net debt variables. These results have a large similarity with the baseline results when we utilize gross debt except other advanced European

of Norway and Korea is below zero, so we cannot conclude that the fiscal finances of two countries are unsustainable.

countries. The coefficients of the net debt-GDP ratio in EMU countries and other advanced non-European countries are similar in sign, size, and statistical significance. However, the coefficient of the net debt-GDP ratio in other advanced European countries, which was significantly positive, became insignificant and negative. These results could be interpreted that one cannot confirm that the fiscal finances of OECD countries are sustainable except EMU countries if one considers net debt instead of total debt.

Table 3.10 The fiscal sustainability of OECD countries across country groups (utilizing net debt)

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All countries | | EMU | | Other European | | Other non-European | |
| | (FE) | (GMM) | (FE) | (GMM) | (FE) | (GMM) | (FE) | (GMM) |
| $d_{t-1}$ | 0.017* | 0.019* | 0.034*** | 0.035*** | -0.011 | -0.011 | 0.016 | 0.016* |
| | (1.77) | (1.85) | (4.58) | (4.83) | (-0.47) | (-0.52) | (1.71) | (1.89) |
| GVAR | -1.210*** | -1.250*** | -1.174*** | -1.174*** | -1.289*** | -1.289*** | -1.371*** | -1.371*** |
| | (-13.20) | (-16.12) | (-9.43) | (-9.97) | (-8.12) | (-9.02) | (-12.43) | (-13.77) |
| YVAR | -0.468*** | -0.455*** | -0.398*** | -0.400*** | -0.563* | -0.563*** | -0.773** | -0.773*** |
| | (-3.74) | (-3.56) | (-3.81) | (-4.07) | (-2.33) | (-2.59) | (-3.22) | (-3.57) |
| $s_{t-1}$ | 0.751*** | 0.749*** | 0.693*** | 0.692*** | 0.673*** | 0.673*** | 0.796*** | 0.796*** |
| | (20.16) | (20.15) | (13.73) | (14.50) | (14.20) | (15.76) | (16.90) | (18.73) |
| F (Wald) | 317.01*** | 1950.11*** | 409.29*** | 1830.09*** | 388.83*** | 1918.21*** | 772.93*** | 3795.33*** |
| $R^2$ | 0.756 | | 0.664 | | 0.756 | | 0.844 | |
| No. of Obs. | 610 | 586 | 270 | 259 | 149 | 143 | 179 | 173 |
| No.of Groups. | 24 | 24 | 11 | 11 | 6 | 6 | 6 | 6 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the net debt-GDP ratio, GVAR is the temporary increase in government expenditure, and YVAR is the temporary variation in the business cycle.
(2) Regression methods are Fixed effects model (FE) with robust standard errors and Generalised Method of Moments (GMM) with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

When one conducts the same analysis through two stage least squares (2SLS) estimation utilizing instrumental variables to deal with the endogeneity of the net debt-GDP ratio, the results are generally consistent with those when total debt was utilized except other advanced European countries as can be seen from Appendix 3. Table 3A.5. To sum up, one can see from the results that the fiscal finances of EMU countries are generally sustainable collectively even when we utilize net debt variables instead of gross debt while those of other advanced countries are not sustainable collectively when we utilize net debt.

Next, our results show that the role of the control variables on fiscal sustainability is not certain. This subsection includes the initial net debt-GDP ratio and the average net debt-GDP ratio into the regression equation, instead of the inital debt-GDP ratio and the average debt-GDP ratio as control variables. Tabel 3.11 shows totally differnt results with those when gross debt was utilized in Table 3.5 of section 3.3.1. The growth rate (GROWTH), the gap between growth rate and interest rate (GAP), income per capita (GDPPC) and the old-age dependency ratio (OLD), which are significant in baseline estimation of Table 3.5, become insignificant and even have oppsite signs. On the other hand, the interest rate (IRL), the average primary balance (AVEBALANCE), and trade openness (OPEN) play a certain role in determing fiscal sustainability, but all coefficients show the opposite signs of the results when gross debt is utilized in the regression equation.

To conclude, the fiscal sustainabilty of each country shows a few differences when we utilize net debt instead of gross debt even though both cases show a similar level of sustainability collectively. Furthermore, the results of the determinant analysis show that the use of net debt might provide misleading implications. One possible explanation could be the limitation of net financial liabilities which are utilized as the concept of net debt. Net financial liabilities cannot give exact figures for net debt because this concept cannot consider real assets such as military assets or historical assets (e.g., Buckingham Palace). Another possible explanation could be that fiscal policymakers do not seem to be affected by net debt when determining a fiscal stance in practice. For example, the countries with a negative net debt-GDP ratio will not decide their fiscal stance according to the variation of net-debt. This could be because the amount of the total debt is the main interest of politicians and voters since assets cannot be utilized immediately in a crisis due to low liquidity.

Table 3.11 The main determinants of fiscal sustainability (utilizing net debt)

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) FE | (2) FE | (3) GMM | (4) GMM | (5) FE 2SLS | (6) FE 2SLS |
| $d_{t-1}$ | 0.121 | 0.172 | 0.161 | 0.215 | 5.830** | 3.732*** |
| | (0.72) | (1.07) | (0.97) | (1.24) | (2.25) | (2.94) |
| GVAR | -1.152*** | -1.150*** | -1.166*** | -1.163*** | -0.928*** | -1.029*** |
| | (-12.77) | (-12.71) | (-14.16) | (-13.98) | (-5.11) | (-8.39) |
| YVAR | -0.680*** | -0.693*** | -0.717*** | -0.734*** | -1.433*** | -0.966*** |
| | (-6.10) | (-6.46) | (-6.93) | (-7.23) | (-3.26) | (-4.17) |
| $s_{t-1}$ | 0.658*** | 0.657*** | 0.652*** | 0.649*** | 0.681*** | 0.718*** |
| | (15.62) | (15.96) | (15.18) | (15.52) | (12.81) | (15.05) |
| GROWTH*$d_{t-1}$ | -0.002 | | -0.002 | | -0.007*** | |
| | (-1.30) | | (-1.27) | | (-2.62) | |
| IRL*$d_{t-1}$ | 0.002* | | 0.002* | | -0.011* | |
| | (1.84) | | (1.82) | | (-1.79) | |
| GAP*$d_{t-1}$ | | -0.002 | | -0.002 | | -0.001 |
| | | (-1.56) | | (-1.62) | | (-1.37) |
| INIDEBT*$d_{t-1}$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| | (0.76) | (0.75) | (0.63) | (0.66) | (1.15) | (1.02) |
| AVEDEBT*$d_{t-1}$ | -0.000 | 0.000 | 0.000 | 0.000 | -0.002* | -0.002** |
| | (-0.02) | (0.03) | (0.14) | (0.16) | (-1.77) | (-2.04) |
| AVEBALANCE *$d_{t-1}$ | -0.009*** | -0.009** | -0.009*** | -0.009** | 0.006 | -0.009 |
| | (-2.96) | (-2.33) | (-2.64) | (-2.09) | (0.55) | (-1.4) |
| GDPPC*$d_{t-1}$ | -0.010 | -0.014 | -0.014 | -0.018 | -0.563** | -0.376*** |
| | (-0.57) | (-0.84) | (-0.75) | (-1.00) | (-2.24) | (-2.91) |
| OPEN*$d_{t-1}$ | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.002*** | 0.001*** |
| | (3.22) | (3.21) | (3.03) | (3.13) | (2.65) | (3.43) |
| OLD*$d_{t-1}$ | -0.000 | -0.001 | 0.000 | -0.001 | 0.002 | 0.006** |
| | (-0.46) | (-0.59) | (-0.40) | (-0.48) | (0.99) | (2.17) |
| POLCON*$d_{t-1}$ | -0.049 | -0.05 | -0.049 | -0.049 | -0.082 | -0.073* |
| | (-1.24) | (-1.25) | (-1.17) | (-1.16) | (-1.62) | (-1.85) |
| RULE*$d_{t-1}$ | 0.007 | 0.006 | 0.006 | 0.005 | 0.033** | 0.049*** |
| | (1.37) | (1.34) | (1.12) | (1.11) | (2.25) | (2.98) |
| F (Wald) | 1013.06*** | 575.36*** | 10270.39*** | 8587.08*** | 555.59*** | 881.77*** |
| $R^2$ | 0.761 | 0.762 | - | - | 0.252 | 0.333 |
| Hausman $chi^2$ | - | - | - | - | 5.05 | 8.29 |
| No. of Obs. | 578 | 578 | 554 | 554 | 557 | 557 |
| No.of Groups | 24 | 24 | 24 | 24 | 24 | 24 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the net debt-GDP ratio, GVAR is the temporary increase in government expenditure, YVAR is the temporary variation in the business cycle, GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between growth rate and interest rate, OPEN is trade openness, INIDEBT is initial net debt, AVEDEBT is average net debt, AVEBANANCE is the average primary balance, GDPPC is log of income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.
(2) Regression methods are Fixed effects model (FE) with robust standard errors in regression (1)-(2), Generalised Method of Moments (GMM) with robust standard errors in regression (3)-(4), and Fixed effects 2SLS Instrumental variables estimation (FE 2SLS) in regression (5)-(6).
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, UN World Population Prospects (The 2010 revision), Henisz database (2010), and IMF fiscal rules database (2009).

### (2) EMU countries

This chapter already examined the level of fiscal sustainability of EMU countries in section 3.3.1. We can see from the results that the fiscal finances of most EMU countries are sustainable except Greece, and these results can also be verified by the results when we examine the fiscal sustainability of 12 EMU countries collectively.

Now, we explore the determinants of fiscal sustainability by analysing a sample of 12 EMU countries with special reference to the role of introducing the SGP rules. Estimation (1) and (2) are based on the application of the Fixed effects model (FE) to consider the heterogeneity of each country. All coefficients of control variables, except initial debt-GDP ratio (INIDEBT), have the same sign as the baseline analysis of Table 3.5, although the degree of statistical significance is different in most variables. The results also show that average debt-GDP ratio (AVEDEBT), income per capita (GDPPC), and fiscal rules (RULE) play a role in the level of fiscal sustainability. These results could be generally confirmed by the results of GMM estimation (regression (3) and (4)). However, the results show a few differences compared with the results of all OECD countries of baseline estimation in Table 3.5. First, growth rate (GROWTH) and the gap between growth rate and interest rate (GAP), which are significant in our basic estimation, do not seem to have any role to maintain a sustainable fiscal policy. This could be because the distribution of economic growth in EMU countries is relatively even rather than that of whole OECD countries which are utilized in the baseline estimation of Table 3.5[115]. Second, fiscal rules (Rule) play a role in maintaining a sustainable fiscal policy.

What one should note is that fiscal rules, which was not significant in our baseline estimation of 26 OECD countries, could play a role in maintaining sustainable fiscal policy in 12 EMU countries. Also, the coefficients of the fiscal rules in Table 3.12 are larger than those of fiscal rules in Table 3.5. The coefficient of interaction term for fiscal rules and the lag value of the debt-GDP ratio is 0.008, which indicates that the adoption of fiscal rules could increase the level of fiscal sustainability by 0.008 on average. This amount indicates that governments respond

115. The standard deviation of GDP growth of 12 EMU countries is 4.52 while that of 26 OECD countries in 5.18.

a one percentage point increase in the debt-GDP ratio by raising the primary budget balance additionally 0.008 percentage points when fiscal rules are introduced.

This could be interpreted that fiscal rules, including the Stability and Growth Pact (SGP) rules, play a certain role for EMU countries to maintain fiscal sustainability[116]. This could be because the fiscal rules of EMU countries have more enforceability than those of other OECD countries. The violaion of the SGP rules is acoompanied by the imposition of penalties from EMU such as public recommendations and financial sanctions, which is different from the violation of other fiscal rules. These results are consistent with the existing literature (Alesina, 2010) which argues that fiscal rules could help achieve fiscal sustainability only when a credible punishment is followed. However, these results do not deny the need for modification of the SGP rules in a way that could enable fiscal finances to become more sustainable, since the size of the effect is not strong in our estimation. This could be rationalized by some literature which shows the SGP rules cannot guarantee fiscal sustainability. Greiner and Semmler (2001) analyse the effect of the Maastricht Criteria on the fiscal sustainability of German fiscal policy, and they show that the criteria of EMU do not guarantee the fiscal sustainability automatically, even though the latter is the prerequisite of successful EMU. Buiter and Grafe (2004) argue that the SGP rules are not well designed to guarantee fiscal sustainability since the SGP rules are myopic and backward-looking. Wyplosz (2012) argues that the SGP rules are not sufficient to ensure fiscal sustainability since they are not supported by effective institutional arrangements.

116. The period during when fiscal rules are adopted and the period during when the SGP rules are adopted are the same in our dataset. This implies that the results will be same when we replace the dummy for fiscal rules into the dummy for the SGP rules.

Table 3.12 The main determinants of fiscal sustainability (EMU countries)

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) FE | (2) FE | (3) GMM | (4) GMM | (5) FE 2SLS | (6) FE 2SLS |
| $d_{t-1}$ | -0.434*** | -0.470*** | -0.412*** | -0.431*** | 0.285 | 0.890 |
| | (-3.34) | (-5.54) | (-2.84) | (-4.18) | (0.49) | (1.19) |
| GVAR | -1.266*** | -1.268*** | -1.253*** | -1.255*** | -2.177 | -0.595 |
| | (-24.09) | (-25.49) | (-25.72) | (-27.35) | (-1.12) | (-0.40) |
| YVAR | -0.337** | -0.313** | -0.337*** | -0.330*** | 2.636 | -2.001 |
| | (-2.67) | (-2.75) | (-2.92) | (-3.20) | (0.39) | (-0.58) |
| $s_{t-1}$ | 0.557*** | 0.551*** | 0.550*** | 0.540*** | -9.903 | 6.483 |
| | (8.66) | (9.56 ) | (8.90) | (9.28) | (-0.47) | (0.45) |
| GROWTH*$d_{t-1}$ | 0.001 | | 0.001 | | 0.007 | |
| | (1.08) | | (1.38) | | (0.50) | |
| IRL*$d_{t-1}$ | -0.001 | | -0.001 | | 0.004 | |
| | (-0.80) | | (-0.76) | | (0.38) | |
| GAP*$d_{t-1}$ | | 0.001 | | 0.001 | | -0.001 |
| | | (1.25) | | (1.41) | | (-0.27) |
| INIDEBT*$d_{t-1}$ | -0.000 | -0.000 | -0.000 | -0.000 | 0.000 | 0.000 |
| | (-0.38) | (-0.34) | (-0.19) | (-0.09) | (-0.26) | (-0.44) |
| AVEDEBT*$d_{t-1}$ | 0.001** | 0.001*** | 0.001** | 0.001*** | 0.006 | -0.003 |
| | (2.71) | (3.40) | (2.05) | (2.78) | (0.58) | (-0.32) |
| AVEBALANCE *$d_{t-1}$ | 0.007 | 0.006 | 0.006 | 0.006 | 0.168 | -0.115 |
| | (1.49) | (1.52) | (1.54) | (1.41) | (0.47) | (-0.46) |
| GDPPC*$d_{t-1}$ | 0.040** | 0.043*** | 0.039** | 0.041*** | 0.989 | -0.664 |
| | (2.76) | (4.38) | (2.44) | (3.53) | (0.47) | (-0.46) |
| OPEN*$d_{t-1}$ | -0.000 | -0.000* | -0.000 | -0.000 | -0.005 | 0.003 |
| | (-1.37) | (-1.80) | (-0.46) | (-0.48) | (-0.46) | (0.47) |
| OLD*$d_{t-1}$ | -0.001 | -0.001 | -0.001* | -0.001** | -0.015 | 0.014 |
| | (-1.21) | (-1.05) | (-1.94) | (-1.98) | (-0.47) | (0.46) |
| POLCON*$d_{t-1}$ | -0.002 | -0.001 | -0.001 | 0.001 | 0.008 | -0.02 |
| | (-0.22) | (-0.08) | (-0.09) | (0.09) | (0.14) | (-0.35) |
| RULE*$d_{t-1}$ | 0.008** | 0.008** | 0.007** | 0.006** | 0.007 | 0.020 |
| | (2.25) | (2.51) | (2.40) | (2.31) | (0.53) | (0.73) |
| F (Wald) | - | - | 97348.82*** | 71018.73*** | 125.35*** | 188.63*** |
| $R^2$ | 0.518 | 0.510 | - | - | 0.179 | 0.009 |
| Hausman $chi^2$ | - | - | - | - | 0.25 | 0.31 |
| No. of Obs. | 282 | 282 | 269 | 269 | 271 | 271 |
| No.of Groups | 12 | 12 | 12 | 12 | 12 | 12 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GVAR is the temporary increase in government expenditure, YVAR is the temporary variation in the business cycle, GROWTH is the growth rate, IRL is the interest rate, GAP is the gap between growth rate and interest rate, OPEN is trade openness, INIDEBT is initial debt, AVEDEBT is average debt, AVEBANANCE is the average primary balance, GDPPC is log of income per capita, OLD is the old-age dependency ratio, POLCON is a power dispersion index, and RULE is a dummy variable for fiscal rules.
(2) Regression methods are Fixed effects model (FE) with robust standard errors in regression (1)-(2), Generalised Method of Moments (GMM) with robust standard errors in regression (3)-(4), and Fixed effects 2SLS Instrumental variables estimation (FE 2SLS) in regression (5)-(6).
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, UN World Population Prospects (The 2010 revision), Henisz database (2010), and IMF fiscal rules database (2009).

## 4. Conclusion and policy implications

Our main results can be summarized as follow. First, we find that most OECD countries seem to operate their fiscal policy in a sustainable way while some countries such as Greece, Iceland, New Zealand, and Slovakia have suffered from unsustainable fiscal finances, which is consistent with the existing literature and current fiscal situation. Second, it could be seen that a number of factors play an important role in determining fiscal sustainability. The growth rate has a positive effect on fiscal sustainability while aging populations have a negative effect. The countries with high income per capita tend to be more likely to have sustainable fiscal finances. Finally, the SGP rules appear to have helped governments maintain fiscal sustainability in EMU countries, although other fiscal rules may not play any role in maintaing fiscal sustainability in OECD countries due to the lack of enforceability when they are violated.

To conclude, our findings indicate that governments could operate their fiscal finances in a sustainable way even under continuous budget deficit and debt accumulation, if the economy keeps growing and the government have a good quality of fiscal institutions. Our findings also show that advanced countries are more likely to maintain sustainable fiscal finances. Our findings, therefore, imply that the best solution might be a stable and sustained economic growth. In addition, policymakers should make an effort to find solutions to alleviate future spending pressure such as ageing population related spending.

