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# Essays on Current Account Imbalances in European Countries

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ESSAYS ON CURRENT ACCOUNT IMBALANCES IN EUROPEAN COUNTRIES

by

Jerome Kueh Swee Hui

A Dissertation Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

In Economics

at

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## ABSTRACT

### ESSAYS ON CURRENT ACCOUNT IMBALANCES IN EUROPEAN COUNTRIES:

by

Jerome Kueh Swee Hui

The University of Wisconsin – Milwaukee, 2015  
Under the Supervision of Professor Rebecca Neumann

This dissertation consists of three chapters in exploring the current account imbalances in the European countries. The first chapter investigates the effect of household indebtedness on the Twin Deficits phenomenon in European countries. Annual data from 1981 to 2012 for 28 European countries are used. Panel regression with fixed effects and General Method of Moments (GMM) approaches are adopted to examine the standard determinants of the current account imbalances and the effect of household indebtedness on the Twin Deficits hypothesis. Empirical findings indicate the existence of positive co-movement between the fiscal balance and current account balance, thus indicating the presence of the Twin Deficits phenomenon in the European region. Meanwhile, there is a negative association between gross household debt and the current account balance. This inverse relationship implies consistent behavior with the Twin Deficits between fiscal balance and current account balance, where increase in the gross household debt contribute to the growth of the current account deficit. Thus, the household debt may marginally exacerbate the Twin Deficits phenomenon. These results can be observed particularly in the countries with low fiscal deficits, public debt and household debt.

The second chapter explores the behavior of the current account deficit and fiscal deficit from the view of thresholds to provide additional understanding on the Twin Deficits phenomenon. Annual data of eleven Euro Area countries from 2000 to 2012 are adopted in this study. This paper examines endogenous thresholds namely public debt, fiscal deficit, household debt, trade openness and financial development as threshold variables, using the sample splitting method (Hansen, 2000). The aim is to examine the Twin Deficits behavior from the perspective of countries above or below the threshold levels. This is due to the fact that households may behave differently in terms of consumption and risk preference in the countries above or below the threshold levels. Empirical findings indicate that there is evidence of Twin Deficits phenomenon in the baseline model without threshold effects. In terms of the threshold effects, there is a significant positive association between the current account balance and the fiscal balance in the countries with public debt, household debt, fiscal deficit, trade openness and financial development below their respective threshold levels. On the other hand, there is no or weak evidence of the Twin Deficits phenomenon in the countries with public debt, household debt, fiscal deficit, trade openness and financial development above the threshold levels. Intuitively, household behavior may indicate Ricardian Equivalence as the effect of the fiscal policy is offset by the opposite behavior from households, such that as the government borrows more (fiscal deficit increase), households may save more. This means that Ricardian Equivalence behavior is more likely observed in the countries with high levels of public debt, household debt, fiscal deficit, trade openness and financial development.

The third chapter investigates the current account sustainability in eleven European (EU) countries using annual data of exports and imports from 1980 to 2013. Im et al. (2003)

panel unit root and Pedroni (1999) panel cointegration are employed to identify the stationarity of the variables and existence of a long-run relationship between the parameters of interest, which are exports and imports. The pooled mean group estimator proposed by Pesaran et al. (1999) is used to estimate the magnitude of the interaction of the exports and imports from the long-run and short-run perspective and at the individual country level, based on a series of sub-periods. The determination of the current account sustainability is based on existence of significant long-run association between exports and imports. If the interaction coefficient is within the equilibrium of one, then there is no violation of the long-run budget constraint and current account is sustainable. In addition, significant negative error-correction terms also indicate that existence of convergence in the long-run and current account is consider as sustainable. In terms of the short-run perspective, current account may be unsustainable if the deviation of the short-run coefficient from equilibrium of one is large. Empirical results show no violation of the long-run budget constraint in the eleven EU countries in the long-run, which implies a sustainable current account over time. However, the sustainability of the current account may shift towards unsustainable when taking into consideration different time frames, namely the effect of formation of the EU in 1992 and debt crisis starting in 2008. The short-run results at the individual country level provide different insight as compared to the results of the error-correction terms. Large short-run imbalances may lead to indications of unsustainable current accounts even though there is no evidence of violation of the long-run budget constraint.

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## **Chapter 1:**

### **Household Indebtedness - Does it Impact the Twin Deficits Hypothesis?**

#### **Panel Analysis of European Countries**

##### **1.1. Introduction**

In the era of globalization, the integration of international trade and financial activities may provide benefits such as efficient resource allocation in terms of saving and investment. At the same time, such integration may lead to global imbalances in the Current Account. These imbalances may be exacerbated by government budget imbalances. One cause for concern has been the tendency of current account deficits and fiscal deficits to grow together, with issues of sustainability of both deficits. There has been a wide debate on the existence of the linkage between current account deficit and the fiscal deficit, known as the 'Twin Deficit Hypothesis'. Under the Twin Deficit hypothesis, the current account deficit is believed to be associated with the fiscal deficit, with prescriptions to reduce the current account deficits by reducing the fiscal deficit. Recent studies that show the existence of co-movement between current account deficits and fiscal deficits include Piersanti (2000), Leachman and Francis (2002), Chinn and Prasad (2003), Gruber and Kamin (2007), Lane and Milesi-Ferretti (2012) and Brissimis et al. (2013).

If there is a twin deficit, then fiscal policy changes can act as one of the tools for improving the current account imbalance. New challenges emerge, however, from the household perspective that may thwart efforts of the government in improving the current account imbalance. This is due to the greater financial integration and deeper degree of domestic financial development in the countries, particularly in the EU region,

that lead to accumulation of household debt. In fact, household indebtedness plays an essential role as a contributor to economic growth via temporary expansion of demand that stimulates the output volume in the future. Although economic growth may rely on household indebtedness, this may also lead to other effects such as greater income inequalities and constant changes in income distribution due to dissaving among the household (Barba and Pivetti, 2008). In this paper, I examine the role that household indebtedness may play in the twin deficits hypothesis. Household indebtedness may exacerbate or mitigate the twin deficits hypothesis. Household debt may rise at the same time as government deficits, with both playing into increasing current account deficits. On the other hand, households may borrow less (save more) in the face of increased fiscal deficits, thus mitigating the linkage between fiscal deficits and current account deficits. These issues are particularly important for the European Union (EU) countries, as this region has faced a debt crisis in recent years. Using panel data on 28 members of the European Union over the period 1981 to 2012, I explore the evolution of government deficits and household debt for the EU countries in order to examine their potentially dual role in changes in current account behavior.