Fiscal sustainability is essential for the success of economic development strategy (Buiter, 2004). It could be functioned as the last resort which the government could rely on when the economy is in crisis. The government, therefore, should operate their fiscal policy in a sustainable way to respond to the business cycle and to invest public capital for supporting sustained economic growth. This is because it is not easy to recover fiscal sustainability once the budget deficit and government debt start to increase, since fiscal policy has inertial properties as confirmed in our analysis. The process of budget consolidation, which aims to improve fiscal sustainability, should be as transparent as possible and stick to a clear

message (Henriksson, 2007). Well organized fiscal rules could be one solution to persuade tax payers. Afonso and Schuknecht (2008) show that fiscal rules could help eliminate the deficit biases in the fiscal policy making process. Bi and Leeper (2010) argue that fiscal reform, such as an expenditure ceiling and budget surplus target, could decrease the possibility of default by reducing the risk premium of debt. What one should note is that fiscal rules should be set to be easy for the government to follow and should be embedded in instituitonal arrangements to confirm the enforceability. OECD (2002) argues that fiscal rules should be credible, flexible, and transparent to be implemented appropriately in practice. Wyplosz (2012) argues that fiscal rules are not sufficient to ensure fiscal sustainability if supporting institutions are not followed. The fiscal responsibility act or independent fiscal policy committees similar to independent central bank could be one possible solution to confirm the enforceability of fiscal rules. It can decide the expenditure or borrowing limit independently, and therefore it could enable governments to avoid political distortion (Calmfors and Wren-Lewis, 2011; Fatás, 2010; Bi and Leeper, 2010; Coeure and Pisani-Ferry, 2005; Wyplosz, 2005; Eichengreen, Hausmann, and von Hagen, 1996).

The contribution of this chapter is that it could provide the basis of research about the determinants of fiscal sustainability which has been ignored in the existing literature. Our analysis provides empirical evidence that economic growth and the level of development could help strengthen fiscal sustainability, and it could also provide the structure of fiscal rules to improve fiscal sustainability. Our results imply that fiscal rules with enforceability, such as the SGP rules, could strengthen the sustainability of fiscal finances. Also, our analysis employs the concept of net debt which also has not been dealt with in the existing literature even though we failed to provide reliable evidence.

However, our analysis has several limitations. First, our analysis tests the fiscal sustainability of the past period historically, but one cannot assure whether the positive response of the government will be continue in the future. Fiscal sustainability is not a problem of the past only but a problem of infinite horizon including the past, the present, and the future altogether. It can be described as the question of whether the current fiscal stance will be maintained in the future on the

basis of the current economic structure and the forecasting of the future economic structure. Aging populations related expenditure might be a good example. Fiscal policy might be unsustainable although the government maintains a sustainable fiscal stance at present because the expenditure of pension and health care will increase automatically in the future. Second, the measurement of debt is another difficult issue. The scope of government debt is considerably different in most countries even though many countries compile government debt statistics according to the Government Finance Statistics (GFS) manual which is composed by IMF. Therefore, the manipulation of publicly published statistics should be performed in empirical works very carefully to coincide with the scope of debt across each country[117]. In addition, one should consider implicit debt such as public pension liability which has been generally neglected in the existing literature[118]. Some literature argues that one needs not to consider implicit debt because the government can pay off without financial burden through continuous reform (Coeure and Pisani-Ferry, 2005; Franco, Marino, and Zotteri, 2004). However, it will finally result in real liabilities of the government if the reform does not satisfy necessary condition. OECD (2002) also recommends that future contingent liabilities about age-relating spending should be considered when one assesses fiscal sustainability. Future studies are needed in these fields.

117. Buiter (2004) and Buiter and Grafe (2004) even argue that one should consider non-monetary net financial debt of the consolidated general government and central bank since the fiscal authority is the last resort that stands behind the central bank. Dias, Richmond, and Wright (2011) suggest a new measure of government debt which is invariant to contractual form since face values of government debt could be a misleading indicator due to different contractual form.

118. Valderrama (2005) estimates the fiscal sustainability of Korea and Thailand in the presence of contingent liabilities. The author adds a private credit expansion variable into Bohn's (1998) reaction function to proxy for contingent liabilities. The results show that fiscal sustainability is not related to the presence of credit expansion in Korea, while it seems to become worse in Thailand.

# Appendix 3

Table3A.1 Estimation period

| | Regression when using gross debt | | Regression when using net debt | |
|---|---|---|---|---|
| | No.of Obs. | Period | No.of Obs. | Period |
| Australia | 20 | 1988-2008 | 20 | 1988-2008 |
| Austria | 38 | 1970-2008 | 28 | 1980-2008 |
| Belgium | 38 | 1970-2008 | 38 | 1970-2008 |
| Canada | 38 | 1970-2008 | 38 | 1970-2008 |
| Denmark | 26 | 1980-2006 | 26 | 1980-2006 |
| Finland | 33 | 1975-2008 | 33 | 1975-2008 |
| France | 30 | 1978-2008 | 30 | 1978-2008 |
| Germany | 15 | 1991-2006 | 15 | 1991-2006 |
| Greece | 9 | 1995-2004 | 9 | 1995-2004 |
| Iceland | 10 | 1998-2008 | 10 | 1998-2008 |
| Ireland | 9 | 1998-2007 | 9 | 1998-2007 |
| Italy | 37 | 1970-2007 | 37 | 1970-2007 |
| Japan | 37 | 1970-2007 | 37 | 1970-2007 |
| Korea | 32 | 1975-2007 | 32 | 1975-2007 |
| Luxembourg | 11 | 1995-2006 | - | - |
| Netherlands | 38 | 1970-2008 | 38 | 1970-2008 |
| New Zealand | 14 | 1993-2007 | 14 | 1993-2007 |
| Norway | 37 | 1970-2007 | 28 | 1979-2007 |
| Poland | 12 | 1995-2007 | 12 | 1995-2007 |
| Portugal | 13 | 1995-2008 | 13 | 1995-2008 |
| Slovakia | 13 | 1995-2008 | 13 | 1995-2008 |
| Spain | 20 | 1987-2007 | 20 | 1987-2007 |
| Sweden | 38 | 1970-2008 | 38 | 1970-2008 |
| Switzerland | 17 | 1990-2008 | - | - |
| UK | 34 | 1970-2004 | 34 | 1970-2004 |
| USA | 38 | 1970-2008 | 38 | 1970-2008 |
| No. of countries | 26 | | 24 | |
| Mean of Obs. | 25.27 | | 25.42 | |

Table 3A.2 The fiscal sustainability of OECD countries across countries (Robust estimation)

| | Debt ratio $_{t-1}$ | t | GVAR | t | YVAR | t | Balance $_{t-1}$ | t | Obs. | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **EMU countries (12)** | | | | | | | | | | |
| Austria | 0.01 | 1.65 | -1.10*** | -4.99 | -0.80** | -2.29 | 0.63*** | 6.53 | 38 | 0.71 |
| Belgium | 0.04*** | 4.95 | -1.39*** | -7.28 | 0.09 | 0.25 | 0.75*** | 14.58 | 38 | 0.95 |
| France | 0.01 | 1.48 | -1.42*** | -3.66 | -0.45 | -1.12 | 0.43*** | 3.10 | 30 | 0.66 |
| Finland | 0.03 | 1.34 | -1.50** | -2.22 | -0.26 | -0.41 | 0.74*** | 6.28 | 33 | 0.74 |
| Germany | 0.04* | 1.86 | -1.33*** | -8.81 | -1.59** | -2.42 | 0.12 | 1.01 | 15 | 0.90 |
| Greece | -0.07 | -0.93 | -0.52 | -1.77 | 0.94 | 0.38 | 0.44 | 1.56 | 9 | 0.94 |
| Ireland | 0.09 | | -2.07 | | -0.00 | | 0.76 | | 6 | 1.00 |
| Italy | 0.06*** | 3.45 | -0.86** | -2.31 | -0.33 | -0.68 | 0.62*** | 6.02 | 37 | 0.91 |
| Luxembourg | 1.14*** | 4.47 | -0.88** | -2.53 | -1.18** | -2.88 | 0.23 | 1.62 | 11 | 0.93 |
| Netherlands | 0.00 | 0.29 | -1.27*** | -5.72 | -0.26 | -0.53 | 0.57*** | 4.96 | 38 | 0.66 |
| Portugal | 0.04 | 0.79 | -1.26* | -2.35 | -0.46 | -0.87 | 0.40** | 2.49 | 12 | 0.60 |
| Spain | 0.01 | 0.45 | -0.46 | -1.12 | 0.40 | 0.92 | 0.92*** | 8.65 | 19 | 0.85 |
| Mean | 0.12 | | -1.17 | | -0.33 | | 0.55 | | 23.8 | |
| S.D. | 0.32 | | 0.44 | | 0.67 | | 0.24 | | 12.9 | |
| **Other Advanced European countries (7)** | | | | | | | | | | |
| Denmark | 0.03 | 0.75 | -1.18** | -2.25 | -1.41 | -1.70 | 0.60*** | 5.07 | 26 | 0.81 |
| Iceland | 0.23 | 0.78 | -2.53 | -1.73 | -1.24 | -1.08 | 0.01 | 0.03 | 9 | 0.93 |
| Norway | 0.18*** | 3.70 | -1.25*** | -4.18 | -0.09 | -0.12 | 0.75*** | 9.23 | 37 | 0.85 |
| Slovakia | -0.10 | -0.99 | -1.35*** | -4.67 | 0.80 | 0.59 | 0.20 | 0.82 | 13 | 0.75 |
| Sweden | 0.04** | 2.32 | -0.69*** | -3.58 | -0.85* | -1.92 | 0.83*** | 11.01 | 38 | 0.86 |
| Switzerland | 0.09*** | 5.82 | -0.73** | -2.83 | -1.66*** | -3.23 | 0.27** | 2.30 | 17 | 0.91 |
| UK | 0.02 | 0.56 | -1.07*** | -2.84 | 0.10 | 0.19 | 0.55*** | 4.81 | 34 | 0.69 |
| Mean | 0.07 | | -1.26 | | -0.62 | | 0.46 | | 24.9 | |
| S.D. | 0.11 | | 0.61 | | 0.91 | | 0.30 | | 12.0 | |
| **Other Advanced non-European countries (6)** | | | | | | | | | | |
| Australia | 0.03 | 0.94 | -0.90 | -0.98 | 0.14 | 0.13 | 0.82*** | 4.95 | 20 | 0.77 |
| Canada | 0.05*** | 5.59 | -1.29*** | -4.85 | -0.58 | -1.54 | 0.72*** | 14.17 | 38 | 0.94 |
| Japan | 0.00 | 0.34 | -1.65*** | -5.35 | -1.02 | -1.48 | 0.84*** | 9.71 | 37 | 0.83 |
| Korea | -0.00 | -0.15 | -1.12*** | -6.57 | -0.85*** | -3.11 | 0.47*** | 4.49 | 32 | 0.73 |
| New Zealand | -0.03 | -1.26 | -1.29** | -3.04 | -1.84** | -2.28 | 0.31 | 1.37 | 14 | 0.75 |
| USA | 0.05** | 3.02 | -1.42*** | -2.98 | -1.49*** | -3.81 | 0.65*** | 7.59 | 38 | 0.81 |
| Mean | 0.02 | | -1.28 | | -0.94 | | 0.64 | | 29.8 | |
| S.D. | 0.03 | | 0.26 | | 0.70 | | 0.21 | | 10.4 | |
| **Emerging Market countries (1)** | | | | | | | | | | |
| Poland | -0.00 | -0.01 | 0.33 | 0.45 | -2.41 | -1.21 | 0.02 | 0.02 | 12 | 0.60 |
| **All countries (26)** | | | | | | | | | | |
| Mean | 0.08 | | -1.16 | | -0.63 | | 0.51 | | 25.0 | |
| S.D. | 0.23 | | 0.53 | | 0.83 | | 0.26 | | 12.0 | |
| MAX | 1.14 | | 0.33 | | 0.94 | | 0.84 | | 38 | |
| MIN | -0.10 | | -2.53 | | -2.41 | | 0.01 | | 6 | |

Note: (1) Dependent variable is the primary budget balance to GDP ratio ($s_t$)
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

Table 3A.3 The fiscal sustainability of OECD countries across countries (Original Bohn's model)

| | Debt ratio$_{t-1}$ | t | GVAR | t | YVAR | t | Obs. | $R^2$ |
|---|---|---|---|---|---|---|---|---|
| **EMU countries (12)** | | | | | | | | |
| Austria | 0.01 | 1.00 | -1.04*** | -4.18 | -0.96** | -2.62 | 38 | 0.36 |
| Belgium | 0.10*** | 11.20 | -1.33** | -2.09 | -0.21 | -0.24 | 38 | 0.63 |
| France | 0.02** | 2.36 | -1.70*** | -4.82 | -0.87** | -2.17 | 30 | 0.56 |
| Finland | -0.04 | -1.45 | -0.95 | -0.78 | -1.96 | -1.55 | 33 | 0.39 |
| Germany | 0.05** | 2.84 | -1.30*** | -14.06 | -1.80*** | -3.77 | 15 | 0.89 |
| Greece | -0.11 | -1.25 | -0.53 | -1.47 | 2.68 | 1.33 | 9 | 0.92 |
| Ireland | 0.11*** | 13.90 | -1.74*** | -9.55 | -1.39*** | -4.57 | 9 | 0.97 |
| Italy | 0.16*** | 9.49 | -0.61 | -1.29 | 0.18 | 0.28 | 37 | 0.83 |
| Luxembourg | 0.82* | 2.07 | -1.12** | -2.44 | -1.19** | -2.68 | 11 | 0.83 |
| Netherlands | 0.01 | 0.48 | -1.18*** | -6.65 | -1.15* | -1.85 | 38 | 0.44 |
| Portugal | -0.06 | -0.96 | -1.96*** | -3.94 | -0.23 | -0.36 | 13 | 0.69 |
| Spain | 0.04 | 1.04 | -0.66 | -1.18 | -1.30 | -1.04 | 20 | 0.14 |
| Mean | 0.09 | | -1.18 | | -0.68 | | 24.25 | |
| S.D. | 0.24 | | 0.46 | | 1.24 | | 12.47 | |
| **Other Advanced European countries (7)** | | | | | | | | |
| Denmark | -0.02 | -0.47 | -1.88** | -2.20 | -3.02*** | -3.60 | 26 | 0.60 |
| Iceland | 0.01 | 0.28 | -1.26*** | -24.02 | -1.61*** | -3.58 | 10 | 0.98 |
| Norway | 0.31*** | 3.20 | -2.07*** | -3.25 | -2.16* | -1.71 | 37 | 0.45 |
| Slovakia | -0.14* | -1.85 | -1.33*** | -6.28 | 1.40* | 2.22 | 13 | 0.77 |
| Sweden | -0.04 | -1.29 | -0.92 | -1.54 | -2.56** | -2.71 | 38 | 0.38 |
| Switzerland | 0.11*** | 8.03 | -0.90** | -2.86 | -2.91*** | -4.78 | 17 | 0.81 |
| UK | 0.02 | 0.42 | -1.88*** | -5.20 | 0.22 | 0.32 | 34 | 0.45 |
| Mean | 0.04 | | -1.46 | | -1.52 | | 25.00 | |
| S.D. | 0.14 | | 0.48 | | 1.69 | | 11.75 | |
| **Other Advanced non-European countries (6)** | | | | | | | | |
| Australia | -0.04 | -1.38 | -1.02 | -0.75 | -3.02* | -1.82 | 20 | 0.47 |
| Canada | 0.12*** | 5.52 | -1.43** | -2.31 | -0.95 | -1.09 | 38 | 0.58 |
| Japan | -0.03*** | -3.39 | -1.28** | -2.43 | -2.05 | -1.46 | 37 | 0.31 |
| Korea | -0.03 | -0.98 | -0.96*** | -4.47 | -1.09*** | -3.43 | 32 | 0.51 |
| New Zealand | -0.04* | -2.09 | -1.31*** | -3.37 | -2.54*** | -5.02 | 14 | 0.73 |
| USA | 0.04** | 2.05 | -2.44*** | -3.44 | -1.45*** | -3.21 | 38 | 0.49 |
| Mean | 0.00 | | -1.41 | | -1.85 | | 29.83 | |
| S.D. | 0.06 | | 0.54 | | 0.83 | | 10.36 | |
| **Emerging Market countries (1)** | | | | | | | | |
| Poland | 0.00 | 0.03 | 0.33* | 1.89 | -2.44*** | -4.17 | 12 | 0.69 |
| **All countries (26)** | | | | | | | | |
| Mean | 0.05 | | -1.25 | | -1.25 | | 25.27 | |
| S.D. | 0.18 | | 0.57 | | 1.35 | | 11.64 | |
| MAX | 0.82 | | 0.33 | | 2.68 | | 38 | |
| MIN | -0.14 | | -2.44 | | -3.02 | | 9 | |

Note: (1) Dependent variable is the primary budget balance to GDP ratio ($s_t$)
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

## Table 3A.4 The fiscal sustainability of OECD countries across country groups (GMM)

Dependent Variable : the primary budget balance to GDP ratio ($s_t$)

| | All countries | | EMU | | Other European | | Other non-European | |
|---|---|---|---|---|---|---|---|---|
| | (DIF) | (SYS) | (DIF) | (SYS) | (DIF) | (SYS) | (DIF) | (SYS) |
| $d_{t-1}$ | 0.027** | 0.004 | 0.030*** | 0.006** | 0.039*** | 0.010 | 0.008 | -0.000 |
| | (2.50) | (1.27) | (5.27) | (2.05) | (2.53) | (0.54) | (1.17) | (-0.08) |
| GVAR | -1.248*** | -1.053*** | -1.171*** | -1.178*** | -1.215*** | -0.912*** | -1.383*** | -1.388*** |
| | (-17.47) | (-11.02) | (-10.28) | (-8.15) | (-10.27) | (-10.53) | (-14.92) | (-14.88) |
| YVAR | -0.510*** | -0.426*** | -0.379*** | -0.222* | -0.564*** | -0.530** | -0.762*** | -0.751*** |
| | (-4.61) | (-3.61) | (-3.64) | (-1.77) | (-2.93) | (-2.41) | (-3.33) | (-3.19) |
| $s_{t-1}$ | 0.730*** | 0.814*** | 0.713*** | 0.794*** | 0.713*** | 0.801*** | 0.792*** | 0.851*** |
| | (22.30) | (23.45) | (18.40) | (16.78) | (11.71) | (13.26) | (18.29) | (25.36) |
| F (Wald) | 1925.57*** | 1012.53*** | 1317.03*** | 722.66*** | 1829.91*** | 506.88*** | 2058.26*** | 3413.18*** |
| Hansen | 18.58 | 20.35 | 10.24 | 7.70 | 3.55 | 1.82 | 0.40 | 0.07 |
| No. of Obs. | 631 | 657 | 279 | 291 | 168 | 175 | 173 | 179 |
| No.of Groups | 26 | 26 | 12 | 12 | 7 | 7 | 6 | 6 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, GVAR is the temporary increase in government expenditure, and YVAR is the temporary variation in the business cycle.
(2) Regression methods are Generalised Method of Moments (GMM) with robust standard errors. DIF is the difference GMM and SYS is the system GMM.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.Source: OECD Economic Outlook Database No.86.

## Table 3A.5 The fiscal sustainability of OECD countries - FE 2SLS Estimation (utilizing net debt)

Dependent Variable : the primary budget balance to GDP ratio ($s_t$)

| | All countries | EMU | Other European | Other non-European |
|---|---|---|---|---|
| $d_{t-1}$ | 0.019*** | 0.040*** | -0.011 | 0.017*** |
| | (5.45) | (8.26) | (-1.05) | (3.71) |
| GVAR | -1.249*** | -1.224*** | -1.286*** | -1.382*** |
| | (-21.19) | (-14.42) | (-11.61) | (-10.30) |
| YVAR | -0.438*** | -0.426*** | -0.440 | -0.832*** |
| | (-3.58) | (-2.79) | (-1.48) | (-4.12) |
| $s_{t-1}$ | 0.747*** | 0.671*** | 0.677*** | 0.797*** |
| | (37.74) | (23.01) | (13.72) | (24.15) |
| Wald | 2329.71*** | 1321.21*** | 557.11*** | 805.51*** |
| $R^2$ | 0.753 | 0.635 | 0.758 | 0.843 |
| Hausman $chi^2$ | 13.47*** | 33.75*** | - | 3.00 |
| No. of Obs. | 586 | 259 | 143 | 173 |
| No.of Groups | 24 | 11 | 6 | 6 |

Note: (1) $s_t$ is the primary budget balance-GDP ratio, $d_t$ is debt-GDP ratio, GVAR is the temporary increase in government expenditure, and YVAR is the temporary variation in the business cycle.
(2) Regression methods are Fixed effects 2SLS Instrumental variables estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

# Chapter 4

# The effect of fiscal procyclicality and sustainability on economic growth

# 1. Introduction

One of the most important objectives of fiscal policy in modern economies is to conduct a cyclical stabilization over a business cycle in the short term and to maintain fiscal sustainability in the long term (Wyploz, 2005). The SGP rules, which are the compulsory criterion that EU member countries have to abide by, also target macroeconomic stability and fiscal sustainability as the main objectives (Buiter, 2004; Buiter and Grafe, 2004). The argument about reform of the SGP rules in the mid-2000s also mainly focused on enhancing both goals.

However, it is not easy to obtain both macroeconomic stability and fiscal sustainability simultaneously. Fiscal policy tends to be procyclical rather than countercyclical in a large number of countries because of credit constraints, political constraints, and weak fiscal instruments as argued in chapter 2. The sustainability of fiscal finances are also difficult to achieve due to the increasing spending pressures from political competition, an aging society, and economic crisis as stated in chapter 3. Moreover, to obtain both countercyclical fiscal policy and sustainable fiscal finances at the same time could be conflicting in practice[119]. Countercyclical fiscal policy is one of the most important economic policy tools which can be utilized by governments when the economy is in recessions, but the risk of deteriorating fiscal sustainability arising from countercyclical fiscal stimulus packages has been recognized by policymakers and economists.

This thesis dealt with the issue of the macroeconomic stabilization function of fiscal policy in chapter 2 and the issue of the fiscal sustainability in chapter 3. This chapter deals with how these two main objectives of fiscal policy affect economic growth. These arguments will verify the rationale of a countercyclical and sustainable fiscal policy if sustained economic growth is assumed to be ultimate objective of economic policy. This chapter firstly explores the effect of fiscal

119. Huart (2011) argues that fiscal stabilization and fiscal sustainability could be contradictory if fiscal policy causes a deficit bias. Coeure and Pisani-Ferry (2005) also argue that fiscal sustainability and macro stabilization could be contradictory by examining the role of the SGP rules on debt sustainability and macroeconomic stability in EMU countries even though to achieve both at the same time depends on the initial fiscal position and the position in the business cycle.

procyclicality on economic growth which is recently starting to be studied in the literature. We specially focus on analysing the effect of the cyclical properties of fiscal policies on economic growth across spending categories, which has been ignored in the existing literature. We find that the composition of government spending plays a key role in its effects on economic growth. More specifically, procyclical government consumption and current transfers, which is assumed to be unproductive, could have a negative effect on economic growth while procyclical government investment, which is considered to be productive, does not hinder economic growth. We also focus on analysing the effect of the cyclical properties of fiscal policies on economic growth across country groups for the first time. We find that negative effect of procyclical fiscal policy is prominent in emerging market countries than in advanced countries. This chapter also assesses the effect of fiscal sustainability on economic growth, which has also been ignored in the existing literature. The relationship between fiscal procyclicality and sustainability is also examined to assess the channel through which fiscal sustainability affects economic growth. We find that the sustainability of fiscal finances do not seem to play any role in economic growth in tranquil times even though it could lead to sudden economic crisis.

The remainder of this chapter is organized as follows: Section 2 provides the empirical evidence on the above topics in the existing literature. Section 3 contains the empirical analysis on the effect of both fiscal procyclicality and sustainability on economic growth. Finally, this chapter ends with some concluding remarks and policy implications.

## 2. The existing empirical evidence

## 2.1. The effect of fiscal procyclicality on economic growth

One of the most controversial issues about economic policy is whether fiscal policy has an effect on the real economy or not. Keynesian models have a clear view that fiscal policy should be operated in a countercyclical pattern to stabilize the variation of the economy because they assume that the economy has an inherent unstable property, while neoclassical models argue that the government should not try to fine tune economy because they assumes that the economy is naturally stable (Mankiw, 1997). Empirical literature has also suggested different results, but it generally shows that productive government expenditure could have a positive effect on long term growth [120]. Nijkamp and Poot (2004) report that government expenditures on education and infrastructure play a role in economic growth even though the effects of conventional fiscal policy on economic growth are weak through the meta analyses of 93 published empirical studies.

The effect of fiscal policy on economic growth is not purely academic as argued by Aghion and Marinescu (2007). The question of whether the cyclical properties of fiscal policy could have an effect on economic growth is also not purely academic. Recently, a number of papers have attempted to assess the effect of the cyclical properties of fiscal policy on economic growth empirically, and they show that countercyclical fiscal policy tend to enhance economic growth while procyclical fiscal policy tend to hinder economic growth (Aghion and Marinescu, 2007; Aghion, Hemous, and Kharroubi, 2009; Woo, 2009). These studies employ a two-step procedure to explore the effect of fiscal cyclicality on economic growth. Firstly,

120. A large number of studies (see, for example, Romero-Ávila and Strauch, 2008; Ismihan and Ozkan, 2005; Bleaney, Gemmell, and Kneller, 2001; Kneller, Bleaney, and Gemmell, 1999) suggest a positive effect of productive spending on economic growth and consider public investment to be productive spending. Some studies show that government investment has a growth enhancing effect utilizing economic classification of government spending, and some studies show that productive spending, such as spending on infrastructure, education, health, and defence, have growth enhancing effects, utilizing functional classifications of government spending (Bleaney, Gemmell, and Kneller, 2001; Kneller, Bleaney, and Gemmell, 1999). On the other hand, some studies (Ghosh and Gregoriou, 2008; Gregoriou and Ghosh, 2009) show that current spending is productive while capital spending is unproductive utilizing both economic and functional classifications of government spending.

they obtain the degree of the cyclicality of fiscal policy by estimating models of the form (4.1) which regresses the proxy for fiscal policy (G) on the fluctuation in business cycle ($\widetilde{Y}$), as already stated in chapter 2. The existing literature employs government spending or budget balance as the proxies for fiscal policy and employs output gap or GDP growth as the proxies for the fluctuation in business cycle. Then, it explores the effect of fiscal cyclicality on economic growth by estimating models of the form (4.2) which regresses economic growth ($\Delta Y$) on the estimated measure for the fiscal cyclicality ($\hat{\beta}$) and a set of control variables (Z). The existing literature employs per capita GDP growth to capture the change in economic growth ($\Delta Y$).

$$G_{it} = \alpha_i + \beta_i \, \tilde{Y}_{it} + \varepsilon_{it} \tag{4.1}$$

$$\Delta Y_{it} = a + b\hat{\beta}_{it} + c \, Z_{it} + v_{it} \tag{4.2}$$

Aghion and Marinescu (2007) explore the effect of fiscal cyclicality on economic growth utilizing a panel of 19 OECD countries. They show that higher countercyclical fiscal policy, which is estimated as time-varying coefficients, could have a positive effect on economic growth especially in the countries with tight credit constraints. At first, they explore the degree of countercyclicality of fiscal policy by regressing budget deficit on output gap. Then, they regress the change in income per capita on the estimated time-varying measure for the countercyclicality of budget deficit by panel data model to examine the effect of fiscal countercyclicality on economic growth. They include the ratio of private credit to GDP as independent variables to control the effect of credit constraints and show that credit constraints are negatively associated with the positive effect of countercyclicality of budget balance on economic growth.

Aghion, Hemous, and Kharroubi (2009) develop Aghion and Marinescu's (2007) argument in a way that utilizes microeconomic data to overcome the weakness of cross country measure of output gap and to avoid the causality issue which is caused by using macroeconomic data. They analyse the panel data of manufacturing industries across 18 OECD countries for the period 1980-2005 and provide the empirical evidence that more countercyclical fiscal policy has a positive effect on value added growth and productivity growth in industry, especially in industries with financial constraints and less tangible asset. They argue that

countercyclical fiscal policy in recessions could play a role in enhancing value added growth and productivity growth by promoting firm's investment to long term projects, and it in turn induces favourable long run effect on economic growth. At first, they obtain the degree of countercyclicality of fiscal policy by regressing the change in budget deficit and government spending on the change in the output gap employing time series analysis for each country, and then they regress real value added growth and productivity growth in industry on the estimated time invariant measure for the countercyclicality of budget deficit and government spending through a panel data model to examine the effect of fiscal countercyclicality on economic growth.

Woo (2009) argues that the social polarization of preferences over fiscal spending could lead to procyclical fiscal policy and finds that procyclical fiscal policy could lead to slow economic growth. The author shows that social polarization, measured by income and education inequality, has a negative effect on economic growth through procyclical fiscal policy by utilizing a cross section data of 96 countries for the period 1960-2003. At first, the author obtains the measure of procyclicality of government spending by regressing the change in government consumption on the change in GDP employing time series analysis[121] for each country and then regresses the change in income per capita on the estimated coefficient for procyclicality of government consumption utilizing cross country analysis to examine the effect of fiscal procyclicality on economic growth. The author includes initial income and initial human capital as the independent variables to control the effect of these variables.

The differences of the methods among the existing literature are as follows. First, Aghion and Marinescu (2007) utilize the time-varying measure of fiscal cyclicality while Aghion, Hemous, and Kharroubi (2009) and Woo (2009) utilize the time invariant measure of fiscal cyclicality for each country. Aghion, Hemous, and Kharroubi (2009) employ the interaction term for the countercyclicality of budget deficit / government spending and financial dependence / asset tangibility to overcome the problem of utilizing time invariant measure of fiscal countercyclicality.

121. Woo (2009) utilizes the time series regression of the form equation (2.6) in chapter 2. The only difference is that the author does not include the lag values of the first difference of log real GDP.

Second, Aghion and Marinescu (2007) utilize the budget deficit as the proxy for fiscal policy while Woo (2009) utilizes government consumption. Aghion, Hemous, and Kharroubi (2009) utilize both the budget deficit and government spending. It seems reasonable to utilize government spending as the proxy for fiscal policy, as is done in the most existing literature on the determinant of fiscal procyclicality. This is because the budget balance cannot reflect policymaker's discretionary action appropriately because of the existence of the cyclical components (Mackiewicz, 2008), as already argued in chapter 2.

Table 4.1 The variables utilized in the second step in the existing literature

| | Dependent variable | Independent variables |
|---|---|---|
| Aghion and Marinescu (2007) | The first difference of the log of real GDP per capita | Lag of estimated coefficients for countercyclicality of budget balance (+)<br>Lag of the ratio of private credit to GDP (-)<br>Lag of interaction of above two variables (-)<br>Lag of log real GDP per capita (-)<br>Human capital (average years of secondary schooling of the population over age 25) (+, but insignificant)<br>Trade openness (+)<br>Government size (-)<br>Investment / GDP (+)<br>Population growth (-)<br>Inflation (-)<br>Inflation targeting (-,but insignificant) |
| Aghion, Hemous, and Kharroubi (2009) | The average annual growth rate in real value added / labour productivity for each industry | Interaction of financial dependence and the countercyclicality of budget balance/GDP (+)<br>Interaction of asset tangibility and the countercyclicality of budget balance/GDP (+)<br>Log of initial share in manufacturing value added (-) |
| Woo (2009) | The average annual growth rate of real GDP per capita | Estimated coefficients for procyclicality of government consumption (-)<br>Initial income per capita (log of initial real GDP per capita) (-)<br>Initial human capital (log of average years of secondary schooling of the population over age 15 in 1960) (+)<br>GDP volatility (-)<br>Trade openness (+)<br>Government size (-, but insignificant) |

Note : The sign of coefficient is in parentheses.

However, the positive effect of countercyclical fiscal policy could be ineffective in practice because of possible time lags and fiscal condition. Alesina (2010) argues that one should be cautious when using countercyclical fiscal measures as policy tools. The author suggests two main factors as the reason. First, countercyclical fiscal policy is likely to be ineffective when the government size is big such as European countries. Second, the possible time lags could reduce the effect of countercyclical fiscal policy. Badinger (2012) also shows that the cyclical properties

of fiscal policy do not have a direct effect on economic growth even though they have an indirect effect on economic growth by affecting out volatility[122]. Varvarigos (2009) even argues that countercyclical fiscal policy, by adjusting the tax rate to stabilize fluctuations in economic activity (e.g., employment and human capital investment), could reduce the long run growth rate since it removes the volatility generated from technology shocks which is beneficial for economic growth, although it could have a favourable effect on social welfare.

## 2.2. The effect of fiscal sustainability on economic growth

Henriksson (2007, p.10) argues that fiscal sustainability is a "prerequisite" for economic growth suggesting a stable macroeconomic climate, which arises from sound and stable public finances, as the reason for success of Scandinavian economies. The existing literature has mainly dealt with the measurement of fiscal sustainability and has ignored the effect of fiscal sustainability on economic growth, in spite of increasing concern about fiscal sustainability which might have played a crucial role in triggering current economic crises since 2009. One can just find some related empirical literature concerned with the effect of fiscal consolidation on economic growth which implies the relationship between fiscal sustainability and economic growth indirectly. This literature, however, has failed to come to consistent results.

The conventional wisdom about the effect of fiscal consolidation on economic growth is that it has a contractionary effect. Keynesians argue that deficit reduction could lead to an economic downturn at least in the short term (Bi, Leeper, and Leith, 2012). The large reduction in government expenditure could lead to the loss of aggregate demand and could make economic growth slow (Makin, 2005). Some literature suggests the empirical evidence that fiscal consolidation could have a negative effect on economic growth. IMF (2010) shows that fiscal consolidation could reduce economic growth in the short term by analysing the fiscal consolidation episodes of 15 advanced countries for the period 1980-2009. It provides the

122. Badinger (2012) shows that the cyclical properties of fiscal policy could amplify output volatility regardless of whether they are procyclical or countercyclical patterns.

empirical evidence that fiscal consolidation equal to one percentage point of GDP decreases the economic growth rate by 0.5 percentage points within two years and suggests that this effect could be mitigated under high perceived debt default risk. It also suggests that fiscal consolidation could boost the economy in the long term if fiscal consolidation is conducted by cutting government consumption and transfers rather than government investment through the simulations of a dynamic general equilibrium model. Perotti (2011) raises a question about the expansionary fiscal consolidation hypothesis. The author suggests the case of four episodes of large fiscal consolidations (Denmark, Finland, Ireland, and Sweden) and argues that the expansionary effect of fiscal consolidations should be interpreted with caution since the driver of growth was internal demand only in Denmark and that the expansionary effect is not likely to be applicable to many countries in the present circumstances of low interest rates and wage increase.

However, much literature has suggested the possibility of the positive effect of fiscal consolidations on economic growth if they are carried out by a reduction in current spending and have been large and decisive (Bi, Leeper, and Leith, 2012; Fatás, 2010; Alesina, 2010; Alesina and Ardagna, 2009; Ismihan and Ozkan, 2005; Alesina and Ardagna, 1998; Alesina and Perotti, 1995). Bi, Leeper, and Leith (2012) argue that the duration of fiscal consolidations, the level of government debt, and monetary policy stance play a role in determining whether fiscal consolidations are expansionary or not. They especially suggest that fiscal consolidations could enhance economic growth if the government could remove the uncertainty associated with the composition and timing of fiscal consolidations. Fatás (2010, p.6) argues that large and quick fiscal consolidations, so called “cold shower approach”, could have a positive effect on economic growth since large adjustments in government spending could increase private consumption and investment through the wealth effect. The author suggests that fiscal consolidations should be driven by the reduction in spending rather than tax increases in order to raise the probability of success in fiscal consolidation and to help boost the economy, by providing the lessons from previous fiscal consolidations case. Alesina (2010) argues that fiscal consolidations could help reduce debt quickly without causing recessions by generating a positive wealth effect and expectation about low interest rates. The author shows that a great number of large fiscal consolidation episodes lead to

sustained economic growth if adjustment is conducted by spending cuts rather than tax increases. Alesina and Ardagna (2010) analyse the fiscal consolidation episodes in OECD countries for the period 1970-2007 and show that fiscal adjustment by spending cuts appeared to avoid economic downturns more effectively rather than fiscal adjustment by tax increases. Ismihan and Ozkan (2005) argue that fiscal contractions could have a positive effect on output performances. They analyse the policymaker's decision making with regard to the composition of public spending by dividing government spending into the current spending and productivity enhancing public investment and show that successful reduction in current spending could result in favourable output performance[123]. Alesina and Ardagna (1998) also show that fiscal adjustment is likely to be successful and expansionary if the size of the deficit adjustment is large, especially spending cuts rather than tax increases, by inducing expectations about permanent changes in fiscal policy, comparing expansionary fiscal adjustment episodes with contractionary fiscal adjustment episodes in OECD countries for the period 1960-1994. Alesina and Perotti (1995) show that successful consolidation could lead to an improvement in economic growth and employment by comparing the growth rate and unemployment rate of G-7 countries before and after the fiscal adjustment.

Overall, the empirical evidence of the effect of fiscal consolidation on economic growth does not suggest a consistent picture. This implies that one cannot be certain the fact that fiscal sustainability could have a favourable effect on economic growth even though a successful fiscal consolidation leads to the improvement of fiscal sustainability.

123. Ismihan and Ozkan (2005) show that current spending at the expense of public investment can be linked to low output performance, which could imply that governments could raise the long term economic growth rate maintaining fiscal sustainability if they allocate their revenues to investment rather than consumption.

# 3. Empirical analysis

## 3.1. Data description

The sample consists of 21 OECD countries, and we employ annual data for the period 1970–2008. Nine OECD countries (Czech Republic, Germany, Hungary, Luxembourg, Mexico, Poland, Slovakia, Switzerland, and Turkey) are excluded due to the data availability[124].

With regard to the data for fiscal variables which are utilized to obtain the level of fiscal procyclicality and sustainability, this chapter employs the same data set as chapter 2 and chapter 3 which are taken from OECD Economic Outlook database No.86: government consumption (CGAAV), interest payments (GGINTPV), current transfers (TCTV), current expenditure (YPGV) [125], government investment (IGAAV), total expenditure (YPGTV), the primary balance-GDP ratio ($s_t$), and the debt-GDP ratio ($d_t$). Summary statistics of fiscal variables are presented in Table 4.2 and 4.3. The fifth and sixth columns of Table 4.2 indicate the share of government spending relative to total expenditure and GDP respectively. The fifth column shows that government consumption (CGAAV) occupies nearly a half of total expenditure (YPGTV) followed by current transfers (TCTV, 28.5%), government investment (IGAAV, 17.3%) and interest payments (GGINTPV, 6.7%).

Table 4.2 Summary statistics of government spending variables

| | No. of countries | No. of observations | Mean (A) | A/H | A/B |
|---|---|---|---|---|---|
| GDPV (B) | 21 | 801 | 40.503 | - | 100% |
| CGAAV (C) | 21 | 801 | 5.646 | 49.6% | 13.9% |
| GGINTPV (D) | 21 | 775 | 0.761 | 6.7% | 1.9% |
| TCTV (E) | 21 | 774 | 3.248 | 28.5% | 8.0% |
| YPGV (F=C+D+E) | 21 | 782 | 9.431 | 82.8% | 23.3% |
| IGAAV (G) | 21 | 793 | 1.970 | 17.3% | 4.9% |
| YPGTV (H=F+G) | 21 | 769 | 11.393 | 100.0% | 28.1% |

Note : (1) Unit of each variable is 1,000 billion unit of local currency. (2) The sample period is 1970–2008.
Sources: OECD Economic Outlook Database No.86.