Investigating the effects of household debt in moderating or exacerbating the Twin Deficits hypothesis is essential for policy makers in ensuring appropriate policies adopted in battling the mounting deficits in the current account and fiscal budgets. This paper distinguishes from previous studies on the Twin Deficit hypothesis in the following elements. First, this study contributes to the literature on current account imbalances with an emphasis on household indebtedness. As far as I can tell, the only paper that includes household debt in investigating current account imbalances is Atoyán et al. (2013). However, they provide little discussion regarding the effect of



household debt in their paper. Furthermore, their model specification differs from the bulk of literature in the selection of exogenous variables such as inclusion of private credit, unemployment rate, exchange rate and relative income. This paper, by contrast, emphasizes discussion on household indebtedness while incorporating standard determinants of current account imbalances in European countries. The standard determinants in empirical studies of the current account consist of the fiscal balance, initial net foreign assets, relative income, GDP growth and age dependencies (Lane and Milesi-Ferretti, 2012; Gruber and Kamin, 2007; Chinn and Prasad, 2003). Second, the empirical approach adopted in this study emphasizes the medium to long-run determinants of current account imbalance where inter-temporal elements are taken into consideration, including demographics, initial wealth, and stage of development. Furthermore, the measurement of some of the exogenous variables such as fiscal balance, relative income, GDP growth, age dependencies and household indebtedness are expressed as deviations from GDP weighted averages, similar to Gruber and Kamin (2007) who use deviations from the GDP-weighted sample means.<sup>1</sup> The purpose of using such deviations is to obtain the real local effects rather than the global effects of the determinants on the current account imbalance.

This study further investigates the effect of household indebtedness in moderating the Twin Deficits via a threshold perspective in terms of the level of fiscal deficit, public debt and household debt. Countries are classified as above or below particular levels of debt or deficit. The results based on the threshold view provide supplementary insight on the behavior of the household and government, which eventually may influence the

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<sup>1</sup> Alternatively, Lane and Milesi-Ferretti (2012) use measures defined relative to a weighted average of country *i*'s trading partners.

current account imbalances when reaching certain degrees of deficit or debts. The focus of this paper is on the EU countries since household debt in the region has grown and may be part of the source of the debt crisis. Household debt in the EU region evolves at a moderate pace in the 2000s prior to the global financial crisis that started in 2008. After the crisis, household debt expanded quickly, especially in the Eastern and Southern EU. For instance, the households of the Netherlands and Ireland had liabilities of 140% of GDP and 128% of GDP respectively in the year 2012 compared to 87% of GDP and 56% of GDP in the year 2000. Germany is the only country in the EU region that reduced household indebtedness over this period, from 74% of GDP in 2000 to 60% of GDP in 2012. The heterogeneous behavior of household indebtedness in the EU countries provides interesting insight on the interaction between public deficits and household debt.

### **1.1.1. Stylized Facts of the Current Account Deficits and Fiscal Deficits in European Union**

The dynamics of the current account as well as fiscal imbalances and household debt in selected EU countries are depicted in Figures 1.1 to 1.3. The objective is to provide insight on the different trends between two main groups in the EU region. The groups refer to the non-periphery countries such as Austria, Finland, France, Germany and the Netherlands, while the periphery countries such as Greece, Ireland, Italy, Portugal and Spain. The values of the current account balance, fiscal balance and household debt are expressed as percentage of GDP and obtained from Eurostat. Figure 1.1 indicates the current account balance of selected EU countries from the year 1990 to 2012. In general, EU countries such as Finland, France and Netherlands experienced surpluses in their current accounts during the sample period. The Netherlands exhibit a consistent current

account surplus with the highest value at 9.7% of GDP in the year 2011. Both Finland and France recorded deteriorating trends of surpluses and eventually settle at current account deficits of 1.7% and 2.4% of GDP respectively in the year 2012, due to the impact of the financial crisis in 2008. Meanwhile, Austria and Germany recorded surpluses in their current accounts after the introduction of the Euro currency in the year 2001. On the other hand, the stressed EU countries in general experienced deteriorating current account deficits during the sample period. Greece, Portugal and Spain reached their highest deficits of 15%, 13% and 10% of GDP respectively at the start of the financial crisis in 2008. However, the deficits diminished over time with Greece, Portugal and Spain recording deficits of 2.9%, 1.5% and 1.1% of GDP in 2012, while Ireland recorded a surplus of 4.9% of GDP.

Figure 1.2 depicts the fiscal balance of selected EU countries during the period 1990 to 2012. Finland experienced large volatility, with a fiscal surplus from the year 1997 to 2008 and a deficit in 2012. The other countries recorded fiscal deficits during the period, except for Germany and the Netherlands, which achieved peak surpluses in the year 2000. The trend of the fiscal balance for the stressed EU countries (lower panel of the graph) exhibit improvements in the fiscal deficits over the late 1990s, with subsequent increases in the deficits following the financial crisis. The fiscal deficit enlarges particularly for Ireland with 31% of GDP in the year 2010 and Greece with 14% of GDP in the year 2009. Although the 2008 financial crisis contributed to the large fiscal deficits for all the EU countries, there were great efforts in attempting to shrink the deficits as moving towards the year 2012. This can be seen via the fiscal austerity measure as a circumstance of bailout funds. For instance, Greece was offered €110

billion bailout loan in May 2010 with one of the condition was to implement fiscal austerity measure in order to restore its fiscal balance.

Figure 1.3 shows the household debt for selected EU countries for the period 1990 to 2012. The household debt for the EU countries indicates an upward trend, except for Germany. For instance, the household debt of the Netherlands exhibits tremendous growth and reached 138% of GDP in the year 2012. Relatively, the household liabilities of Austria, Finland and France indicate diminishing incremental trends with only Germany showing a reduction over time. Likewise, the household debt for the stressed EU countries (lower panel of the figure) also depict mounting debt with Ireland reaching 128% of GDP, followed by Portugal with 106% of GDP and Spain with 90% of GDP in the year 2009. This is due to the real estate market expansion particularly in Ireland and Spain. Household debt expanded at a moderate pace in the early 1990s, but grew significantly following the 2008 financial crisis.

The mounting level of household indebtedness during a period when current account deficits and fiscal deficits also grew indicates a need to examine more fully how the three are intertwined. Thus, I explore this issue using panel regression with period fixed effects. The main reason of adopting this panel period fixed effects is to allow capturing of the variation from across countries. This is due to controlling for country fixed effects may eliminate important information from the cross-country variation. Empirical findings indicate evidence of Twin Deficits in the 28 EU countries and inclusion of the household debt in the model further intensifies the Twin Deficits effect. In addition, there is a significant inverse association between current account balance and household debt. The remainder of the paper is organized as follows: In section 1.2, previous studies

related to Twin Deficits and the linkage between household indebtedness and the Twin Deficits are discussed. In section 1.3, I present the model specification and estimation techniques adopted in this study. Estimation results and conclusions are shown in sections 1.4 and 1.5, respectively.

## **1.2. Literature Review on Twin Deficits**

There are a number of studies on the Twin Deficits hypothesis using different approaches. Some studies portray existence of an association between current account deficits and fiscal deficits while others provide contradictory findings. I summarize a number of these studies below.

In line with the Keynesian approach via the Mundell-Fleming framework, there exists co-movement between current account deficits and fiscal deficits. A surge in the fiscal deficit indirectly leads to appreciation in the currencies, which leads to growth in the current account deficit. These are among the findings from studies such as Rosensweig and Tallman (1993), Vamvoukas (1999) and Leachman and Francis (2002). Rosensweig and Tallman (1993) investigated the association between the trade balance, fiscal deficits and exchange rate of the United States using a five variables Vector Autoregression (VAR) system with quarterly data from 1961 to 1989. Their empirical findings showed that growing fiscal deficits lead to appreciation of the dollar and eventually contribute to the trade deficit. Vamvoukas (1999) studied the relationship between fiscal deficits and current account deficit for Greece with the annual sample period from 1948 to 1994. They adopted time-series analysis, namely cointegration, error-correction modelling (ECM) and Granger trivariate causality. The results implied the existence of positive co-movement between fiscal deficits and current account

deficits in the short-run and long-run and causal effect from fiscal deficits to current account deficits. Leachman and Francis (2002) applied the multi-cointegration method to examine the Twin Deficits issue for the United States post World War II with quarterly data covering 1948 to 1992. They argued that evidence of the Twin Deficits is rather time specific and ECM results indicated that the fiscal deficit contributed to the persistent current account deficit at the latter stage of the sample period.

The Twin Deficits hypothesis can be observed from the literature on the determinants of current account balances, due to the significance of the fiscal balance as one of the key drivers of the current account balance as in Chinn and Prasad (2003), Gruber and Kamin (2007), Lane and Milesi-Ferretti (2012) and Brissimis et al. (2013). Although the main objective of these papers is to investigate the determinants of the current account, the findings point to a positive association between fiscal balances and current account balances. These studies adopt advanced econometric panel approach such as panel regression with period fixed effects and panel cointegration. The first three use samples of countries that include advanced countries and developing countries while Brissimis et al. (2013) focus on the European countries.

Chinn and Prasad (2003) examine the medium-term macroeconomic determinants of the current accounts for 18 developed countries and 71 developing countries, using five year non-overlapping averages of yearly data covering the years 1971 to 1995. They apply cross-section analysis and panel regression in order to capture the variation of the current account across countries and over time. Their core outcomes show the existence of a positive association between fiscal balance and current account balance. The effect of the fiscal balance on the current account balance stood at around 0.31 of magnitude

in the full sample. This coefficient implies that a 1 percentage point increase in the fiscal balance is associated with approximately 0.30 percentage point increase in the current account balance to GDP ratio. Furthermore, there is strong evidence of the fiscal balance effect on the CA in the developing countries, but no evidence of fiscal balance effect on the CA in the developed countries in their panel regression results.

Bussière et al. (2004) investigate the determinants of the current account on a panel of 33 OECD and European accession countries for the time period 1980-2002, from the intertemporal perspective. They adopt the panel data fixed effects and dynamic Generalized Method of Moments (GMM) estimator approach for their estimation purposes. Their empirical findings indicate that fiscal balance, relative income and relative investment are important drivers of the current account in the medium term. There is a positive interaction between fiscal balance on the current account with coefficient around 0.10. Meanwhile, lower level of relative income and higher level of investment tend to worsen the current account deficit.

Gruber and Kamin (2007) adopt a similar approach to Chinn and Prasad (2003) with 61 countries covering the period 1982 to 2003. There are a few differences in their regression model such as the inclusion of the degree of financial development and quality of institutions along with the standard determinants of current account balance. Gruber and Kamin (2007) measure some determinants of the current account balance in terms of difference from the GDP weighted mean of the sample. Their main empirical results also show a positive relationship between the fiscal balance and the current account balance with magnitude around 0.11, implying a smaller magnitude than in Chinn and Prasad (2003).

Lane and Milesi-Ferretti (2012) investigate the behavior of the current account adjustment controlling for the impact of financial crisis in developed countries and emerging economies from 1969 to 2008. They express the exogenous variables in the model in terms of relative to a weighted average as adopted in Gruber and Kamin (2007), but taken as deviation from country  $i$ 's trading partner instead of deviation from the sample mean. Their key results depict evidence of Twin Deficits with magnitude around 0.24 in the full sample, 0.27 for developed countries and 0.26 for emerging economies, thus showing smaller impacts than 0.31 in Chinn and Prasad (2003), but greater than 0.11 in Gruber and Kamin (2007). There are some important points that can be drawn from the three studies. All three studies opt for panel regression with period fixed effects rather than panel regression with country specific fixed effects. The argument is that using the country fixed effects may lead to exclusion of essential cross-country variation in the current account balance. The weighted average measurement of the variables adopted in the studies by Gruber and Kamin (2007) and Lane and Milesi-Ferretti (2012) act as an alternative to that in Chinn and Prasad (2003) to remove the common factors across the countries while capturing the local effects rather than global effects. I use a similar weighting to that in Gruber and Kamin (2007), where the common factors are removed by taking deviation from the weighted average GDP. Further, these three papers measure their data using non-overlapping averages of either four or five years to smooth the effect of fluctuations due to the business cycle. In my empirical analysis, I use four year non-overlapping averages of the data to accomplish the same thing.

Brissimis et al. (2013) use a similar approach to the three papers above but focus on the Euro area over the period 1980 to 2008. They apply panel estimation approaches,



namely Fixed Effects method, Seemingly Unrelated Regression, and Fully Modified OLS to explore the drivers of current account imbalances. Empirical results indicate that current account imbalances, particularly for the initial 12 EU members, can be explained by the fundamental drivers where the magnitude of the fiscal balance effect is approximately 0.20 to 0.29 across the three different panel estimation methods.

By contrast, Evans and Hasan (1994) and Kaufmann et al. (2002) show no interaction between current account deficits and fiscal deficits in their empirical studies on Canada and Australia respectively. Their theoretical arguments are based on the Ricardian Equivalence hypothesis. Any distortion in the fiscal deficit via taxes may not have implications on the market interest rate, capital inflows, and eventually the current account deficit. In other words, the key to the explanation lies in the rational expectation theory where households are assumed to be rational agents. This means that for any increase in the fiscal deficit, households will have the tendency to increase their savings to counter the expected surge in taxes in the future when the government starts to pay down the higher deficits. Moreover, Kim and Roubini (2008) conduct empirical study on the relationship between current account balance, fiscal balance and real exchange rate for the United States by employing Vector Auto-Regression (VAR) approach. The empirical findings indicate an inverse association between the two deficits, referred to as Twin Divergence. They argue that any increment in the fiscal deficit in fact helps to improve the current account deficit via depreciation in the domestic currency.