124. Five countries (Czech Republic, Hungry, Mexico, Poland, and Turkey) are excluded following chapter 1 and 2. Two countries (Luxembourg and Slovakia) are also excluded because there is no available data for initial human capital. Two countries (Germany and Switzerland) are additionally excluded because the time series of the fiscal procyclicality and sustainability indicator are below ten.
125. Current expenditure is the sum of government consumption, interest payments, and current transfers.

With regard to the data for the estimation of the effect of both fiscal procyclicality and sustainability on economic growth, this chapter employs the growth rate in GDP per capita (GDPPCR) as the dependent variable, which is taken from Penn World Tables 6.3. This chapter employs two main control variables which have been commonly employed in the neoclassical literature on the determinant of economic growth. Initial income (INIIC) is included to reflect the concept of the conditional convergence effect which has been advocated by the neoclassical growth model following Aghion and Marinescu (2007) and Woo (2009). This variable is defined as the log of real initial GDP per capita at 1970. Initial human capital (INIHC) is included to control for the positive effect of human capital on economic growth following Aghion and Marinescu (2007) and Woo (2009). This variable is defined as years of schooling at the secondary and higher level for males aged 25 and over at 1970[126] and is taken from Barro and Lee dataset (2000). The summary statistics of these variables are explained in Table 4.3. This chapter also introduces some other control variables, such as output volatility, trade openness, and government size, following Woo (2009) to check the effect of endogenous growth factors and the robustness of our results.

Table 4.3 Summary statistics of variables

| | No. of countries | No. of observations | mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|---|
| $s_t$ | 21 | 755 | 0.282% | 3.345 | -14.069 | 16.135 |
| $d_t$ | 21 | 636 | 59.073% | 30.215 | 4.980 | 175.274 |
| GDPPCR | 21 | 760 | 2.471% | 2.972 | -13.022 | 11.639 |
| INIIC | 21 | 571 | $14,349 | 3,754 | 3,030 | 22,689 |
| INIHC | 21 | 571 | 2.490 | 1.117 | 0.907 | 5.066 |

Note : The sample period is 1970–2008.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

This chapter additionally utilizes a sample of 53 IMF member countries[127] for the period 1980–2009, which is taken from IMF World Economic Outlook (2011), to assess the effect of fiscal procyclicality on economic growth. The growth rate of real GDP per capita (GDPPCR) are averaged over the period 1980-2009. Initial income

126. Some initial income (INIIC) and initial human capital (INIHC) variables are defined as at different year depending on the data availability.
127. We utilize data from 53 countries out of 187 IMF countries for which we have at least 20 years of data which is consistent with the criterion of selecting 21 OECD countries from OECD Economic Outlook Database.

(INIIC) is defined as the log of real initial GDP per capita at 1980, and initial human capital (INIHC) is defined as years of schooling at the secondary and higher level for males aged 25 and over at 1980. The Summary statistics of these variables are explained in Table 4.4.

Table 4.4 Summary statistics of variables (IMF dataset)

| | No. of countries | No. of observations | mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|---|
| GDPV | 53 | 1,488 | 15.210 | 71.836 | 0.0004 | 560.651 |
| YPGTV | 53 | 1,359 | 4.803 | 23.885 | 0.0001 | 198.327 |
| GDPPCR | 53 | 53 | 5.025% | 2.468 | 1.365 | 15.945 |
| INIIC | 53 | 53 | $5,916 | 6,438 | 197 | 35,770 |
| INIHC | 40 | 40 | 2.228 | 1.415 | 0.081 | 5.644 |

Note : (1) Unit of GDPV and YPGTV are 1,000 billion unit of local currency (2) The sample period is 1980–2009.
Sources: IMF World Economic Outlook Database (2011) and Barro and Lee dataset (2000).

## 3.2. Empirical methodology

To explore the effect of fiscal procyclicality on economic growth, this chapter conducts both cross country analysis of the form (4.3) using time invariant procyclicality indicators following Woo (2009), and panel analysis of the form (4.4) using time-varying procyclicality indicators which are obtained by rolling window estimation following Aghion and Marinescu (2007), Alberola and Montero (2007), and Alberola, Mínguez, Hernández de Cos, and Marqueés (2003). A positive value of $\beta$ implies the positive effect of a procyclical fiscal policy on economic growth.

The same methods are applied to examine the effect of fiscal sustainability on economic growth. This chapter conducts both cross country analysis of the form (4.5) and panel analysis of the form (4.6) using time-varying sustainability indicators which are obtained by recursive estimation[128]. A positive value of $\gamma$ implies the positive effect of a sustainable fiscal policy on economic growth.

128 . This chapter employs recursive estimation to find out time-varying estimator of fiscal sustainability since recursive estimation is more suitable than rolling window estimation when one estimates the trend of long term fiscal sustainability. This is because fiscal sustainability is a long term characteristics, not short term concept as argued by Wyplosz (2012).

$$Y_i = \alpha + \beta\, P_i + \lambda\, Z_i + u_i \quad (4.3)$$

$$Y_{it} = \alpha + \beta\, P_{it} + \lambda\, Z_{it} + u_{it} \quad (4.4)$$

$$Y_i = \alpha + \gamma\, S_i + \lambda\, Z_i + u_i \quad (4.5)$$

$$Y_{it} = \alpha + \gamma\, S_{it} + \lambda\, Z_{it} + u_{it} \quad (4.6)$$

where $Y_{it}$ is the growth rate of real GDP per capita. $P_{it}$ is the procyclicality indicator which is obtained by regressing various categories of government spending growth on the GDP growth, as can be seen from equation (2.6) in chapter 2. $S_{it}$ is the sustainability indicator which is obtained by regressing the primary budget balance-GDP ratio on the debt-GDP ratio, as can be seen from the equation (3.6) in chaptetr 3. $Z_{it}$ is a set of control variables. Two main control variables (initial income and initial human capital) are included following the suggestion of Woo (2009)[129], and some other control variables, such as output volatility, trade openness, and government size, are included to check the robustness of results.

To explore the effect of fiscal sustainability on fiscal procyclicality, this chapter utilizes the panel data model that we employed in chapter 2 to assess the level of fiscal procyclicality. We include the interaction term for the indicator of fiscal sustainability and GDP growth directly into the regression equation (2.7) in chapter 2, which estimates the fiscal procyclicality, following the argument of the existing literature (Gavin and Perotti, 1997; Alberola and Montero, 2007; Mackiewicz, 2008; Lledó, Yackovlev, and Gadenne, 2009).

$$\Delta \log G_{it} = \alpha_i + \sum_{j=0}^{2} \beta_j \Delta\, logGDP_{i,t-j} + \gamma S_{it} \times \Delta logGDP_{it} + \varepsilon_{it} \quad (4.7)$$

in which $\Delta\log G_{it}$ is a first difference of the log real government spending, $\Delta\log GDP_{it}$ is a first difference of log real GDP, and $S_{it}$ is the fiscal sustainability indicator which is obtained by recursive estimation. A positive $\beta_0$ implies a procyclical behaviour of government spending, and a positive $\gamma$ indicates that sustainable fiscal finances play a role in enhancing fiscal procyclicality.

129. Woo (2009) argues that this analysis on the effect of procyclicality on economic growth should focus on a core set of explanatory variables since the existing literature on the economic growth using many control variables often experiences the sensitive estimates to other conditional variables.

## 3.3. Estimation results

This chapter explores the effect of both fiscal procyclicality and sustainability on economic growth utilizing both cross country data and pooled data. Firstly, we conduct estimations including the fiscal procyclicality indicators and fiscal sustainability indicators simultaneously as independent variables, as can be seen from subsection 3.3.3. Then, we conduct estimations including the fiscal procyclicality indicators and fiscal sustainability indicators separately as independent variables in subsection 3.3.1 and 3.3.2. The results show a large degree of similarity between both estimations including the fiscal procyclicality and sustainability indicators simultaneously and separately. We at first explain the results of the analysis including the fiscal procyclicality and sustainability indicators separately for better understanding of our argument.

### 3.3.1.The effect of fiscal procyclicality on economic growth

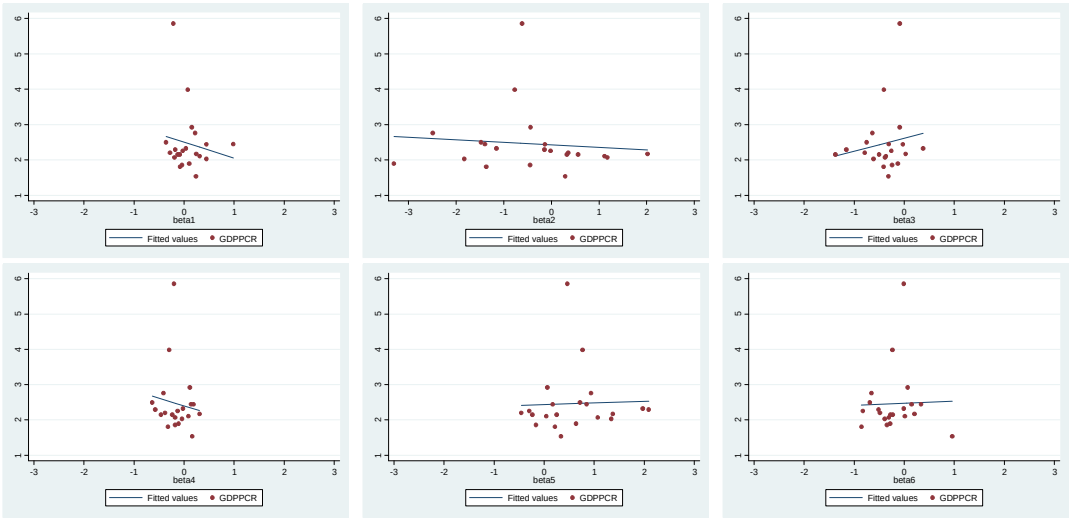
#### (1) Baseline results

If we include the fiscal procyclicality indicators and fiscal sustainability indicators simultaneously as independent variables in the estimation, all coefficients of fiscal sustainability indicators are insignificant as can be seen from Table 4.16 in subsection 3.3.3. This section, therefore, conducts analysis excluding the fiscal sustainability indicators to explore the effect of fiscal procyclicality on economic growth utilizing both cross country data and pooled data. A iteratively reweighted least squares (RWLS) procedure is used to reduce the effect of outliers following Woo (2009) [130]. Firstly, we conduct cross country analysis using time invariant procyclicality indicators following Woo (2009). Time invariant procyclicality indicators are obtained by regressing various categories of government spending growth on GDP growth across countries, which can be seen from Table 2.12 of Chapter 2.

130. We do not employ GMM method in this chapter. This is because we cannot control initial income and initial human capital variables when we estimate by GMM due to the collinearity.

Graph 4.1 shows a scatter plot between the procyclicality of fiscal policy and economic growth which is the average growth rate in income per capita for the period 1970-2008[131]. The graphs do not show a clear picture across spending categories. Government consumption (first panel) and current expenditure (fourth panel) appear to have a negative correlation with the average growth rate in income per capita, while current transfers (third panel) seems to have a positive correlation with the average growth rate in income per capita.

Graph 4.1 The procyclicality of fiscal policy and average growth rate




Note: GDPPCR is the average growth rate in income per capita, beta1-6 are the procyclicality indicators of government consumption (1), interest payments (2), current transfers (3), current expenditure (4), government investment (5), and total expenditure (6) respectively. A positive value of beta implies the procyclical behaviour of government spending.

However, these relaionships become clear if one controls initial outcome and inital human capital as can be seen from Table 4.5. The procyclicality of government spending has a negative effect on economic growth except for government investment in column (5), even though the coefficients are only significant in explaining the effect of procyclicality of government consumption and total expenditure[132]. A unit increase in the procyclicality of government spending[133]

131. Some countries are averaged over shorter period due to the data availability.
132. Korea is excluded from the estimation in column (2) – (5) of cross country data analysis since it has large residual and leverage. The case of Korea explains a great deal of portions of estimates in regression (1) and (6). If we exclude the sample of Korea from regression (1) and (6), the values of $R^2$ drop to 0.602 in regression (1) and 0.471 in regression (6) even though the results are generally consistent with baseline estimation in Table 4.5.

could reduce income per capita by 0.429 percentage points in government consumption and 0.486 percentage points in total expenditure.

Table 4.5 The effect of fiscal procyclicality on economic growth in OECD countries

| Dependent Variable : the growth rate of real GDP per capita | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| **<cross county data>** | | | | | | |
| P | -0.429** | -0.030 | -0.124 | -0.272 | 0.046 | -0.486*** |
| | (-2.66) | (-0.54) | (-0.72) | (-1.13) | (0.43) | (-5.84) |
| INIIC | -2.278*** | -0.871** | -0.872* | -0.976** | -0.832* | -2.433*** |
| | (-17.57) | (-2.14) | (-2.06) | (-2.45) | (-1.95) | (-25.73) |
| INIHC | 0.138*** | 0.045 | 0.020 | 0.037 | 0.043 | 0.174*** |
| | (2.97) | (0.58) | (0.27) | (0.53) | (0.53) | (5.34) |
| F | 112.94*** | 1.96 | 1.93 | 2.85* | 1.68 | 226.65*** |
| $R^2$ | 0.952 | 0.269 | 0.266 | 0.348 | 0.240 | 0.976 |
| No. of outliers | - | 1 | 1 | 1 | 1 | - |
| No. of Obs. | 21 | 20 | 20 | 20 | 20 | 21 |
| **<pooled data>** | | | | | | |
| P | -0.292** | -0.033 | -0.191* | -0.470*** | 0.029 | -0.067 |
| | (-2.01) | (-0.82) | (-1.66) | (-2.87) | (1.01) | (-0.65) |
| INIIC | -2.483*** | -2.568*** | -2.365*** | -2.471*** | -2.608*** | -2.578*** |
| | (-9.23) | (-9.14) | (-8.19) | (-9.34) | (-9.19) | (-9.08) |
| INIHC | 0.122 | 0.161* | 0.123 | 0.147 | 0.161* | 0.143 |
| | (1.30) | (1.70) | (1.32) | (1.61) | (1.69) | (1.52) |
| F | 30.83*** | 29.33*** | 23.59*** | 32.17*** | 29.29*** | 28.74*** |
| $R^2$ | 0.140 | 0.138 | 0.114 | 0.149 | 0.135 | 0.137 |
| No. of Obs. | 571 | 554 | 552 | 557 | 568 | 548 |

Note: (1) P is the procyclicality indicator, INIIC is initial income, and INIHC is initial human capital.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

Initial income (ININC) and initial human capital (INIHC) variables show expected signs, which is in line with the theory and the existing literature. Initial income (ININC) is significantly negatively associated with per capita GDP growth, which supports the general notion of conditional convergence which has been advocated by the neoclassical growth model (Barro, 1996). That is, the per capita GDP growth rate will be high when initial GDP per capita is low, if other conditions are constant. Table 4.5 shows that the growth rate in GDP per capita (GDPPCR) is estimated to fall by 0.8~2.4 percentage points across spending categories for every

133. A one unit of increase in the procyclicality of government spending indicates that the coefficient of GDP growth in equation (2.6) of chapter 2 increases by one unit. In other words, it means that government spending growth, which increased by the same amount of GDP growth (e.g., one percentage point), increases by two times of the amount of GDP growth (e.g., two percentage points) for every one unit increase in GDP growth (e.g., one percentage point).

one percent increase in initial income (INIIC). This coefficient is very similar to that of Barro (1996) which explores the determinants of economic growth while that of Woo (2009) shows huge difference with both our analysis and Barro (1996) as can be seen from Table 4.6

Initial human capital (INIHC) is significantly positively associated with GDP per capita growth in explaining the effect of procyclicality of government consumption in column (1) and total expenditure in column (6), which implies that the countries with higher initial human capital tend to achieve higher economic growth. Table 4.5 shows that the growth rate in GDP per capita (GDPPCR) is estimated to increase by 0.138 percentage points in column (1) and 0.174 percentage points in column (6) for every additional year of schooling at the secondary and higher level for males aged 25 and over (INIHC).

If one compares our baseline results with that of Woo (2009), one can find the fact that our baseline results suggests a smaller negative effect of fiscal procyclicality on economic growth compared to Woo (2009). The coefficient of the procyclicality of government consumption is smaller than that of Woo (2009). Our cross country analysis might not be as informative as Woo (2009) who analyses 79 countries worldwide. This could be because OECD countries generally show homogeneous characteristics in economic growth (Romero-Ávila and Strauch, 2008), and because our sample size is smaller than that of Woo (2009).

Table 4.6 The comparison of the size of coefficients

| | Our analysis | Woo (2009) | Barro (1996) |
|---|---|---|---|
| P | -0.429** | -0.7*** | |
| INIIC | -2.278*** | -0.1 | -2.25*** ~ - 2.54*** |
| INIHC | 0.138*** | 0.4** | 0.98***~ 1.18*** |
| No. of Observations | 21 | 79 | 87 |

Note: The coefficients of Woo (2009) is corrected reflecting the difference of measurement unit.

First, the distribution of economic growth in OECD countries is relatively even rather than that of those countries which Woo (2009) utilizes in his analysis, as can

be seen from Table 4.7[134]. Second, our cross country analysis utilizes only 21 samples, so there is a possibilty of suffering from small sample bias.

Table 4.7 Summary statistics of the growth rate of income per capita

| | No. of observations | Mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|
| Woo (2009) | 96 | 1.7 | 1.6 | -3.0 | 6.3 |
| Our analysis | 21 | 2.465 | 0.923 | 1.536 | 5.857 |

Note: The number of observations which Woo (2009) utilizes in the analysis of the effect of procyclicality on economic growth is 79 out of 96 total observations.

Therefore, this chapter conducts the same analysis using pooled data of time-varying procyclicality indicators which are obtained by rolling window estimation following Aghion and Marinescu (2007) to overcome the problem of using cross country data, which can be seen from Graph 2.3 and 2.4 of chapter 2.

Table 4.5 shows that the signs of coefficients are the same, but statistical signifcance levels are different with those of cross country data analysis. Therefore, the coefficients of procyclicality indicators are significant in explaining the effect of procyclicality of government consumption, current transfers, and current expenditure. A negative effect of procyclical current transfers on economic growth could be interpreted that stronger automatic stabilizers could enhance economic growth. A unit increase in procyclicality of government spending could reduce income per capita by 0.29 percentage points in government consumption, 0.19 percentage points in current transfers, and 0.47 percentage points in current expenditure.

To conclude, procyclical current expenditure, especially government consumption and current transfers, could have a negative effect on economic growth, while procyclical interest payments and government investment do not play any role in economic growth. These results are generally consistent with the existing literature (Aghion and Marinescu, 2007; Aghion, Hemous, and Kharroubi, 2009; Woo, 2009). One could think of several channels that procyclical fiscal policy hinders economic growth. First, procyclical fiscal policy could amplify output volatility, so it in turn leads to lower economic growth (Badinger, 2012). Second,

134. If we exclude Korea from our sample, the distribution of economic growth becomes more similar among sample countries. The mean of sample in 2.295, standard deviation is 0.511, min is 1.536, and max is 3.986.