Further studies investigate the relationship between the current account balance and fiscal balance based on specific criteria such as regional analysis or threshold levels of the deficits. Empirical panel cointegration findings from Bagnai (2010) portrays co-

movement between fiscal deficits and current account deficits in the Central and Eastern European Countries (CEEC), but shows that the magnitude of the interaction is small for a sample period from 1995-2006. Furthermore, countries such as Portugal, Ireland, Greece, and Spain exhibit weak existence of Twin Deficits and only with the inclusion of time effects in the panel model. Abbas et al. (2010) adopted panel regression and panel VARs for a larger sample size of 124 countries from 1985 to 2007. They point out the existence of the Twin Deficits and show that the association is stronger in the emerging and developing countries compared to developed countries. Furthermore, the effect is higher in the emerging and developing countries when output exceeds potential level. In term of the thresholds, Nickel and Vansteenkiste (2008) investigate the association between current account deficit and fiscal deficit for 22 industrialized countries from the Ricardian equivalence perspective. They estimate the dynamic panel thresholds of the public debt to GDP ratio and provide evidence of non-Ricardian equivalence for countries with 90% public debt to GDP ratio or less. This implies higher fiscal deficit will lead to higher current account deficit and vice versa. However, the relationship will become insignificant for countries with high public debt of over 90% to GDP ratio. They also perform this test specifically on 11 Euro area countries and revealed that the relationship between fiscal deficit and current account deficit becomes insignificant or evidence of Ricardian equivalence can be observed in those high debt countries with public debt of over 80% to GDP ratio. Their empirical results indicate that a positive relationship exists between current account balance and fiscal balance with 0.360 coefficient when the public debt threshold is less than 54% of GDP, 0.140 coefficient when public debt threshold is between 54%-80% of GDP and -0.610 coefficient when public debt threshold exceeds 80% of GDP. A recent study by Forte and Magazzino (2013) provides evidence of the Twin Deficits hypothesis in 33

European countries from 1970 to 2010, using Generalized Method of Moments (GMM) dynamic panel approach and also fixed effects method. Their investigation is based on the classification of the specific benchmark of the fiscal deficit; those with deficits greater than 2% of GDP are labeled as high deficit countries and those with deficits less than 2% of GDP are labeled as low deficit countries. They show that the Twin Deficits evidence can only be observed in the high fiscal deficit countries. Given the importance of this threshold analysis, I also consider how the inclusion of household debt affects the relationship between the fiscal deficit and current account deficit for countries above a certain threshold, using the fiscal deficits, public debt or household debt as the threshold.

### **1.2.1. Interaction between Current Account Balance, Fiscal Balance and Household Debt**

The relationship between fiscal balance and current account balance can be seen in the Twin Deficits hypothesis. The Ricardian versus non-Ricardian equivalence or Keynesian perspective are two platforms of the Twin Deficit phenomenon based in the consumption behavior of the household. Ricardian equivalence stems from the forward-looking rational expectations among the households, who optimize consumption in the intertemporal allocation. Thus, a rational household does not perceive government debt as net wealth (Barro, 1974). For instance, increases in public expenditure (not financed by taxation) may lead to a higher level of saving among the household due to precautionary saving to pay for future tax hikes (Feldstein and Elmendorf, 1990). This may have implications for the current account with subsequent increases in the current account balance (declines in the current account deficit). On the other hand, non-Ricardian equivalence rules out the consumption smoothing motive among the

household and argues that they tend to spend their disposable income (Campbell and Mankiw, 1991). This means that an increase in public expenditure (without an increase in current taxes) will tend to have positive impact on private consumption, and thus reduce the current account surplus.

The association between fiscal balance and household debt became a debatable issue. This issue focuses on the sustainability aspect and policies to curb the expansion of the debts. There is an inverse association between fiscal balance and household debt as stated by Eggertsson and Krugman (2012) who argued that impediments arise from the view of the responsiveness of the household and firms towards fiscal policy that adopted by the government. This means that the fiscal balance may affect the debt deleveraging effort among the household and eventually may contribute to the current account imbalances. Debt deleveraging efforts may occur due to the awareness of those households regarding their excessive debt. The adoption of the fiscal expansionary policy to accommodate the aggregate demand indirectly eases the effort of debt deleveraging or reducing the debt of the households. The fiscal expansionary policy implies increase in fiscal expenditure and reduces in the taxation with the aim to stimulate the household consumption due to higher disposable income. However, when the government implements fiscal contraction policy as to govern the high public deficit, this may severely affect the household deleveraging activities, particularly in the period of the financial crisis. The fiscal contraction policy implies reduce in the fiscal spending and increase in the taxation. This eventually leads to declination in the disposable income among the household and thus effort in debt deleveraging may diminish.

The impact of household debt on the relationship between the fiscal deficit and the current account is not clear. In European countries, the effect of the private sector has greater dominance than the public sector in terms of consumption, which affects the current account deficit in Greece, Ireland, Portugal and Spain (Atoyan, et al. 2013). This is due to the fact that domestic excess consumption is financed by the banks instead of by the government. Therefore, the fiscal deficit may not be sufficient in reducing the current account deficit. Thus, household indebtedness deserves to be taken into consideration.

### **1.3. Methodology and Empirical Model**

#### **1.3.1 Data and Empirical Approach**

The aim of this study is to examine the effect of household indebtedness on the association between the fiscal balance and current account balance in the European countries. This paper uses a panel dataset of the European Union countries with 28 members from the year 1981 to 2012. Annual data are obtained from various sources such as World Bank, Eurostat, International Financial Statistics and Lane and Milesi-Ferretti database (specific sources are listed in the Data Appendix). The observations are structured as non-overlapping four year averages, thus providing eight period observations over the 28 cross-sectional countries. The main purpose of using four year averages is to mitigate the business cycle fluctuations in the sample period to obtain the real effect of variations in the long to medium term instead of short term variations. In other words, the empirical results have the tendency to be less subjective to the temporary and permanent shocks as argued by Chinn and Prasad (2003). Note that Chinn and Prasad (2003) used non-overlapping five year averages while Gruber and Kamin (2007) and Lane and Milesi-Ferretti (2012) used non-overlapping four year

averages in their studies. Using four year averages allows for more period observations for the time period considered here. I have also explored using five-year averages, with similar results to those shown.

This study adopts a panel regression approach with the current account balance measured relative to GDP as the dependent variable and a vector of exogenous variables that consist of standard drivers of the current account balance. The common drivers of the current account balance are those adopted by Lane and Milesi-Ferretti (2012), Gruber and Kamin (2007) and Chinn and Prasad (2003). These determinants comprise of the fiscal balance, the stock of net foreign asset, relative income per capita, GDP growth, the age dependency ratio of the young and the age dependency ratio of the old. As my contribution to this literature, I also include a measure of household debt as an exogenous variable. The goal is to examine the role that household debt plays in the relationship between the fiscal balance and the current account balance. Thus, I consider the household liability variable as an additional determinant of the current account balance. I focus on the European region where most of the countries have been experiencing mounting twin deficits and increases in household debt. Despite that, investment variable also included in the model for the purpose of robustness check.

Panel regression with period fixed effects is used to capture the variations of the current account balance from period to period in the cross-section sample. I exclude country fixed effects from the model to ensure that I do not eliminate important cross-country variations in the current account balance, which are essential to the study. Fiscal balance, relative income, GDP growth and age dependencies are measured as demeaned with

respect to their weighted GDP average as in Gruber and Kamin (2007)<sup>2</sup>. This approach serves as a way to eliminate the cross-section common features (i.e., any global or regional effects) to maintain the focus on the country specific effect. The subsequent section describes the modelling elements and the measurement of the variables in the model.

This study also examines the debt thresholds to examine whether countries above a certain threshold of fiscal deficit or public debt behave differently. I also consider threshold for household debt. The classification of the fiscal deficit and public debt thresholds is based on the Stability and Growth Path (SGP) of the European Union, where the critical level for fiscal deficit is -3% to GDP ratio and public debt is 60% to GDP ratio. Meanwhile, the household debt threshold is determined by using the 75<sup>th</sup> percentile of the data range from the period 1995-2012, which turns out to be a threshold of household debt of 73% of GDP.

### **1.3.2. Basic Estimation**

Table 1.1 provides a brief description of the data used. The figures shown are the mean values of the variables, classified into 8 periods of 4 years of non-overlapping average, over the time span from 1981 to 2012. Largely, the current account balance and fiscal balance of the European countries record deficit values that are persistent during the period of investigation. In general, both the current account deficit and fiscal deficit show a deteriorating trend from 1981 to 1996 from deficits of 2.49% of GDP to 0.74% of GDP and 5.51% of GDP to 4.52% of GDP, respectively. This implies a common

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<sup>2</sup> Note that Lane and Milesi-Ferretti (2012) used the weighted average with respect to country trading partner while Gruber and Kamin (2007) used weighted average with respect to GDP.

positive co-movement trend between the current account balance and fiscal balance. However, the relationship between current account balance and fiscal balance becomes ambiguous from 1996 onwards. Although there are indications of reduced deficits for some period for both of the variables, the magnitude of the current account deficit peak at 4.73% of GDP for the current account balance in the period (2005-2008) while fiscal balance reached the lowest level at 1.11% of GDP. Meanwhile, the fiscal balance recorded the peak of 4.93% of GDP in the period (2009-2012) while current account deficit reached the lowest level of 0.47% of GDP. This reflects that the current account deficit worsened prior to the global financial crisis and subsequently fiscal deficits recorded highest level during the global financial crisis. In terms of the other variables, there is an upward trend in relative income, gross household debt, net household income and net foreign asset, while economic growth experiences downward trend, particularly in the last period of the financial crisis period. Moreover, the age dependency of the young and old converge to the ratio of 23 and 25 comparatively to large gap during the 1980s, which means younger household and lesser older household in the region.

Gross household debt demonstrates dynamic behavior during the time periods concerned where the values show the debt owned by the household is increasing. The average value of gross household debt was 45.89% of GDP in the period 1989-1992 and declined to 36.14% of GDP in the subsequent period 1993-1996. Since then, gross household debt has shown an increasing trend to average 39.49% of GDP over 1997-2000, 49.96% of GDP over 2001-2004 and 64.68% of GDP over 2005-2008, prior to the global financial crisis period. The average gross household debt reached a peak of 67.19% of GDP over 2009-2012.



### 1.3.3. Research Model

The general structure of the Balance of Payment accounts embeds the association between the fiscal balance and current account balance. Public sector, private sector and foreign sector are used in the simple three sectors model in Equation (1.1) as shown in Obstfeld and Rogoff (1996).  $Y$  refers to gross domestic product,  $C$  is private consumption,  $I$  is investment,  $G$  refers to public consumption, and  $(X - M)$  is current account, which is net exports including goods and services as well as income flows. This equation denotes that aggregate demand consists of the summation of private consumption, investment, public consumption and net export.

$$Y = C + I + G + (X - M) \quad (1.1)$$

By rearranging the variables in the model, we can write:

$$(X - M) = Y - C - G - I = S - I \quad (1.2)$$

Equation (1.2) shows that the current account can be written as the difference between national saving and investment, where national savings is defined as the difference between national income and consumption from the private and public sectors. Therefore, lower private consumption or lower public consumption will raise national saving and generate a surplus in the current account. Higher investment will tend to have negative impact on the current account.

$$(X - M) = (Y - C - T) - (T - G) = S^P + S^G - I \quad (1.3)$$

Equation (1.3) provides classification of private saving and public saving. Private saving,  $S^P$ , is defined as the residual after consuming out of national disposable income  $(Y - T)$ , while public saving,  $S^G$ , refers to the difference between tax income and

public spending. Holding private saving and investment constant, there is a direct positive association between current account balance and fiscal balance, which comprises the Twin Deficits hypothesis. On the other hand, Ricardian Equivalence can be observed if private saving is not constant, such that  $S^P$  increases when  $S^G$  falls. There will be a negative relationship between current account balance and fiscal balance, known as Twin Divergence. Holding  $I$  constant, this implies no relationship between fiscal deficits and current account deficits.

#### **1.3.4. Econometric Estimation Techniques**

The main econometric approach adopted in this study is panel regression, with fixed effects. The advantage of panel regression is this method accommodates both information from time series and cross sectional data while controlling for the effect of unobserved variables. Panel regression with fixed effects method is essential for taking into account the effect of country heterogeneity and controlling for the omitted factors that vary across observations but are invariant across time. Pooled OLS (ordinary least square) regression method is also used with the aim to provide a general view on the association between the current account balance and the potential determinants of current account. I also use a dynamic GMM approach to consider the dynamic perspective as a robustness check purpose.

##### **1.3.4.1. Panel Regression with Fixed Effects**

This study used the panel regression with period fixed effects, which means controlling for the effect of unobserved period specific that are invariant across countries. In general, the relationship between the current account balance and the determinants can be shown in panel regression with period-fixed effects as in Equation (1.4).

$$CAB_{it} = \tau_t + \beta X_{it} + \varepsilon_{it} \quad (1.4)$$

where  $CAB_{it}$  denotes the current account balance as the ratio to GDP in country  $i$  and time period  $t$ ,  $X_{it}$  refers to the vector of drivers of current account balance in country  $i$  and time period  $t$ ,  $\beta$  consists of the coefficients of the parameters of interest,  $\varepsilon$  is the disturbance error with zero mean, and constant variance as well as uncorrelated across country and time,  $\tau_t$  refers to period-specific effect which is common to all countries.