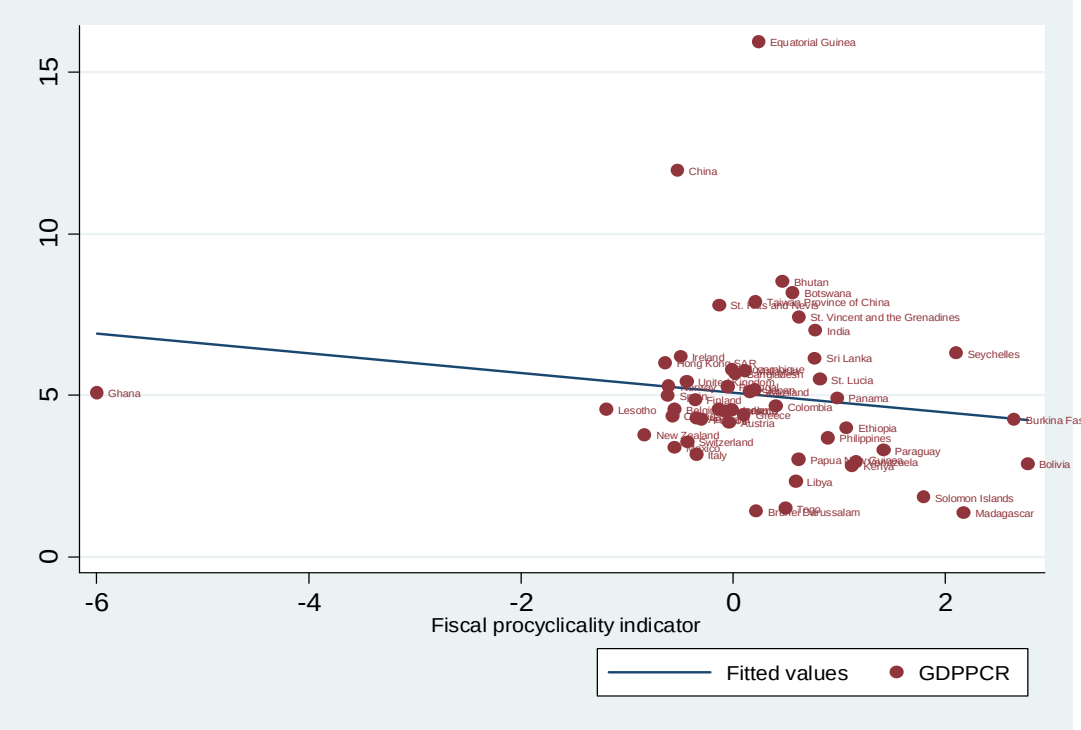
procyclical fiscal policy could be considered to be a sign of poor policy, so it could have an unfavourable effect on economic growth. For example, fiscal policymakers often decide expansionary fiscal policy after the economy starts to recover (Burger and Jimmy, 2006) due to the lack of forecasting ability. This policy tends to become procyclical and could amplify the volatility of business cycle, so it in turn leads to lower economic growth. Third, procyclical government spending in recessions could foster both firms and workers, who are faced by credit constraints, to make growth-enhancing investments such as R&D and human capital (Aghion and Marinescu, 2007; Aghion, Hemous, and Kharroubi, 2009). Lastly, unproductive government spending in booms, such as government consumption and current transfers, could cause crowding out of private economic activity as argued by neoclassical literature.

### (2) The different effect depending on country groups

This subsection extends our samples into more comprehensive samples including both OECD and non-OECD countries to check robustness of baseline analysis. The sample consists of 53 IMF member countries for the period 1980–2009, which is taken from IMF World Economic Outlook (2011). This section analyses only cross section data of 53 IMF countries because of data availability[135]. Graph 4.2 shows a scatter plot between the procyclicality of total expenditure and the average growth rate in GDP per capita. The graph generally shows a negative correlation between them, which implies that procyclical fiscal policy could hinder economic growth.

135. The average number of time-varying fiscal procyclicality indicators of each country is only 15.5.

Graph 4.2 The procyclicality of fiscal policy and average growth rate (IMF countries)




Note: GDPPCR is the average growth rate in income per capita. A positive value of the fiscal procyclicality indicator implies the procyclical behaviour of government spending.

This conjecture can be confirmed by the results of Table 4.8. To obtain the robust estimates avoiding the effect of outliers, an iteratively reweighted least squares (RWLS) estimation is employed following Woo (2009) [136]. The results show that the procyclicality of government spending has a significantly negative effect on economic growth. A unit increase in procyclicality of government spending could reduce income per capita by 0.748 percentage points on average in column (1). The size of coefficient is larger than that of baseline analyses of Table 4.5 and similar with that of Woo (2009). This could be because this estimation includes both advanced countries and emerging market countries following Woo (2009).

136. Ghana is excluded from the estimation since it has large residual and leverage.

Table 4.8 The effect of fiscal procyclicality on economic growth (IMF countries)

| Dependent Variable : the growth rate of real GDP per capita | | | | | | |
|---|---|---|---|---|---|---|
| | All countries | | Advanced countries | | Emerging market countries | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| P | -0.748** | -0.597* | -0.038 | -0.064 | -0.862* | -0.729 |
| | (-2.42) | (-1.94) | (-0.07) | (-0.12) | (-1.76) | (-1.24) |
| INIIC | -0.421** | -0.250 | -2.443*** | -2.897*** | -0.546 | -0.842 |
| | (-2.06) | (-0.91) | (-5.33) | (-4.99) | (-1.46) | (-1.41) |
| INIHC | | 0.007 | | 0.206 | | 0.998 |
| | | (0.03) | | (1.21) | | (1.20) |
| F | 3.67** | 1.49 | 15.92*** | 11.48*** | 2.74* | 1.47 |
| $R^2$ | 0.130 | 0.113 | 0.652 | 0.683 | 0.159 | 0.228 |
| No. of outliers | 1 | 1 | - | - | 1 | 1 |
| No. of Obs. | 52 | 39 | 20 | 20 | 32 | 19 |

Note: (1) P is the procyclicality indicator, INIIC is initial income, and INIHC is initial human capital.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: IMF World Economic Outlook Database (2011), Penn World Tables 6.3, and Barro and Lee dataset (2000).

This section additionally analyses the effect of procyclicality on economic growth across country group to reflect the different characteristics of county groups depending on the level of development. The results show that the negative effect of procyclical fiscal policy on economic growth is prominent in the emerging market countries while it is not noticeable in advanced countries. The coefficient of fiscal procyclicality in the advanced countries is negative, but it is insignificant. However, the corresponding coefficient in emerging market countries is significantly negative, and the size of coefficient is much larger than that of advanced countries. A unit increase in the procyclicality of government spending could reduce income per capita by 0.038 percentage points on average in advanced countries and 0.862 percentage points in emerging market countries. These results imply that the emerging market countries should be more cautious to operate fiscal policy since their economic growth is likely to be more sensitive to their fiscal stance.

One could conjecture several reasons why the ecomomic growth of emerging market countries is more sensitive to procyclical fiscal policy. First, emerging market countries are more likely suffer from poor policy making due to the lack of forecasting ability. Therefore, fiscal policymakers in emerging market countries are more likely to decide their fiscal policy under a veil of ignorance about the state of the economy (Manasse, 2005), so procyclical fiscal policy could amplify the

volatility of the business cycle more than in advanced countries. Second, emerging market countries tend to have more volatile output [137] since their economic infrastructure is more vulnerable to external shock than advanced countries (Cuadra, Sanchez, and Sapriza, 2010; Carmignani, 2010), and more volatile output in turn could lead to lower economic growth (Badinger, 2012).

### (3) The effect of cyclically adjusted spending

One should consider carefully the properties of each spending categories when one interprets estimation results as is already argued in chapter 2. Government spending can be divided into a discretionary component which is taken by fiscal authorities, and a cyclical component which is affected by business cycle fluctuations (Candelon, Muysken, and Vermeulen, 2010; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003; Galí and Perotti, 2003). It has been generally assumed that automatic stabilizers mainly have an effect on current transfers and taxation, not government consumption and investment (Romero-Ávila and Strauch, 2008; Alberola, Mínguez, Hernández de Cos, and Marqueés, 2003). Automatic stabilizers make government spending more countercyclical as can be seen from the results of Table 2.14 in chapter 2 since unemployment benefit payments increase in recessions and decrease in booms[138].

Table 4.9 presents the effect of fiscal procyclicality of cyclically adjusted government spending on economic growth. The procyclicality of government spending has a negative effect on economic growth across all spending categories, even though the coefficients are only significant in explaining the effect of procyclicality of total expenditure in cross county data analysis and in explaining the effect of procyclicality of current expenditure in pooled data analysis. A unit increase in the fiscal procyclicality indicator in cross county data analysis could reduce income per capita by 0.345 percentage points in total expenditure and by

137. Output volatility, measured as the standard deviation of per capita GDP growth for the period 1984-2006, is 3.1 in industrial economies, 5.2 in low income economies, and 5.5 in middle income economies (Carmignani, 2010).
138. The only item of government spending which is treated as cyclically sensitive is unemployment-related current transfers (Girouard and André, 2005; CBO, 2008).

0.408 percentage points in cyclically adjusted total expenditure. A unit increase in the fiscal procyclicality indicator in pooled data analysis could reduce income per capita by 0.394 percentage points in current expenditure and by 0.351 percentage points in cyclically adjusted current expenditure. These results show that the effect of procyclical government spending on economic growth is not different regardless of whether the cyclical component is included or not. The coefficients of the procyclicality indicator have same signs and similar sizes. This could be because the cyclical component does not affect the level of the negative effect of procyclical spending on economic growth, but it only mitigates the level of fiscal procyclicality *per se*.

Table 4.9 The effect of fiscal procyclicality on economic growth (cyclically adjusted spending)

| Dependent Variable : the growth rate of real GDP per capita | | | | | | |
|---|---|---|---|---|---|---|
| | Current Transfers | | Current Expenditure | | Total Expenditure | |
| | Original | Cyclically adjusted | Original | Cyclically adjusted | Original | Cyclically adjusted |
| **<cross county data>** | | | | | | |
| P | -0.124 | -0.064 | -0.272 | -0.293 | -0.345** | -0.408*** |
| | (-0.72) | (-0.38) | (-1.13) | (-1.25) | (-2.37) | (-3.21) |
| INIIC | -0.872* | -0.842* | -0.976** | -1.009** | -1.237*** | -1.285*** |
| | (-2.06) | (-1.93) | (-2.45) | (-2.53) | (-3.17) | (-3.73) |
| INIHC | 0.020 | 0.027 | 0.037 | 0.048 | 0.068 | 0.089 |
| | (0.27) | (0.35) | (0.53) | (0.68) | (1.01) | (1.50) |
| F | 1.93 | 1.63 | 2.85* | 2.97* | 4.75*** | 6.75*** |
| $R^2$ | 0.266 | 0.234 | 0.348 | 0.357 | 0.471 | 0.559 |
| No. of Obs. | 20 | 20 | 20 | 20 | 20 | 20 |
| **<pooled data>** | | | | | | |
| P | -0.184 | -0.162 | -0.394** | -0.351** | -0.036 | -0.040 |
| | (-1.63) | (-1.38) | (-2.45) | (-2.12) | (-0.36) | (-0.36) |
| INIIC | -1.544** | -2.246*** | -1.662** | -2.299*** | -1.429** | -2.253*** |
| | (-2.33) | (-3.33) | (-2.53) | (-3.45) | (-2.12) | (-3.32) |
| INIHC | 0.052 | 0.045 | 0.076 | 0.068 | 0.039 | 0.052 |
| | (0.48) | (0.41) | (0.70) | (0.63) | (0.35) | (0.48) |
| F | 2.91** | 5.48*** | 4.17*** | 6.42*** | 2.10* | 5.10*** |
| $R^2$ | 0.016 | 0.032 | 0.023 | 0.038 | 0.012 | 0.030 |
| No. of Obs. | 529 | 498 | 529 | 498 | 523 | 498 |

Note: (1) One country (Korea) for which no cyclically adjusted data are available is excluded from the sample.
(2) P is the procyclicality indicator, INIIC is initial income, and INIHC is initial human capital.
(3) Regression methods are reweighted least squares (RWLS) estimation.
(4) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

### (4) The time horizon of effect

This section also explores the persistency of the effect of fiscal procyclicality on economic growth. We modify the regression equation by replacing the lag values of fiscal procyclicality indicator as is implemented in Aghion and Marinescu (2007). Table 4.10 shows that an increase in procyclicality of current expenditure, especially government consumption and current transfers, have a negative effect on economic growth during two or four years, which is consistent with Aghion and Marinescu (2007) who show that the effect of an increase in fiscal countercyclicality lasts two or three years. A unit increase in the current procyclicality indicator of government consumption could reduce income per capita by 0.292 percentage points on average, and a unit increase in the past procyclicality indicators of government consumption at t-1, t-2, and t-3 could reduce current income per capita by 0.265, 0.289, and 0.250 percentage points respectively. However, an increase in procyclicality of government investment has a positive effect on economic growth for the next two years, even though it has no effect during the current year. A unit increase in the procyclicality indicators of government investment at last year and the year before last year could raise current income per capita by 0.061 and 0.079 percentage points respectively. This could be because the accumulated capital by government investment could have a positive effect on the future economic growth for years.

Table 4.10 The time horizon of the effect of fiscal procyclicality on economic growth

| Dependent Variable : the growth rate of real GDP per capita | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $P_{it}$ | -0.292** | -0.033 | -0.191* | -0.470*** | 0.029 | -0.067 |
| | (-2.01) | (-0.82) | (-1.66) | (-2.87) | (1.01) | (-0.65) |
| $P_{it-1}$ | -0. 265* | 0.085** | -0.228* | -0.326* | 0.061* | -0.019 |
| | (-1.80) | (2.12) | (-1.95) | (-1.93) | (1.82) | (-0.17) |
| $P_{it-2}$ | -0.289** | 0.141*** | -0.183 | -0.217 | 0.079* | 0.022 |
| | (-1.97) | (3.55) | (-1.56) | (-1.27) | (1.93) | (0.20) |
| $P_{it-3}$ | -0.250* | 0.159*** | -0.108 | -0.143 | 0.077 | 0.043 |
| | (-1.69) | (4.01) | (-0.92) | (-0.82) | (1.58) | (0.38) |
| $P_{it-4}$ | -0.168 | 0.136*** | -0.106 | -0.099 | 0.059 | 0.060 |
| | (-1.10) | (3.38) | (-0.88) | (-0.55) | (1.15) | (0.49) |
| $P_{it-5}$ | -0.152 | 0.048 | -0.229* | -0.296 | 0.0545 | 0.016 |
| | (-0.99) | (1.18) | (-1.81) | (-1.60) | (0.81) | (0.12) |

Note: (1) $P_{it}$ is the procyclicality indicator. All regressions include INIIC (initial income) and INIHC (initial human capital) as control variables. (2) Regression methods are reweighted least squares (RWLS) estimation. (3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

### (5) Summary of results

To conclude, procyclical government spending could have a unfavourable effect on economic growth. These results are generally consistent with the existing literature (Aghion and Marinescu, 2007; Aghion, Hemous, and Kharroubi, 2009; Woo, 2009).

Our analysis develops these argument further and deals with the effect of fiscal procyclicality across the spending categories while the existing literature only deals with the effect of fiscal procyclicality in terms of government consumption (Woo, 2009), total spending (Aghion, Hemous, and Kharroubi, 2009) or budget balance (Aghion and Marinescu, 2007; Aghion, Hemous, and Kharroubi, 2009). More specifically, our findings show that procyclical current expenditure, especially government consumption and current transfers, could have a negative effect on economic growth while procyclical interest payments and government investment do not play any role in economic growth. One thing we should note is that procyclical government investment does not hinder economic growth. Furthermore, government investment is generally considered to be productive, namely growth enhancing[139], so an increase in government investment even during booms could help the long term economic growth since the accumulation of capital stock by government investment could have favourable effect on the future economic performances.

Also, our analysis deals with the effect of fiscal procyclicality across different country groups. The results show that the negative effect of fiscal procyclicality is more prominent in emerging market countries than in advanced countries.

139. See, for example, Romero-Ávila and Strauch, 2008; Ismihan and Ozkan, 2005; Bleaney, Gemmell, and Kneller, 2001; Kneller, Bleaney, and Gemmell, 1999.

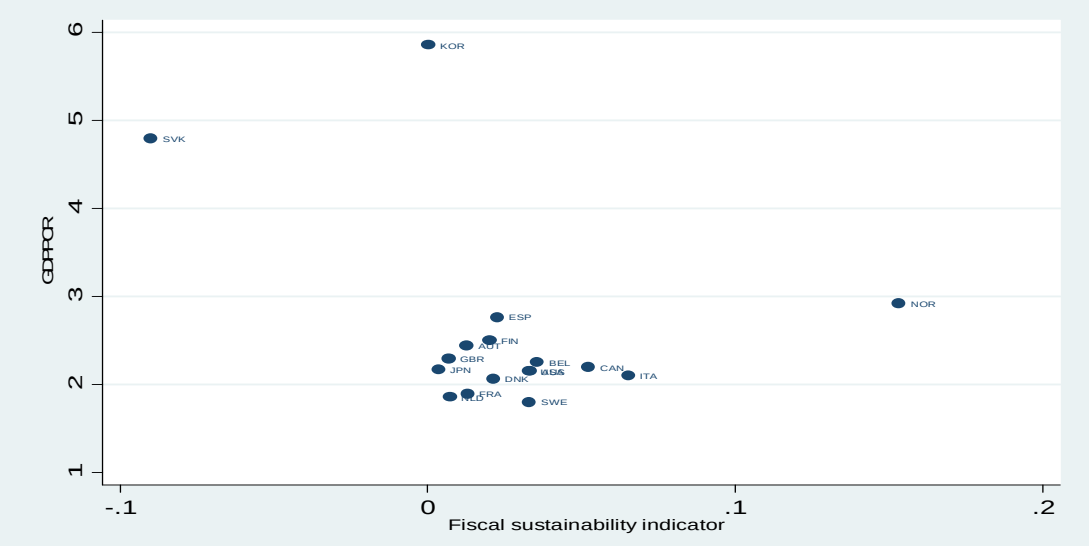
## 3.3.2.The effect of fiscal sustainability on economic growth

### (1) Baseline results

To explore the effect of fiscal sustainability on economic growth, this section conducts estimation utilizing both cross country data and pooled data. First, we conduct cross country analysis using time invariant fiscal sustainability indicators. Time invariant fiscal sustainability indicators are obtained by regressing the primary budget balance-GDP ratio on the lag value of the debt-GDP ratio across countries, which can be seen from Table 3.2 of chapter 3. Second, we conduct the same analysis using pooled data of time-varying sustainability indicators which are obtained by recursive estimation, which can be seen from Graph 3.3 of chapter 3, to overcome the problem of using cross country data.

Graph 4.3 shows a scatter plot between the sustainability of fiscal policy and economic growth which is the average growth rate in income per capita for the period 1970-2008. We can see that the figure does not show a meaningful relationship between the level of fiscal sustainability and economic growth.

Graph 4.3 The sustainability of fiscal policy and average growth rate




Note: GDPPCR is the average growth rate in income per capita. A positive value of the fiscal sustainability indicator implies a sustainable fiscal policy.