The model specification as shown in Equation (1.4), follows the model specification adopted by Gruber and Kamin (2007) and Chinn and Prasad (2003) to capture the main drivers of the dependent variable. I also consider the household liabilities and total investment variable in addition to the standard drivers of current account balance. The inclusion of the household liabilities variable in the model is based on the study by Atoyán et al. (2013) while the inclusion of the investment variable is based on study by Brissimis et al. (2013) and Bussière et al. (2004), although both studies have slightly different determinants of the current account. Identifying the investment as determinant of the current account in the model is important as to incorporate the fundamental components in the current account from theoretical perspective as shown in Equation (1.3), which is comprised of savings and investments. Meanwhile, the selection for the proxy for the savings variable is crucial as to avoid estimating the savings and investments variables together, which is in fact equal to the current account variable. Household liabilities is included in the model as it reflects the accumulation of the past household borrowing instead of net savings as a flow variable. Thus, this enables capturing the direct implication of the accumulated household debt towards the Twin Deficits.

The dependent variable refers to current account balance, which is expressed as a ratio to GDP. A positive value of the current account balance indicates surplus while a negative value indicates deficit.

Expanding the elements in  $X_{it}$ , I estimate the following:

$$CAB_{it} = \tau_t + \beta_1 FB_{it} + \beta_2 NFA_{it} + \beta_3 RI_{it} + \beta_4 RGDP_{it} + \beta_5 ADRO_{it} + \beta_6 ADRY_{it} + \beta_7 HHL_{it} + \beta_8 INV_{it} + \varepsilon_{it} \quad (1.5)$$

where  $CAB_{it}$  refers to measurement of current account balance for country  $i$  and year  $t$ . The main drivers consists of fiscal balance,  $FB_{it}$ , initial net foreign asset,  $NFA_{it}$ , relative income per capita,  $RI_{it}$ , real GDP growth,  $RGDP_{it}$ , age dependency ratio for old,  $ADRO_{it}$ , age dependency ratio for young,  $ADRY_{it}$ . My contribution is the focus on household liabilities,  $HHL_{it}$ . I also consider the investment variable,  $INV_{it}$  as ratio to GDP.  $\tau_t$  represents the period fixed effects and  $\varepsilon_{it}$  denotes error term. Most of the independent variables such as fiscal balance, relative income, GDP growth, age dependency ratio for old, age dependency ratio for young and household liabilities and investment, are expressed as demeaned with respect to a weighted GDP average except for initial net foreign asset. This approach is consistent with Gruber and Kamin (2007) with the objective to capture the local effect rather than global effect. The gross household debt expressed as ratio to the GDP is used as proxy to the household liabilities variable.

The following section depicts the expected responses of the current account balance to the exogenous variables.

### Fiscal Balance

The effect of the fiscal balance depends on the two perspectives: non-Ricardian equivalence or the standard Keynesian view and Ricardian equivalence. From Equation (1.3), fiscal balance and current account balance are directly related holding consumption and investment constant. However, consumption and investment may change. Rational household may increase their savings as precautionary purpose to pay for the future taxes. Thus, a positive sign is expected under the non-Ricardian equivalence or Keynesian view where a higher fiscal deficit leads to higher consumption (C) and investment (I), thus deteriorating the CAB and leading to a higher current account deficit. On the other hand, a negative sign is expected under the Ricardian equivalence view where a higher fiscal deficit induces higher saving and eventually improves the current account deficit.

### Initial Net Foreign Assets (NFA)

Initial Net Foreign Assets can be viewed as representing the level of indebtedness in the economy, for negative values of NFA. Most of the European countries under consideration have had negative NFA, which implies previous the borrowing. This borrowing may have assisted the expansion of the economy via available foreign funding to accommodate domestic development needs and thus create positive relationship between NFA and current account balance. Therefore, the expected sign is positive. NFA used in the model is measured as lagged value in order to avoid

correlation with current account balance since NFA indirectly reflect the accumulation of previous current account balance.

### Relative Income

This factor ties to the catching-up process where countries with lower income levels are predicted to experience larger current account deficits (lower current account balance). Developing economies tend to have relatively lower savings but relatively higher consumption to income. To accommodate this higher consumption level in addition to investment, the country borrows abroad, thus increasing the current account deficit. Therefore, the expected sign is positive. This means that higher relative income may lead to current account surplus, while lower relative income may contribute to current account deficit. The relative income is derived from the real income per capita measured relative to the income per capita of benchmark country, which is the United States.

### Real GDP growth

If the economy experiences high GDP growth, this will lead to expansion of the current consumption level among the household or likewise higher degree of dissaving among the household due to the expectation of better prospects for GDP in the future. Thus, faster growth should be associated with larger current account deficits, so that the expected sign is negative.

### Demographic factor

Demographic effects play a significant role in determining the CAB (Kim and Lee, 2007; Chinn and Prasad, 2003; Lührmann, 2003). The dependency ratio is calculated

for two groups: ratio of the old that is over 65 of age and ratio of the young that is under 19 of age relative to the working age population. If the countries have higher dependency ratios for these two groups, it indicates a smaller portion of the population is earning and saving. Thus, the level of the current account deficit will expand due to lower saving level. The expected sign is negative.

### Household Liability

This factor captures the effect of the private sector or household indebtedness towards the CAB. The indicator used to represent this is gross household debt expressed as ratio to GDP. The data are available from the Statistical Office of the European Communities (Eurostat) and Annual Macro-Economic Database of European Commission (AMECO). The gross household debt indicator portrays direct liabilities held by the household at the gross level. Increases in gross household debt may contribute directly to the growing current account deficit, thus a negative sign is expected.

### Investment

The effect of the investment variable on the current account rely much either the investment is financed by domestic savings or via international capital flows. There will be no implication on the current account if the investment is funded by domestic savings. On the other hand, financing the investment by international capital may affect the current account significantly (Brissimis et al. 2013). The expected sign is negative.

Besides the direct effect, it is interesting to explore the effect of household indebtedness towards the Twin Deficits phenomenon. The selection of gross household debt as a proxy for household indebtedness is based on the fact that the indicator represents the

behavior of the household in terms of the saving and investment decision. Atoyán et al. (2013) also include household debt in their model investigating current account adjustment where the higher level of private debt in some European countries such as Greece and Portugal has greater implication on current account balance relative to fiscal balance. Their model specification is based on three broad dimensions: cyclical position (fiscal balance, private credit growth, unemployment rate and capital inflows), external competitiveness (real effective and nominal exchange rate) and external environment (VIX index measuring market sentiment towards risk). They showed that cyclical factors such as high credit growth, large capital inflows and low unemployment rates largely influenced the current account, particularly during the booming period. On the other hand, the fiscal balance exhibits insignificant impact on the current account balance during the booming period for the full sample EU countries and emerging EU countries. Based on Atoyán et al. (2013) findings, I explore this issue further. My model specification is based on the standard drivers of the current account balance as used by Lane and Milesi-Ferretti (2012), Gruber and Kamin (2007) and Chinn and Prasad (2003). Inclusion of the household debt along with the standard drivers of current account balance can provide additional information regarding the behavior of the household in their saving and investment decision.