Table 4.11 confirms this finding and presents the results for the effect of fiscal sustainability on economic growth using both the cross country data and the pooled data. Regression (1) utilizes a sample of 16 OECD countries to coincide a sample of pooled data in regression (2) and (3). One can see from the results that it is difficult to establish a significant role for fiscal sustainability on economic growth. The coefficient of the fiscal sustainability indicator in cross country data analysis in column (1) is small and insignificant[140]. Income per capita is estimated to be increased by about 0.38 percentage points for every one unit increase in fiscal sustainability[141]. We conduct the same analysis utilizing pooled data to check the robustness of the results, considering the fact that the result of cross county data analysis in column (1) might suffer from small sample bias. The results in column (2) show a large degree of similarity with the results of cross country data analysis. The size of coefficient of the fiscal sustainability indicator is similar to that of cross country data analysis, which indicates that fiscal sustainability does not have any effect on economic growth. We additionally conduct the same analysis utilizing time varying fiscal sustainability indicators which are obtained by rolling window estimation, which can be seen from Graph 3.4 of chapter 3, to check the robustness of result of pooled data analysis in column (2). The results in column (3) show a large degree of similarity with those of column (2). The coefficient of the fiscal sustainability indicator is still insignificant, which indicates that we cannot find any evidence for an effect of fiscal sustainability on economic growth.

In addition, the relationship between fiscal sustainability and economic growth does not show a consistent picture when one explores the effect of fiscal sustainability of economic growth country by country. The coefficients of the fiscal sustainability indicator are generally insignificant, and the sign of coefficients are not consistent across countries[142]. To sum up, the results show that fiscal sustainability does not play any role in economic growth. Our result could be consistent with Irons

140. Korea and Norway are excluded from the estimation since they have large residual and leverage.
141. A one unit of increase in the fiscal sustainability indicates a one unit of increase in the coefficient of the lag value of the debt-GDP ratio in equation (3.6) of chapter 3. In other words, it means that governments respond to a one unit increase in the debt-GDP ratio (e.g., one percentage point) by raising the primary budget surplus-GDP ratio, which the government increase by the same amount of change in the debt-GDP ratio (e.g., one percentage point), by two times of the amount of change in the debt-GDP ratio (e.g., two percentage points).
142. The coefficient of fiscal sustainability indicators is significant only three countries. It is significantly positive in Japan while it is significantly negative in Italy and Netherlands.

and Bivens (2010) who argue that the stock of government debt does not hinder current economic growth. Our results could also be rationalized by the fact that the short-term violation of fiscal sustainability might not hinder long-term economic growth. Successful fiscal stimulus packages in recessions could boost economy although they are generally accompanied by an increase in debt, and they in turn induce the deterioration of fiscal sustainability as argued in the existing literature (Taylor, Proaño, de Carvalho, and Barbosa, 2012[143]; Padoan, 2009; Freedman, Kumhof, Laxton, Muir, and Mursula, 2009; Bi, 2010; Bi and Leeper, 2010).

Table 4.11 The effect of fiscal sustainability on economic growth

| Dependent Variable : the growth rate of real GDP per capita | | | |
|---|---|---|---|
| | cross country data | pooled data | |
| | (1) | (2) | (3) |
| S | 0.381 | 0.307 | -0.662 |
| | (0.11) | (0.31) | (-0.86) |
| INIIC | -2.049*** | -2.478*** | -2.453*** |
| | (-3.17) | (-9.11) | (-9.03) |
| INIHC | 0.100 | 0.043 | 0.053 |
| | (1.45) | (0.41) | (0.52) |
| F | 3.80** | 29.28*** | 29.64*** |
| $R^2$ | 0.532 | 0.187 | 0.189 |
| No. of outliers | 2 | - | - |
| No. of Obs. | 14 | 387 | 387 |

Note: (1) S is the sustainability indicator, INIIC is initial income, and INIHC is initial human capital.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

### (2) The channel of the effect of fiscal sustainability on economic growth

Our empirical evidence in subsection 3.3.1 suggests that countercyclical fiscal policy could enhance economic growth. This result could imply that there is a possibility that sustainable fiscal finances could have a favourable effect on economic growth, if fiscal sustainability could change the behaviour of fiscal authorities in a way that is more countercyclical.

This subsection examines the existence of this possible channel to verify our results that fiscal sustainability does not have an effect on economic growth. This

143. Taylor, Proaño, de Carvalho, and Barbosa (2012) show that an increase in the government deficit could stimulate faster economic growth.

subsection explores the relationship between the cyclical properties of fiscal policy and fiscal sustainability. Little has been dealt with the relationship between them directly. Some literature considers fiscal sustainability as one of the determinants of fiscal procyclicality and suggests that the concern about fiscal sustainability could bring about procyclical fiscal policy by inducing credit constraints (Gavin and Perotti, 1997; Alberola and Montero, 2007; Mackiewicz, 2008; Lledó, Yackovlev, and Gadenne, 2009; Cuadra, Sanchez, and Sapriza, 2010) [144]. Gavin and Perotti (1997) suggest credit constraints which arise from the fear of unsustainable budget deficits as the main reason for fiscal procyclicality and show that a high initial deficit could lead to more procyclical pattern of budget balance than a low initial deficit by analysing 13 Latin American countries. Alberola and Montero (2007) also suggest that the financial market's perception of debt sustainability, which comes from financial vulnerability, could make fiscal policy more procyclical by showing the positive relationship between current threshold budget balance, which is needed to maintain current debt level, and the cyclically adjusted primary budget balance analysing the example of nine Latin American countries. Mackiewicz (2008) points out that high debt could cause credit constraints, and it in turn leads to reducing the room for countercyclical policy. Lledó, Yackovlev, and Gadenne (2009) show that high external debt could negatively affect the government's ability to respond to the business cycle because it signals tighter financial conditions of that country. Cuadra, Sanchez, and Sapriza (2010) argue that the possibility of government debt default could lead to procyclical fiscal policy by inducing a high risk premium. The results of this literature could imply that sustainable fiscal finances could provide governments with the ability to respond to recession by increasing spending or decreasing tax rates, in other words, sustainable fiscal finances are likely to be accompanied by countercyclical fiscal policy. However, these studies mainly focus on the effect of debt or budget balance on fiscal cyclicality. In this subsection, we attempt to explore the effect of fiscal sustainability on fiscal procyclicality directly.

144. The issue on the effect of the cyclical properties of fiscal policy on fiscal sustainability have been ignored in the existing literature. This could be because any theoretical foundations cannot be found about this relationship. Procyclical fiscal policy could reduce the deficit and debt in recession while it could increase the deficit and debt in booms. The effect of cyclical properties of fiscal policy on the fiscal sustainability, therefore, could be concluded to be neutral. Empirical analysis also shows that the effect of fiscal procyclicality on fiscal sustainability is not certain as can be seen from Appendix 4.

First, this subsection explores the effect of fiscal sustainability on fiscal procyclicality reflecting the argument of existing literature by estimating equation (4.7). Table 4.12 shows that fiscal sustainability does not have any role in the level of fiscal procyclicality[145]. The coefficient of the interaction term for the fiscal sustainability indicator and GDP growth is negative in explaining the growth in government consumption, current transfers, current expenditure, and investment while it is positive in explaining the growth in interest payments and total expenditure. However, all coefficients are insignificant at the conventional levels.

Table 4.12 The effect of fiscal sustainability on fiscal procyclicality

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $S_t * GDP_t$ | -0.158 | 0.299 | -0.216 | -0.028 | -0.904 | 0.025 |
| | (-0.48) | (0.18) | (-0.37) | (-0.07) | (-1.17) | (0.05) |
| $GDP_t$ | 0.001 | -0.522 | -0.344** | -0.176 | 0.494*** | -0.323** |
| | (0.01) | (-1.55) | (-2.62) | (-1.48) | (4.25) | (-2.59) |
| $GDP_{t-1}$ | 0.201*** | 0.122 | -0.404*** | -0.008 | 0.698*** | 0.314*** |
| | (4.64) | (0.32) | (-4.35) | (-0.12) | (3.77) | (3.21) |
| $GDP_{t-2}$ | 0.294*** | -1.508** | 0.254** | 0.143** | 0.449** | 0.027 |
| | (5.07) | (-2.28) | (2.48) | (2.36) | (2.41) | (0.38) |
| F | 9.72*** | 11.18*** | 9.05*** | 1.97 | 30.11*** | 5.41*** |
| $R^2$ | 0.254 | 0.019 | 0.009 | 0.016 | 0.109 | 0.049 |
| No. of Obs. | 406 | 406 | 406 | 406 | 406 | 406 |
| No. of Groups | 16 | 16 | 16 | 16 | 16 | 16 |

Note: (1) S is the sustainability indicator, and GDP is first difference of the log real gross domestic product.
(2) Regression methods are Fixed effects model with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86.

To avoid the possible endogeneity issue that government spending has an effect on economic growth, this section conducts two stage least squares (2SLS) estimation utilizing instrumental variable. The GDP growth of the USA (for other OECD countries) and the average GDP growth of OECD countries (for USA) are utilized as the instrument of GDP growth following the existing literature (Candelon, Muysken and Vermeulen, 2010; Galí and Perotti, 2003) as stated in chapter 2. The results confirm our baseline estimation of Table 4.12. Appendix 4. Table A4.2 shows that there is a large degree of similarity between baseline estimation and IV estimations,

145. The results of coefficients of other independent variables generally confirm the result of Table 2.13 of chapter 2.

which confirms that our baseline estimation properly address the endogeneity issue although it employs OLS estimation.

Second, this subsection explores the effect of fiscal sustainability on fiscal procyclicality in a more explicit way. We regress the fiscal procyclicality indicator on the fiscal sustainability indicator and the lag value of the fiscal procyclicality indicator. We include the lag value of the dependent variable to reflect the inertial properties of fiscal policy following the result of chapter 2 that the trend of cyclical properties of fiscal policy is stable over time. Table 4.13 shows that fiscal sustainability is negatively associated with fiscal procyclicality, but all coefficients of the fiscal sustainability indicator are insignificant. To sum up, fiscal sustainability does not appear to have a statistically significant effect on the cyclicality of fiscal policies.

Table 4.13 The effect of fiscal sustainability on fiscal procyclicality (Revisited)

| Dependent Variable : fiscal procyclicality indicator | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $S_t$ | -0.454 | -0.709 | -0.480 | -0.310 | -0.838 | -0.354 |
| | (-1.69) | (-0.53) | (-1.30) | (-1.33) | (-1.47) | (-1.60) |
| $P_{t-1}$ | 0.728*** | 0.854*** | 0.727*** | 0.815*** | 0.751*** | 0.864*** |
| | (23.71) | (38.37) | (12.66) | (19.64) | (22.10) | (17.55) |
| F | 396.91*** | 1248.09*** | 84.77*** | 257.06*** | 261.09*** | 161.01*** |
| $R^2$ | 0.698 | 0.754 | 0.703 | 0.751 | 0.621 | 0.742 |
| No. of Obs. | 386 | 386 | 384 | 386 | 386 | 386 |
| No. of Groups | 16 | 16 | 16 | 16 | 16 | 16 |

Note: (1) S is the fiscal sustainablity indicator and P is the fiscal procyclicality indicator.
(2) Regression methods are Fixed effect (FE) estimation with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86 and Penn World Tables 6.3.

To conclude, fiscal sustainability does not appear to have a direct effect on economic growth. Unsustainable fiscal finances do not hinder economic growth in tranquil times, even though the deterioration of fiscal finances could lead to sudden economic crisis by endangering the default of government debt as is argued by Rankin and Roffia (2003) [146]. This finding could be rationalized by the fact that one

146. Rankin and Roffia (2003) argue that finite maximum sustainable level of debt does exist before capital stock reaches its limit even though there is possibility of sudden ceases by employing an overlapping generation model. That is, further small increases in debt could result in unstable capital decummulation. They, therefore, suggest that the government whose debt has been gradually

cannot confirm the possible channel that an unsustainable fiscal policy could have a harmful effect on ecominimic growth by inducing procyclical government spending, as can be seen from the empirical evidence of this subsection. These results are not consistent with the argument set out in the existing literature on the determinant of fiscal procyclicality (Gavin and Perotti, 1997; Alberola and Montero, 2007; Mackiewicz, 2008; Lledó, Yackovlev, and Gadenne, 2009). However, the argument of existing literature could not be supported by our empirical evidence of chapter 2 and 3. Table 2.18 of chapter 2 shows that the government debt ratio has a negative effect on fiscal procyclicality, and Table 3.5 of chapter 3 shows that initial debt and average debt are positively related to the level of fiscal sustainability even though the level of significance is low. This could be because high debt could reduce the incentive of an increase in spending by arousing the concern about fiscal sustainability in practice as argued by Guichard, Kennedy, Wurzel, and André (2007), so it could reduce the level of procyclicality and strengthen fiscal sustainability. Also, our results could be rationalized by growth enhancing effect of government spending across spending categories (see, for example, Romero-Ávila and Strauch, 2008; Ismihan and Ozkan, 2005; Bleaney, Gemmell, and Kneller, 2001; Kneller, Bleaney, and Gemmell, 1999). An increase in productive spending, such as government investment, could help enhancing economic growth while an increase in unproductive spending could hinder economic growth. Therefore, the effect of government spending on economic growth is unclear in terms of total spending even though both spending could reduce of the level of fiscal sustainability at least in the short-term. To sum up, it may be difficult empirically to establish a significant role for fiscal sustainability on economic growth.

### 3.3.3. Additional robustness checks

To check the robustness of the baseline analysis, this subsection conducts a few additional analyses. First, we add some control variables which affect economic growth following Woo (2009) who adds three variables into the regression equation respectively to check whether the baseline result is sensitive to inclusion of these

increased should monitor its debt level carefully to avoid sudden deterioration of debt sustainability. Michel, von Thadden, and Vidal (2010) also argue that there exists a sustainable target level of steady-state debt by employing overlapping generation model.

three variables. Output volatility (GDPVOL) is included to control for the negative effect of output volatility on economic growth, which is measured by the standard deviation of the GDP growth for the period 1970-2008. Trade openness (OPEN) is included to control the positive relationship between trade openness and economic growth, which is defined as the sum of exports and imports over GDP which is taken from Penn World Tables 6.3. Government size (GOVSIZE) is included to control for the negative effect of government size on economic growth, which is measured by the ratio of government expenditure relative to GDP. One can see from Table 4.14 that the results show a large degree of similarity with the baseline estimation, both in cross country data analysis and pooled data analysis, even though these three variables are insignificant in most cross country data analysis. The differences are below: the coefficients of the procyclicality indicator of current expenditure becomes significant in cross country analyses, and the coefficient of the procyclicality indicator of government consumption in cross coutnry data analysis and current transfers in pooled data analysis become insignificant when government size is controlled. These results confirm that our baseline estimation is not affected by additional control variables, which is consistent with the result of Woo (2009).

This section also conducts the same regression including three control variables into the regression equation altogether. Appendix 4. Table 4A. 3 also generally confirms our baseline estimation, but the significance level is different. Therefore, the coefficients of the procyclicality indicator of current expenditure in cross country data analysis and that of interest payments in pooled data analysis become significant, and the coefficient of the procyclicality indicator of government consumption and current transfers becomes insignificant in pooled data analyses. The reason why the results show a few differences with the baseline results is that a cross-country analysis of the effect of fiscal procyclicality on economic growth is unlikely to be robust to inclusion of additional control variables when samples are small (Aghion, Hemous and Kharroubi, 2009).

Table 4.14 The effect of fiscal procyclicality on economic growth
(Additional control variables)

Dependent Variable : the growth rate of real GDP per capita

| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
|---|---|---|---|---|---|---|
| **<cross county data>** | | | | | | |
| P | -0.502*** | -0.048 | -0.245 | -0.532** | -0.111 | -0.516*** |
| | (-2.97) | (-0.57) | (-1.10) | (-2.41) | (-0.75) | (-5.24) |
| GDPVOL | -0.231** | 0.231 | 0.324* | -0.119 | 0.421** | 0.050 |
| | (-2.02) | (1.69) | (2.00) | (-1.09) | (2.37) | (0.65) |
| F | 84.04*** | 18.41*** | 24.69*** | 63.36*** | 23.46*** | 142.54*** |
| $R^2$ | 0.955 | 0.822 | 0.861 | 0.941 | 0.854 | 0.973 |
| No. of Obs. | 21 | 21 | 21 | 21 | 21 | 21 |
| P | -0.422** | -0.015 | -0.128 | -0.531** | 0.061 | -0.537*** |
| | (-2.62) | (-0.22) | (-0.69) | (-2.43) | (0.50) | (-7.47) |
| OPEN | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | -0.001 |
| | (0.38) | (0.25) | (0.23) | (0.39) | (0.27) | (-0.91) |
| F | 85.69*** | 30.21*** | 1.32 | 61.21*** | 1.22 | 253.10*** |
| $R^2$ | 0.955 | 0.883 | 0.261 | 0.939 | 0.246 | 0.984 |
| No. of outliers | - | - | 1 | - | 1 | - |
| No. of Obs. | 21 | 21 | 20 | 21 | 20 | 21 |
| P | -0.377 | -0.071 | -0.123 | -0.476** | -0.031 | -0.526*** |
| | (-1.68) | (-0.95) | (-0.53) | (-2.32) | (-0.21) | (-6.27) |
| GOVSIZE | -0.013 | -0.019 | -0.013 | -0.011 | -0.016 | -0.017*** |
| | (-1.28) | (-1.49) | (-1.01) | (-1.36) | (-1.15) | (-3.23) |
| F | 40.39*** | 24.57*** | 22.31*** | 67.39*** | 21.28*** | 168.28*** |
| $R^2$ | 0.91 | 0.86 | 0.848 | 0.944 | 0.842 | 0.977 |
| No. of Obs. | 21 | 21 | 21 | 21 | 21 | 21 |
| **<pooled data>** | | | | | | |
| P | -0.291** | -0.037 | -0.203* | -0.508*** | 0.029 | -0.082 |
| | (-1.99) | (-0.92) | (-1.76) | (-3.08) | (1.02) | (-0.76) |
| GDPVOL | -0.017 | 0.175 | 0.183 | 0.251 | -0.053 | 0.146 |
| | (-0.09) | (0.82) | (0.88) | (1.20) | (-0.27) | (0.66) |
| F | 23.06*** | 22.07*** | 17.82*** | 24.36*** | 21.95*** | 21.59*** |
| $R^2$ | 0.140 | 0.139 | 0.115 | 0.15 | 0.135 | 0.137 |
| No. of Obs. | 571 | 554 | 552 | 557 | 568 | 548 |
| P | -0.254* | -0.038 | -0.206* | -0.459*** | 0.028 | -0.056 |
| | (-1.74) | (-0.95) | (-1.79) | (-2.80) | (0.99) | (-0.54) |
| OPEN | 0.006** | 0.006** | 0.006** | 0.006* | 0.007** | 0.005* |
| | (2.03) | (2.02) | (2.05) | (1.88) | (2.11) | (1.72) |
| F | 24.11*** | 23.30*** | 18.42*** | 25.01*** | 23.23*** | 22.34*** |
| $R^2$ | 0.146 | 0.145 | 0.119 | 0.153 | 0.142 | 0.141 |
| No. of Obs. | 571 | 554 | 552 | 557 | 568 | 548 |
| P | -0.285** | -0.055 | -0.120 | -0.441*** | 0.028 | -0.070 |
| | (-1.99 | (-1.38) | (-1.04) | (-2.72) | (1.00) | (-0.68) |
| GOVSIZE | -0.052*** | -0.054*** | -0.047*** | -0.049*** | -0.053*** | -0.050*** |
| | (-4.26) | (-4.32) | (-3.84) | (-4.00) | (-4.32) | (-4.06) |
| F | 28.37*** | 27.49*** | 22.13*** | 28.67*** | 27.36*** | 26.33*** |
| $R^2$ | 0.168 | 0.167 | 0.139 | 0.172 | 0.164 | 0.162 |
| No. of Obs. | 565 | 554 | 552 | 557 | 562 | 548 |

Note: (1) P is the procyclicality indicator, GDPVOL is output volatility, OPEN is trade openness, and GOVSIZE is government size. All regressions include INIIC (initial income) and INIHC (initial human capital) as additional control variables.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

We conduct the same analysis with regard to the effect of fiscal sustainability on economic growth as well. We add three control variables (GDP volatility, trade openness, and government size) into the regression equation to check whether the baseline results are sensitive to inclusion of these variables. One can see from Table 4.15 that three variables are generally insignificant, and therefore the results generally confirm our baseline analysis. All coefficients of the sustainability indicator in both cross county data and pooled data are insignificant, even though the former could suffer from small sample bias. To sum up, our results of baseline estimation that fiscal sustainability does not play any role in economic growth is not affected by additional control variables.

Table 4.15 The effect of fiscal sustainability on economic growth
(Additional control variables)

Dependent Variable : the growth rate of real GDP per capita

| | cross country data | | | | pooled data | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| S | 0.323 | 0.303 | 0.220 | -2.429 | 0.531 | 0.263 | 0.541 | 0.441 |
| | (0.09) | (0.08) | (0.07) | (-1.70) | (0.52) | (0.26) | (0.55) | (0.43) |
| INIIC | -1.817** | -2.186** | -1.822** | -1.685*** | -1.978*** | -2.408*** | -1.834*** | -1.643*** |
| | (-2.77) | (-3.16) | (-3.05) | (-14.05) | (-3.98) | (-9.06) | (-5.45) | (-3.09) |
| INIHC | 0.108 | 0.104 | 0.092 | 0.102*** | 0.044 | 0.045 | 0.012 | 0.015 |
| | (1.56) | (1.41) | (1.44) | (4.75) | (0.42) | (0.43) | (0.12) | (0.15) |
| GDPVOL | 0.192 | | | 0.295** | 0.476 | | | 0.068 |
| | (0.94) | | | (3.23) | (1.20) | | | (0.15) |
| OPEN | | 0.001 | | 0.004** | | 0.001 | | 0.007* |
| | | (0.23) | | (3.23) | | (0.27) | | (1.81) |
| GOVSIZE | | | -0.011 | -0.019*** | | | -0.044*** | -0.055*** |
| | | | (-1.44) | (-4.24) | | | (-3.38) | (-3.75) |
| F | 2.81* | 2.87* | 3.60* | 271.47*** | 22.38*** | 21.78*** | 25.85*** | 17.99*** |
| $R^2$ | 0.555 | 0.561 | 0.615 | 0.995 | 0.190 | 0.186 | 0.213 | 0.221 |
| No. of outliers | 2 | 2 | 2 | 1 | - | - | - | - |
| No. of Obs. | 14 | 14 | 14 | 15 | 387 | 387 | 387 | 387 |

Note: (1) S is the procyclicality indicator, GDPVOL is output volatility, OPEN is trade openness, and GOVSIZE is government size. All regressions include INIIC (initial income) and INIHC (initial human capital) as additional control variables.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

Second, this subsection conducts the same analysis including the fiscal procyclicality indicators and fiscal sustainability indicators simultaneously[147]. These

147. We do not include the interaction for the fiscal procyclicality indicator and the fiscal sustainability indicator since the two variables do not seem to have a certain relationship as can be seen from section 3.3.2 and Appendix 4. Regression results also show that the coefficients of interaction terms are all insignificant.

estimates generally confirm the results of our baseline estimation in spite of different levels of statistical significance. With regard to the effect of fiscal procyclicality on economic growth, the coefficients of the procyclicality indicator show a large similarity with baseline results except that of government consumption in cross country data analysis and that of current transfers in pooled data analysis become insignificant when the level of fiscal sustainability is controlled. With regard to the effect of fiscal sustainability on economic growth, all coefficients are still insignificant even though many show the opposite signs. To sum up, our results of baseline estimation of Table 4.5 and 4.11 are not affected when the level of fiscal procyclicality and sustainability is controlled. The effect of fiscal procyclicality on economic growth is not affected when the level of fiscal sustianbility is constant, and the same thing applies to the effect of fiscal sustianbility on economic growth.

Table 4.16 The effect of fiscal procyclicality and sustainability on economic growth (Control each other)

| Dependent Variable : the growth rate of real GDP per capita | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| **<cross county data>** | | | | | | |
| P | -0.279 | -0.019 | -0.157 | -0.317 | -0.027 | -0.393*** |
| | (-1.25) | (-0.36) | (-1.07) | (-1.67) | (-0.20) | (-4.68) |
| S | -0.033 | 0.528 | -0.510 | -0.069 | -0.279 | -0.914 |
| | (-0.01) | (0.13) | (-0.15) | (-0.02) | (-0.06) | (-0.65) |
| INIIC | -2.294*** | -2.118** | -2.116*** | -2.333*** | -2.158** | -2.694*** |
| | (-16.96) | (-3.00) | (-3.43) | (-4.33) | (-3.00) | (-9.88) |
| INIHC | 0.113** | 0.107 | 0.104 | 0.131* | 0.099 | 0.164*** |
| | (2.52) | (1.34) | (1.56) | (2.22) | (1.32) | (5.25) |
| F | 89.12*** | 2.61 | 3.65* | 5.48** | 2.70* | 29.25*** |
| $R^2$ | 0.973 | 0.537 | 0.618 | 0.709 | 0.545 | 0.929 |
| | 1 | 2 | 2 | 2 | 2 | 2 |
| No. of Obs. | 15 | 14 | 14 | 14 | 14 | 14 |
| **<pooled data>** | | | | | | |
| P | -0.289* | -0.065 | -0.205 | -0.508*** | 0.072 | -0.049 |
| | (-1.78) | (-1.55) | (-1.53) | (-2.90) | (1.42) | (-0.41) |
| S | -0.018 | 0.036 | -0.162 | -0.370 | 0.528 | 0.225 |
| | (-0.02) | (0.04) | (-0.16) | (-0.38) | (0.53) | (0.22) |
| INIIC | -2.502*** | -2.435*** | -2.319*** | -2.518*** | -2.486*** | -2.501*** |
| | (-9.25) | (-8.98) | (-8.42) | (-9.41) | (-9.12) | (-9.07) |
| INIHC | 0.055 | 0.06 | 0.047 | 0.094 | 0.034 | 0.054 |
| | (0.53) | (0.58) | (0.45) | (0.91) | (0.33) | (0.50) |
| F | 23.12*** | 22.47*** | 19.25*** | 24.67*** | 22.37*** | 22.08*** |
| $R^2$ | 0.195 | 0.190 | 0.168 | 0.205 | 0.190 | 0.188 |
| No. of Obs. | 387 | 387 | 386 | 387 | 387 | 387 |

Note: (1) P is the procyclicality indicator, S is the sustainability indicator, INIIC is initial income, and INIHC is initial human capital.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

Third, this subsection conducts two stage least squares (2SLS) estimation utilizing instrumental variables to deal with the endogeneity problem of the reverse casual effect of economic growth on fiscal procyclicality and sustainability. The average GDP per capita and the level of fiscal procyclicality are measured during the same period, so this could be functioned as the source of endogeneity (Woo, 2009). Freedman, Kumhof, Laxton, and Mursula (2009) argue that not only the level of fiscal sustainability might have an effect of economic growth, but also economic growth might play a role in the level of fiscal sustainability.

This section mainly focuses on estimating pooled data since fiscal procyclicality of each country cannot be instrumented appropriately[148]. To solve the possible endogeneity relationship, the lag and the lead value are utilized as the instrument of current fiscal procyclicality and sustainability indicators following Aghion and Marinescu (2007)[149]. Table 4.17 shows that one should consider the potential endogeneity problem in explaining the effect of procyclicality of government consumption and current expenditure since the Hausman test for exogeneity of an explanatory variable is rejected at the conventional levels. The results also show that the coefficient of the procyclicality indicator of government consumption and current expenditure, which were significant in the baseline analysis, becomes insignificant. To sum up, procyclical current expenditure including government consumption and current transfers could have a negative effect on economic growth, but this negative effect of procyclical current expenditure on economic growth will be lessened if one considers the reverse causuality that economic growth affects the level of procyclicality of government consumption.

With regard to the effect of sustainability, the result show a few differences with baseline estimation of Table 4.11. The coefficient of fiscal sustainability indicator becomes larger and significant. However, we need not to consider the

148. Woo (2009) employs two variables (natural resource endowments and settler mortality in European colonies in the seventeenth to nineteenth centuries) to instrument the level of procyclicality in his cross country analysis. However, these variables are only available to developing or underdeveloped countries. The dataset of natural resource endowments (Auty, 2001) includes only three OECD countries (Korea, Mexico, and Turkey), and that of settler mortality (Acemoglu, Johnson and Robinson, 2001) includes only four OECD countries (Canada, Mexico, New Zealand, and the USA).

149. The results of the overidentifying test (OID) are insignificant in all specifications except in explaining the effect of procyclical interest payments in column (2), which indicates that the instrumental variables (the lag and the lead value) are valid.

potential endogeneity problem since the Hausman test for exogeneity of an explanatory variable is accepted at the conventional levels. To conclude, fiscal sustainability does not appear to have a statistically significant effect on economic growth if we consider the result of baseline estimation of Table 4.11 and robust estimation of Table 4.17.

Table 4.17 The effect of fiscal procyclicality and sustainability on economic growth (2SLS)

| Dependent Variable : the growth rate of real GDP per capita | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) Consump-tion | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure | (7) Sustain-ability |
| P | -0.205 | 0.036 | -0.218 | -0.327 | 0.078** | 0.053 | |
| | (-1.07) | (0.71) | (-1.48) | (-1.52) | (2.18) | (0.41) | |
| S | | | | | | | 2.872** |
| | | | | | | | (2.19) |
| INIIC | -2.176*** | -2.147*** | -2.157*** | -2.224*** | -2.185*** | -2.138*** | -2.158*** |
| | (-7.11) | (-6.64) | (-6.33) | (-7.14) | (-6.80) | (-6.43) | (-6.59) |
| INIHC | 0.092 | 0.092 | 0.094 | 0.114 | 0.131 | 0.097 | 0.012 |
| | (0.86) | (0.84) | (0.87) | (1.07) | (1.22) | (0.89) | (0.10) |
| F | 17.92*** | 15.48*** | 14.31*** | 18.19*** | 17.21*** | 15.20*** | 16.39*** |
| $R^2$ | 0.090 | 0.079 | 0.076 | 0.095 | 0.082 | 0.080 | 0.120 |
| No. of Obs. | 551 | 530 | 528 | 535 | 547 | 526 | 374 |
| Hausman $chi^2$ | 21.63*** | 6.50* | 1.61 | 48.56*** | 6.04 | 1.39 | 0.23 |
| OID | 0.95 | 18.43*** | 0.50 | 2.18 | 2.19 | 0.44 | 0.49 |

Note: (1) P is the procyclicality indicator, S is the sustainability indicator, INIIC is initial income, and INIHC is initial human capital.
(2) Regression methods are 2SLS instrumental variables estimation with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

## 4. Conclusion and policy implications

Our analyses could confirm the facts that a countercyclical fiscal policy could have a positive effect on economic growth while sustainable fiscal finances do not seem to play any role in economic growth.

With regard to the effect of the cyclical properties of fiscal policy on economic growth, our empirical evidence shows that the procyclical behaviour of unproductive government spending, such as government consumption and current transfers, could

hinder economic growth. These results could imply that stronger automatic stabilizers in the budget system could help enhance economic growth since current transfers include the cyclical component of budget. On the other hand, procyclical government investment does not hinder economic growth, and it could even have a positive effect on future economic growth. This could be because government investment is generally considered to be productive (see, for example, Romero-Ávila and Strauch, 2008; Ismihan and Ozkan, 2005; Bleaney, Gemmell, and Kneller, 2001; Kneller, Bleaney, and Gemmell, 1999), so an increase in government investment even during booms could help long term economic growth since the accumulation of capital stock by government investment could have a favourable effect on the future economic performances. We can also confirm the negative effect of procyclical fiscal policy on economic growth through more comprehensive samples including both advanced countries and emerging market countries. Our findings suggest that the negative effect of procyclical fiscal policy on economic growth is prominent in the emerging market countries while it is not noticeable in advanced countries.

With regard to the effect of the fiscal sustainability on economic growth, our findings suggest that it may be difficult empirically to establish a significant effect for sustainable fiscal policy on economic growth. This result implies that fiscal sustainability does not seem to play any role in economic growth in tranquil times, even though the deterioration of fiscal finances could lead to a sudden economic crisis by endangering default of government debt.

The contribution of our study is that it not only confirms the results of the existing literature that suggests the empirical evidence of the negative effect of procyclical government spending on economic growth, but also provides several new implications by analysing these effects across spending categories and country groups for the first time. First, our analysis provides policy implications that fiscal authorities should control the increasing pressure on unproductive spending, such as government consumption and current transfers, in booms to avoid an unfavourable effect of procyclical fiscal policy on economic growth. Second, our empirical result of the negative relationship between procyclical current transfers and economic growth implies that fiscal authorities should make an effort to reform the budget systems in a way that has stronger automatic stabilizers to enhance economic growth.

Third, our analysis recommends that emerging market countries should be more cautious to operate fiscal policy since their economic growth is more sensitive to the level of fiscal procyclicality than in advanced countries. Another important contribution of our study is that it shows that unsustainable fiscal finances do not hinder economic growth in tranquil times even though it could lead to a sudden economic crisis.

Policymakers, therefore, should aim both a countercyclical and sustainable fiscal policy to achieve sustained economic growth avoiding economic crisis. Well-designed countercyclical fiscal stimulus measures could achieve both fiscal sustainability and macroeconomic stability. Countercyclical fiscal stimulus measures should be accompanied by appropriate exit strategies to avoid the deterioration of fiscal sustainability (Corsetti, Kuester, Meier, and Müller, 2010). Countercyclical fiscal measures in recessions should also be spending increases rather that tax cuts to maintain fiscal sustainability. Spending increases have a temporary effect even though some spendings could be difficult to terminate due to political reasons, while tax cuts have a permanet effect on fiscal sustainability (Padoan, 2009). Well-designed fiscal rules could also help to achieve both two main objectives of fiscal policy. Schick (2003) argues that fiscal rules should be designed in a way that is helpful to countercyclical and sustainable fiscal policy. The author, therefore, suggests realistic, enforced, and a multi-year covered rule as the condition for efficient fiscal rules. Our empirical findings in chapter 2 and 3 also suggest that fiscal rules should be designed in a way that is multi-year covered and is enforced to enhance fiscal countercyclicality and sustainability.

Our analyses have also several limitations. First, the measurement of time-varying indicators of fiscal procyclicality and sustainability is a difficult issue. Fiscal procyclicality mainly focuses on the short term change of policy stance responding to the business cycle. However, the dataset should have some degree of freedom to obtain the level of procyclicality by the regression method, so it cannot reflect the real degree of fiscal procyclicality at a certain time. On the other hand, fiscal sustainability focuses on the long term persistency of fiscal policy, so the level of fiscal sustainability at a certain time is difficult to obtain by regression methods which are adopted in our analysis. Some literature have attempted to find

appropriate sustainability indicators at certain time (see, for example, Buiter, 1985; Blanchard, 1990; Uctum and Wickens, 2000; Croce and Juan-Ramón, 2003; Polito and Wickens, 2005), but it still has a weakness that the consensus about the target level of the debt is difficult[150]. Second, this chapter examines the effect of fiscal sustainability on economic growth in OECD countries. However, the results could be different depending on country groups like the effect of fiscal procyclicality on economic growth as examined in this chapter. We can include a further analysis of these issues in our agenda of future research.

150. The literature does not suggest a helpful answer about the level of optimal debt (Wren-Lewis, 2011).

# Appendix 4

## The effect of fiscal procyclicality on fiscal sustainability

To explore the effect of fiscal procyclicality on fiscal sustainability, we employ a similar method that we utilized in section 3.3.2 where we assessed the effect of fiscal sustainability on fiscal procyclicality. We include the interaction term for the indicator of fiscal procyclicality and the debt-GDP ratio into the regression equation (3.7) in chapter 3 which estimates the level of fiscal sustainability.

$$s_{it} = \alpha_i + \beta d_{i,t-1} + \gamma GVAR_{it} + \lambda YVAR_{it} + \theta_i s_{i,t-1} + \delta P_{it} \times d_{i,t-1} + u_{it} \quad (4A.1)$$

in which $s_{it}$ is the primary budget balance-GDP ratio, $d_{it}$ is the debt-GDP ratio, $GVAR_{it}$ is the temporary government expenditure, $YVAR_{it}$ is the proportional short fall of output, and $P_{it}$ is the fiscal procyclicality indicator obtained by rolling window estimation. A positive β implies sustainable fiscal finances, and a positive δ indicates that a procyclical fiscal policy plays a role in enhancing fiscal sustainability.

Table 4A.1 shows that the effect of fiscal procyclicality on fiscal sustainability is not certain. The estimated coefficients do not provide a clear picture. The interaction term for procyclicality of current expenditure (government consumption / interest payments / current transfers) and the debt-GDP ratio are negatively associated with the primary budget balance-GDP ratio, while that of government investment are positively associated with the primary budget balance-GDP ratio. These results could be interpreted that procyclical current expenditure could play a role in deteriorating fiscal sustainability, but these effects are offset by the positive effect of procyclical government investment on fiscal sustainability. As a result, procyclical total expenditure could help maintain fiscal sustainability. One of the possible explanations of these empirical results could be the different effect of fiscal procyclicality on economic growth depending on the types of government spending,

as discussed in section 3.3.1. Procyclical current expenditure including government consumption and current transfers, which is assumed to be unproductive, could cause a crowding out effect, and it in turn leads to negative effect on the fiscal sustainability. On the other hand, procyclical government investment, which is assumed to be productive, could help enhancing economic growth, and it in turn could raise the fiscal sustainability by increasing tax revenue. Therefore, procyclical total expenditure could help maintain fiscal sustainability if the negative effect of procyclical current expenditure is overwhelmed by the positive effect of procyclical government investment on fiscal sustainability. However, all coefficients are insignificant, so one cannot confirm the effect of fiscal procyclicality on fiscal sustainability.