#### **1.3.4.2. Pooled OLS Regression**

The other econometric approach used is the pooled OLS regression with the objective to provide a general view on the relationship between current account balance and its determinants without controlling for unobserved country-specific or period-specific variables. Furthermore, this model is able to capture the crisis effect by including the dummy crisis in the pooled OLS model specification, which is omitted in the panel



regression with period fixed effects model. The pooled OLS model can be written as follow:

$$CAB_{it} = \alpha + \beta X_{it} + \gamma CrisisDummy_{it} + \varepsilon_{it} \quad (1.6)$$

where  $CAB_{it}$  denotes the current account balance as the ratio to GDP in country  $i$  and time period  $t$ ,  $X_{it}$  refers to the vector of drivers of current account balance in country  $i$  and time period  $t$ ,  $\beta$  consists of the coefficients of the parameters of interest, crisis dummy taking on a value of one if country  $i$  experience crisis in period  $t$  and zero otherwise,  $\varepsilon$  is the disturbance error with zero mean, and constant variance as well as uncorrelated across country and time,  $\alpha$  refers to constant.

#### Crisis dummy

This factor captures the effect of the global financial crisis and European debt crisis. The crisis dummy is included for 2008 and 2009 to capture the global financial crisis and for 2010 and 2011 to capture the ongoing European debt crisis.

#### **1.3.4.3. Dynamic Generalized Method of Moments (GMM) Panel Estimator**

The dynamic GMM panel estimator is adopted with the aim to capture the dynamic view of the interaction between current account balance and its determinants. With regards to that, lagged of the parameter of interest is included in the model. The objectives of the usage of lagged variable such as lagged of current account balance are to control the effects of omitted variables and possible endogeneity bias. The dynamic GMM estimators can be written in the following modelling:

$$CAB_{it} = \beta_0 + \beta_1 CAB_{it-1} + \beta_1 X_{it} + \tau_t + \varepsilon_{it} \quad (1.7)$$

where  $CAB_{it}$  denotes current account balance,  $CAB_{it-1}$  is lagged current account balance,  $X_{it}$  refers to vector of determinants of current account balance,  $i$  and  $t$  represent the country and time respectively,  $\tau_t$  denotes unobserved time specific effects,  $\varepsilon_{it}$  is the error term which is independently distributed with  $E(\varepsilon_{it}) = 0$  and uncorrelated with  $\tau_t$  or  $E(\varepsilon_{it}, \tau_t) = 0$ .

The inclusion of the lagged dependent variable may lead OLS estimation tend to be upward bias due to the possible existence of correlation between the lagged variable and the time specific effect. In order to overcome this endogeneity and to ensure consistent estimation, an instrumental variable (IV) approach is needed. Therefore, dynamic panel GMM estimators introduced by Arellano and Bond (1991) and further described by Blundell and Bond (1998), are adopted. The possible instruments are the lagged of the dependent and independent variables and lagged of the dependent variables is commonly used as the instrument. Thus, the lagged current account balance is used as instrumental variable in this study. The main reason of the selection is that by including the contemporaneous current account balance may lead to possible endogeneity impediment. A country with high level of current account deficit may contribute to the expansion of fiscal deficit and a country with high level of fiscal deficit may lead to larger current account deficit.

In order to ensure the validity of the instruments used in the two-step system GMM estimators, Sargan test and Arellano Bond serial correlation test will be conducted as suggested by Arellano and Bond (1991) and Arellano and Bover (1995). Sargan test of over-identification of restriction is performed to test validity of the instruments. Failure to reject the null hypothesis indicates the model is excluded from over-identifying

restriction element and the instruments used are uncorrelated with the residuals. The serial correlation test determines the null hypothesis that the residuals are correlated in the first order but uncorrelated in the second order.

## **1.4. Estimation Results**

### **1.4.1. Pair-wise Correlation Matrix Results**

Table 1.2 shows the pair-wise correlation matrix of the variables estimated in order to provide a broad view of the correlation interaction between the variables of interest. The current account balance is positively correlated with fiscal balance (0.299), net foreign assets (0.439), relative income (0.674), age dependency of old and young (0.213 and 0.199) and gross household debt (0.330), while GDP growth is inversely correlated with the current account balance (-0.276). The correlation of the interaction between the fiscal balance and the financial crisis dummy is 0.187 and the interaction between the gross household debt and the financial crisis dummy is 0.066.

With regards to the trend between fiscal balance and gross household debt, intuitively, the household can be viewed as acting in a Ricardian behavior particularly from the period of 1993-1996 onwards until prior to the financial crisis period as shown in Table 1.1. This can be seen via the increasing (decreasing) fiscal deficits that were accommodated by decreasing (increasing) gross household debts. However, non-Ricardian behavior can be observed in the financial crisis period of 2009-2012 where both the fiscal deficits and gross household debt increase. The positive correlation relationship between fiscal balance and gross household debt of 0.075 as shown in Table 1.2, may indicate that households have less difficulty in deleveraging their debts when the governments implement fiscal expansionary policy. Impediments arise when

governments choose to consolidate their fiscal balance that further complicates the household effort in lessening their debts. This is due to the level of disposable income among the household may reduce when the government intend to shrink the fiscal deficit via increase in taxation and decrease in spending. This eventually led to lesser savings and ability of the household in easing their debts. This is in line with the findings of Eggertsson and Krugman (2010). Consequently, fiscal expansionary policy may leads to the increase in the fiscal deficit and ability of the households in deleveraging their debts. Thus, the household debts level will decline. On the other hand, fiscal balance consolidation will cause the deterioration of the fiscal deficit and will lead to gross household debt to increase.

#### **1.4.2. Panel Regression Results with Period Fixed Effects**

As the benchmark regression, Table 1.3 depicts the panel regression results with period fixed effects of the fundamental determinants of current account balance for the 28 European countries. The panel regressions with period fixed effects are preferred to the country fixed effects as the latter tends to eliminate the cross-country variation in the current account balance. The standard determinants of current account balance (following Lane and Milesi-Ferretti, 2012; Gruber and Kamin, 2007; Chinn and Prasad, 2003) are shown in column A1. Column A2 adds gross household debt. The first row of each parameter of interest denotes the coefficients of estimation while the second row represents the standard errors. Since controlling for period fixed effects, interaction of the parameters of interest with the financial crisis dummy is omitted. In general, the panel regression with period fixed effects show consistent results with the previous studies in most of the explanatory variables such as Brissimis et al. (2013), Lane and Milesi-Ferretti (2012), Gruber and Kamin (2007) and Chinn and Prasad (2003).