Table 4A.1 The effect of fiscal procyclicality on fiscal sustainability

| Dependent Variable : the primary budget balance to GDP ratio ($s_t$) | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $P_t * d_{t-1}$ | -0.001 | -0.001 | -0.001 | -0.002 | 0.001 | 0.004 |
| | (-0.48) | (-0.82) | (-0.39) | (-0.46) | (1.19) | (1.72) |
| $d_{t-1}$ | 0.023* | 0.023* | 0.023* | 0.023* | 0.023* | 0.030*** |
| | (1.77) | (1.85) | (1.84) | (1.79) | (1.87) | (3.12) |
| $GVAR_t$ | -127.040*** | -126.229*** | -126.912*** | -126.484*** | -126.670*** | -127.008*** |
| | (-12.33) | (-11.89) | (-12.70) | (-12.58) | (-12.63) | (-14.37) |
| $YVAR_t$ | -48.863*** | -45.516** | -48.397*** | -49.180*** | -48.961** | -49.412*** |
| | (-3.02) | (-2.57) | (-3.07) | (-3.06) | (-3.03) | (-3.32) |
| $s_{t-1}$ | 0.744*** | 0.740*** | 0.746*** | 0.742*** | 0.746*** | 0.744*** |
| | (23.26) | (24.95) | (22.54) | (24.95) | (21.27) | (23.07) |
| F | 1036.38*** | 1138.82*** | 1002.55*** | 1423.56*** | 626.47*** | 718.67*** |
| $R^2$ | 0.758 | 0.756 | 0.756 | 0.756 | 0.753 | 0.741 |
| No. of Obs. | 490 | 487 | 485 | 490 | 487 | 481 |
| No. of Groups | 21 | 21 | 21 | 21 | 21 | 21 |

Note: (1) $P_t$ is the procyclicality indicator, $s_t$ is the primary budget balance-GDP ratio, $d_t$ is the debt-GDP ratio, $GVAR_t$ is the temporary increase in government expenditure, and $YVAR_t$ is the temporary variation in the business cycle.
(2) Regression methods are Fixed effect estimation with robust standard errors.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

It is intuitively clear that cyclical properties of fiscal policy do not play a certain role in determining fiscal sustainability. A countercyclical fiscal policy to recover economic recession is generally accompanied by an increase in debt, and it in turn induces the deterioration of fiscal sustainability as argued in the existing literature

(Padoan, 2009; Freedman, Kumhof, Laxton, Muir, and Mursula, 2009; Bi, 2010; Bi and Leeper, 2010) [151]. However, a considerable amount of budget deficit will be offset by the function of automatic stabilizers (Freedman, Kumhof, Laxton, Muir, and Mursula, 2009), and this effect will be strengthened if the economy starts to recover due to the effect of successful countercyclical fiscal measures. On the other hand, countercyclical fiscal policy could decrease debt in booms by reducing spending. Hence, the effect of the countercyclical fiscal policy on fiscal sustainability could be concluded to be neutral. The same rationale could be applied to procyclical fiscal policy. Procyclical fiscal policy could reduce deficits and debt in recessions while it could increase deficits and debt in booms.

151. Padoan (2009) argues that current fiscal packages could cause a more serious debt sustainability problem because the current economic crisis could induce lower growth and higher interest rates by analysing the effect of discretionary fiscal stimulus packages on the short term demand and the long term growth since 2008. Freedman, Kumhof, Laxton, Muir, and Mursula (2009) also argue that a countercyclical fiscal stimulus could have short term effect on economic growth, but they could lead to long-run crowding out effects due to inducing higher debt if fiscal stimulus leads to permanent increase in debt by calibrating the short run fiscal multiplier and long run crowding out effect of G20 fiscal stimulus packages which was implemented over 2009 and 2010. Bi (2010) and Bi and Leeper (2010) argue that countercyclical transfers could enlarge the dispersion of distribution of fiscal limit (maximum sustainable debt) by worsening the budget deficit, which implies that the probability of default is likely to increase, by analysing the fiscal data of OECD countries.

Table 4A.2 The effect of fiscal sustainability on fiscal procyclicality (FE 2SLS)

| Dependent Variable : Difference in log of real government spending | | | | | | |
|---|---|---|---|---|---|---|
| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
| $S_t * GDP_t$ | -0.191 | 0.179 | -0.260 | -0.074 | -0.935 | -0.022 |
| | (-0.68) | (0.14) | (-0.70) | (-0.25) | (-0.98) | (-0.06) |
| $GDP_t$ | -0.541*** | -2.448*** | -1.054*** | -0.924*** | -0.013 | -1.085*** |
| | (-2.82) | (-2.83) | (-4.16) | (-4.53) | (-0.02) | (-4.01) |
| $GDP_{t-1}$ | 0.429*** | 0.933* | -0.105 | 0.307*** | 0.911** | 0.634*** |
| | (4.05) | (1.95) | (-0.75) | (2.72) | (2.56) | (4.24) |
| $GDP_{t-2}$ | 0.234*** | -1.724*** | 0.174* | 0.059 | 0.392 | -0.059 |
| | (3.27) | (-5.35) | (1.79) | (0.78) | (1.63) | (-0.58) |
| Wald | 673.91*** | 44.25*** | 465.80*** | 563.72*** | 44.65*** | 300.62*** |
| $R^2$ | 0.063 | 0.010 | 0.001 | 0.001 | 0.098 | 0.007 |
| Hausman $chi^2$ | 28.50*** | 39.35*** | 214.64*** | 81.66*** | 0.71 | 32.99*** |
| No. of Obs. | 406 | 406 | 406 | 406 | 406 | 406 |
| No. of Groups | 16 | 16 | 16 | 16 | 16 | 16 |

Note: (1) $S_t$ is the sustainability indicator, and GDP is first difference of the log real gross domestic product.
(2) Regression methods are Fixed effect 2SLS Instrumental variables estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Source: OECD Economic Outlook Database No.86.

Table 4A.3 The effect of fiscal procyclicality on economic growth
(Three additional control variables)

Dependent Variable : the growth rate of real GDP per capita

| | (1) Consumption | (2) Interest Payments | (3) Current Transfers | (4) Current Expenditure | (5) Investment | (6) Total Expenditure |
|---|---|---|---|---|---|---|
| **<cross county data>** | | | | | | |
| P | -0.484** | -0.078 | -0.239 | -0.539*** | 0.105 | -0.545*** |
| | (-2.83) | (-1.28) | (-1.29) | (-3.55) | (0.57) | (-4.09) |
| INIIC | -2.274*** | -1.737*** | -1.823*** | -2.022*** | -1.815*** | -1.880*** |
| | (-12.65) | (-7.30) | (-7.5) | (-14.72) | (-5.13) | (-11.08) |
| INIHC | 0.093* | 0.167** | 0.146** | 0.166*** | 0.127 | 0.170*** |
| | (1.81) | (2.30) | (2.20) | (4.28) | (1.18) | (3.46) |
| GDPVOL | -0.271** | 0.088 | 0.283* | -0.111 | -0.092 | 0.106 |
| | (-2.58) | (0.63) | (1.98) | (-1.36) | (-0.42) | (0.98) |
| OPEN | 0.003 | 0.006* | 0.006* | 0.004* | 0.011* | 0.003 |
| | (0.98) | (1.85) | (1.79) | (1.93) | (2.11) | (1.25) |
| GOVSIZE | -0.020* | -0.030** | -0.017 | -0.028*** | -0.039* | -0.028** |
| | (-1.94) | (-2.22) | (-1.20) | (-3.57) | (-1.95) | (-2.88) |
| F | 53.02*** | 25.57*** | 26.88*** | 83.82*** | 12.26*** | 52.79*** |
| $R^2$ | 0.958 | 0.916 | 0.920 | 0.973 | 0.840 | 0.958 |
| No. of Obs. | 21 | 21 | 21 | 21 | 21 | 21 |
| **<pooled data>** | | | | | | |
| P | -0.215 | -0.074* | -0.100 | -0.415** | 0.028 | -0.032 |
| | (-1.50) | (-1.85) | (-0.87) | (-2.53) | (0.99) | (-0.30) |
| INIIC | -1.743*** | -1.693*** | -1.614*** | -1.660*** | -1.876*** | -1.827*** |
| | (-5.08) | (-4.74) | (-4.48) | (-4.86) | (-5.30) | (-5.15) |
| INIHC | 0.057 | 0.115 | 0.072 | 0.097 | 0.087 | 0.081 |
| | (0.59) | (1.17) | (0.74) | (1.00) | (0.89) | (0.81) |
| GDPVOL | -0.254 | -0.133 | -0.145 | -0.073 | -0.288 | -0.202 |
| | (-1.22) | (-0.60) | (-0.66) | (-0.33) | (-1.37) | (-0.87) |
| OPEN | 0.012*** | 0.013*** | 0.012*** | 0.011*** | 0.012*** | 0.011*** |
| | (3.61) | (3.88) | (3.68) | (3.52) | (3.75) | (3.40) |
| GOVSIZE | -0.074*** | -0.076*** | -0.069*** | -0.067*** | -0.076*** | -0.071*** |
| | (-5.5) | (-5.48) | (-4.94) | (-4.91) | (-5.63) | (-5.12) |
| F | 21.72*** | 21.45*** | 17.42*** | 21.31*** | 21.66*** | 19.94*** |
| $R^2$ | 0.189 | 0.19 | 0.161 | 0.189 | 0.19 | 0.181 |
| No. of Obs. | 565 | 554 | 552 | 557 | 562 | 548 |

Note: (1) P is the procyclicality indicator, GDPVOL is output volatility, OPEN is trade openness, and GOVSIZE is government size.
(2) Regression methods are reweighted least squares (RWLS) estimation.
(3) t-statistics are in parentheses. *, **, *** indicate significance at the 10%, 5%, 1% level respectively.
Sources: OECD Economic Outlook Database No.86, Penn World Tables 6.3, and Barro and Lee dataset (2000).

# Chapter 5

# Conclusion

The main purposes of this thesis are to examine the determinants of fiscal procyclicality and sustainability with special reference to the role of fiscal rules and to explore the effect of both fiscal procyclicality and sustainability on economic growth. The main conclusion of this thesis could be summarized as follows.

First, we find that a large number of OECD countries seem to operate their fiscal policy in a procyclical way from the viewpoint of some spending categories, as can be seen from chapter 2. More specially, government consumption and investment appear to be procyclical while current transfers appear to be countercyclical in a large number of OECD countries. This could be explained by the characteristics of spending categories. Government consumption and investment are the main spending categories which policymakers can control discretionarily while current transfers are not easy to be adjusted by governments since they are functioned as automatic stabilizers. Also, we confirm that some factors which are commonly introduced in the existing literature play a certain role in determining the level of fiscal procyclicality. The level of development and the government debt ratio have a negative effect on fiscal procyclicality.

Second, we show that most OECD countries seem to operate their fiscal policy in a sustainable way while some countries appear to suffer from unsustainable fiscal finances such as Greece, Iceland, New Zealand, and Slovakia, as can be seen from chapter 3. We find that a number of factors play an important role in determining fiscal sustainability. The growth rate has a positive effect on fiscal sustainability while aging populations have a negative effect. Our empirical findings also suggest that advanced countries are more likely to maintain sustainable fiscal finances and that fiscal rules with enforceability, such as the SGP rules, could improve the sustainability of fiscal finances.

Third, we show that a countercyclical fiscal policy could help enhancing economic growth while fiscal sustainability does not play any role in economic growth, as can be shown in chapter 4. Our empirical findings also suggest that the composition of government spending plays a key role in its effects on economic growth. More specifically, procyclical current expenditure, especially government consumption and current transfers, which are assumed to be unproductive, plays a role in reducing economic growth while procyclical government investment, which

is considered to be productive, does not hinder economic growth, and it could even have a positive effect on the future economic growth since the accumulation of capital stock by government investment could have favourable effects on the future economic performances. This negative effect of procyclical government spending on economic growth appears to be more prominent in emerging market countries than in advanced countries. We also find that fiscal sustainability does not seem to play any role in economic growth in tranquil times, even though the deterioration of fiscal finances could lead to sudden economic crisis by endangering the default of government debt.

Finally, the introduction of fiscal rules not only help achieve both countercyclical and sustainable fiscal policy as can be seen from chapter 2 and 3, but also boost economic growth indirectly as can be seen from chapter 4. Fiscal rules were originally introduced to improve fiscal sustainability, but they also could help governments operate fiscal policy in a more countercyclical way. With regard to the effect of fiscal rules on fiscal sustainability, fiscal rules are effective only when they are accompanied by enforceability because most fiscal rules are designed in a way that has an effect on fiscal sustainability directly such as a budget balance rule or debt ceiling. We provide the empirical evidence in chapter 3 that the Stability and Growth Pact (SGP) rules appear to have helped for policymakers maintain a sustainable fiscal policy in EMU countries, although other fiscal rules do not seem to have any role in maintaining fiscal sustainability in OECD countries due to lack of enforceability when they are violated. With regard to the effect of fiscal rules on fiscal cyclicality, multi-year fiscal rules tend to stimulate a countercyclical fiscal policy more efficiently than annual fiscal rules because they allow the long-term perspective on fiscal policy making. The introduction of multi-year fiscal rules could reduce the level of procyclicality or make fiscal policy more countercyclical, while the effect of anual fiscal rules is not as clear as multi-year fiscal rules as can be see from chapter 2. These results could imply that fiscal rules could help boost economic growth indirectly by stimulating countercyclical fiscal policy if one

considers the results of chapter 4 that countercyclical fiscal policy could enhance economic growth[152].

This thesis deals with several new issues on fiscal procyclicality and sustainability for the first time. We explore the role of the time coverage of fiscal rules in determining fiscal procyclicality and assess the effect of fiscal procyclicality on economic growth across spending categories and county groups. We also attempt to answer the determinants of fiscal sustainability and the effect of fiscal sustainability on economic growth. The main contributions of this thesis are that our analyses not only confirm the results of recent literature on fiscal cyclicality that the fiscal policy of advanced countries have also been procyclical at times and procyclical fiscal policy could hinder economic growth, but also suggest several novel and interesting implications. First, we find a new important determinant of fiscal procyclicality by showing that fiscal rules could play a different role in determining fiscal procyclicality depending on their time coverage. We show that multi-year fiscal rules could contribute more towards mitigating the level of fiscal procyclicality than annual fiscal rules. This result implies that the existing studies about the role of the SGP rules on fiscal cyclicality could be misleading since they do not differentiate the effect of the SGP rules, which are annual rules, and their own national fuscal rules which take generally the form of multi-year rules. Second, we provide the main determinant of fiscal sustainability, which has been ignored in the existing literature, and the structure of fiscal rules to improve fiscal sustainability that fiscal rules should be designed in a way that has enforceability. Third, our analyses provide the empirical findings that the effect of procyclical fiscal policy on economic growth is different depending on spending categories and country groups. These findings suggest that fiscal authorities should control the increasing pressure on government consumption and current transfers in booms, and that fiscal authorities in emerging market countries should be more cautious to operate their fiscal policies in a countercylcial way to avoid an unfavourable effect of procyclical fiscal policy. Finally, our finidings also suggest that unsustainable fiscal finances do not hinder economic growth in tranquil times, even though they could lead to sudden economic crisis by endangering the default of government debt.

152. Badinger (2012) suggests another path through which fiscal rules affect economic growth. The author argues that fiscal rules which are designed to limit discretionary fiscal policy could enhance economic growth by reducing output volatility.

It could be concluded from these findings that governments should operate fiscal policy in a countercyclical and sustainable way to ensure sustained economic growth without endangering sudden economic crisis. The policymakers, therefore, should operate fiscal policy both from the short-term and long-term perspective to achieve both a countercyclical and sustainable fiscal policy. A successful fiscal policy could provide governments with a more strengthened ability on macroeconomic stabilization and more efficient debt management, and it in turn results in sustained economic growth.

One of the most effective solutions could be well-designed fiscal rules which could help achieve both a countercyclical and sustainable fiscal policy (Schick, 2003). Our empirical findings suggest that fiscal rules should be designed in a way that is multi-year covered and is enforced to enhance fiscal countercyclicality and sustainability[153]. Another solution about fiscal policy is that countercyclical fiscal stimulus measures should be accompanied by appropriate exit strategies to avoid the deterioration of fiscal sustainability (Corsetti, Kuester, Meier, and Müller, 2010). Various kinds of budget system innovations could also be used as possible solutions to improve fiscal countercyclicality and sustainability. Independent fiscal policy committees similar to independent central banks (for example, Swedish Fiscal Policy Council) or fiscal watchdog (for example, the UK Office for Budget Responsibility) could prevent unsustainable fiscal finances and mitigate the level of fiscal procyclicality by checks and balances (Wyplosz, 2012; Calmfors and Wren-Lewis, 2011; Fatás, 2010; Bi and Leeper, 2010; Debrun and Kumar, 2008; Coeure and Pisani-Ferry, 2005; Wyplosz, 2005; Eichengreen, Hausmann, and von Hagen, 1996). Rainy day funds (Fernández-Arias and Montiel, 2011; Hou, 2006) and mid-term budget reviews could be helpful to operate fiscal policy in a more countercyclical way helping maintain fiscal sustainability. Raising the ratio of automatic stabilizers (Carmignani, 2010; Eskesen, 2009), enhancing the government's ability to forecast economic variables (Carmignani, 2010; He, 2003), and reducing implementation time lags might also be solutions for successful fiscal policy.

153. Much literature on the role of the SGP rules argues that the augmented fiscal rules could help both maintain fiscal sustainability and improve countercyclicality of fiscal policy (Menguy, 2008; Buiter, 2004; Buiter and Grafe, 2004).

However, our analyses have several limitations. First, the analysis period in this thesis is 1970-2008, thus it cannot reflect the effect of recent crisis on fiscal procyclicality and sustainability. Second, this thesis mainly makes use of the data of OECD countries, even though we analyse a more comprehensive dataset from 53 IMF countries when we explore the effect of fiscal procyclicality on economic growth. Fiscal data seems to have low reliability, especially in emerging market countries. This could be not only because the measurement of some fiscal variables such as government debt is difficult, but also because the budget systems of each country are different according to the development of fiscal democracy of each country.

Therefore, there are several interesting issues to develop our analyses further. First, there is a need to assess the effect of the recent economic crisis even though fiscal sustainabiliy is a relatively long-term issue[154]. It would be interesting to examine how the recent crisis affects the fiscal procyclicality and sustainability and whether our results are robust in this regard[155]. The experience of the current economic crisis shows that countercyclical fiscal packages lead to the deterioration of fiscal sustainability in some countries, and they in turn result in further economic crisis. Therefore, one can conjecture from this experience that the positive effect of countercyclical fiscal policy on economic growth will last during only short period of time, as argued in chapter 4. One can also conjecture that unsustainable fiscal finances could have a negative effect on the long-term economic growth by triggering other crises such as the default of government debt, which is not sufficiently dealt with in our analysis. Second, this thesis shows that multi-year fiscal rules could be more effective to mitigate the level of fiscal procyclicality by analysing the data of OECD countries. Thus, there is a need to confirm this result by extending the sample to emerging market countries. Fiscal rules are a kind of fiscal institutions (Fatás, 2010), so they could be closely related to the quality of institutions that are commonly employed as the determinant of economic growth in

154. For example, the ratio of the breaches of the SGP rules was 25.4% (45 out of 177 possible cases) for the period 1999-2007, but it rocketed up to 76.5% (62 out of 81 possible cases) for the period 2008-2010 (Calmfors and Wren-Lewis, 2011). Misra and Khundrakpam (2010) also show that the fiscal sustainability of India deteriorated rapidly during 2008-2009 by analysing the correlation of government spending and revenue.

155. For example, European Commission (2011) shows that the SGP rules do not play any role on ensuring sound fiscal finances during the recent crisis, which is not consistent with the result of chapter 3 that the SGP rules could help maintain sustainable fiscal finances in EMU countries.

the literature. Therefore, it would be interesting to explore whether the negative effect of multi-year fiscal rules on fiscal procyclicality also applies to emerging market countries where the quality of institutions may not be particularly high. Third, this thesis confirms that the effect of fiscal procyclicality on economic growth is prominent in emerging market countries than in advanced countries. It would also be interesting to explore whether the effect of fiscal sustainability on economic growth also varies across country groups by extending sample into emerging market countries.

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