The fiscal balance coefficient is significant and positive with coefficient of 0.404 for the standard model without gross household debt. In other words, this result suggests that a one percentage point increase in the fiscal balance contributes to a 0.404 percentage point increase in the current account balance. The fiscal balance coefficient of 0.404 is similar to the coefficient of 0.396 from Chinn and Prasad (2003), but higher than coefficient of 0.296 from Brissimis et al. (2013), 0.243 from Lane and Milesi-Ferretti (2012) and 0.110 from Gruber and Kamin (2007). The main reason contributed to the different coefficient of the fiscal balance is due to different model specification adopted in those papers. For instance, inclusion of the private investment, real effective exchange rate and credit to private sector in the model by Brissimis et al. (2013), financial crisis as well as Asian crisis dummy and oil balance in the model by Lane and Milesi-Ferretti (2012) and currency crisis dummy, openness and oil balance in the model by Gruber and Kamin (2007). This means that Twin Deficits hypothesis is confirmed in the European countries, as a higher fiscal surplus is associated with a higher current account surplus (or a larger fiscal deficit is associated with a larger current account deficit).

In Column A2, the coefficient on the fiscal balance is 0.422 with the inclusion of gross household debt. The gross household debt shows a negative and significant coefficient of -0.056. This implies that a one percentage point increase in gross household debt leads to approximately 0.056 percentage point decrease in the current account balance. In other words, a higher level of gross household debt is associated with higher current account deficits. Alternatively, a lower level of gross household debt is associated with a current account surplus.

The negative coefficient of the interaction between the gross household debt and current account is consistent with Atoyán et al. (2013). They find a higher coefficient of -0.125 for all EU countries and -0.089 for advanced EU countries. Two possible reasons contribute to the diverse results: different model specification and a shorter sample than used here. Atoyán et al. (2013) only consider data from 2000-2012 and use different set of explanatory variables. One interpretation of the negative coefficient on the gross household debt is the credit expansion in the EU region, particularly in the 2000s, eventually contributed to escalating the household debt. Furthermore, the convergence of the economies via the formation of EU and single market, led to lower interest rates, easing borrowing constraints. In other words, the behavior and risk preference of the household change due to the stability of the macroeconomic as well as financial integration in the region. Therefore, the persistent positive growth and credit expansion in the early 2000s led to the high income expectations among households. Thus, they increased borrowing as they were optimistic on their ability to repay in the future.

Linking the current account deficit, fiscal deficit and gross household debt together, the Twin Deficits phenomenon still can be observed with the inclusion of the gross household debt in the model with coefficient around 0.42 compared to 0.40 without gross household debt variable. Although the effect of the gross household debt on the Twin Deficits is marginal, however, the interaction of the gross household debt and current account deficit also indicate similar behavior with the relationship between fiscal deficit and current account deficit. This means that increase in the gross household debt may worsen the current account deficit since the gross household debt refers to the accumulation of the household borrowing. Furthermore, this also implies

that both increase in the gross household debt and fiscal deficit may contribute to the expansion of the current account deficit. This may be due to the indirect linkage between the household behavior in deleveraging their debt and the fiscal policy as stated by Eggertsson and Krugman (2012). Increasing in the fiscal deficit may dampen the effort of the household in their debt deleveraging effort. For instance, if the government implements expansionary fiscal policy via increasing government expenditure or reduction in the taxation that lead to the increase in the fiscal deficit, household will have additional disposable income and may borrow more. As a result, the gross household debt level will increase simultaneously with the growth in the fiscal deficit. This eventually leads to the worsening of the current account deficit. Therefore, increase (decrease) in the fiscal deficit may lead to the increase (decrease) in the gross household debt and ultimately contributes to the improvement (worsening) of the current account deficit.

With regards to the other determinants of current account even with inclusion of the gross household debt in the model, the net foreign assets and relative income per capita also depict positive association with the current account balance with coefficients of around 0.022 to 0.029 and 0.087 to 0.128, respectively. In view of net foreign assets, prior borrowing may contribute to the growth of the economy due to the sufficient foreign fund to meet the needs of the local development and ultimately may generate current account surplus. Meanwhile, in terms of relative income per capita, the positive coefficient entails that economic convergence or catching-up among the European countries leading to improvement in the current account balance or shrinking the level of the current account deficit. GDP growth is negatively related to the current account balance with coefficients of around 0.441 to 0.583. This could indicate that the need to

finance potential investments and economic growth occurs tends to lead to current account deficits. There is insignificant association between current account balance and age dependency of young and old, which is consistent with findings from Chinn and Prasad (2003) in their overall sample.

In sum, there is evidence of the Twin Deficits phenomenon in the European region from the panel regression results with period fixed effects either with or without gross household debt in the model specification. Gross household debt captures the household liability effect and depicts a negative linkage with current account balance. This implies that efforts to shrink the current account deficit do not solely depend on strategies to slash the fiscal deficit, but also efforts to reduce household debt. Ultimately, the Twin Deficits phenomenon may be more complicated with escalating levels of household debt.

#### **1.4.3. Pooled OLS Regression Results**

The pooled OLS regression approach is adopted as to provide an overall view on the association between current account balance and its determinants without controlling for unobserved country-specific or period-specific variables. Table 1.4 depicts the results of the Pooled OLS regression where it allows the model to capture the variation of the current account from the time-series and cross-sectional perspectives. Columns A1-A3 demonstrate results of the fundamental determinants of the current account balance without gross household debt, and Columns B1-B3 indicate fundamental determinants of the current account balance with gross household debt. I also consider the impact of the financial crisis by including the crisis dummy in Column A2 and B2 and the crisis dummy and fiscal balance interaction in Column A3 and B3.



The coefficient of the fiscal balance is 0.432, but declines slightly to 0.383 when including the crisis dummy and 0.322 when including the crisis dummy and interaction between fiscal balance and crisis dummy, as reported in Columns A1-A3. The effect of the crisis dummy is significant and positive. An insignificant results obtained on the interaction between fiscal balance and crisis dummy. Including the crisis dummy affects the results for the other determinants of the current account balance with significant coefficients such that with net foreign assets (0.033 and 0.031), relative income (0.082 and 0.085) and GDP growth (-0.426 and -0.432) as shown in Column A2 and A3. The insignificant relationship between age dependencies of the young and old towards the current account balance, remains

The results reported in Column B1-B3 indicate that the fiscal coefficient of the fiscal balance is 0.468, slightly higher value when including the gross household debt in the model, but falls to 0.413 when considering the crisis dummy and 0.381 when considering both crisis dummy and interaction between gross household debt and crisis dummy as well as fiscal balance and crisis dummy. The coefficient on gross household debt is -0.055 and decreases to -0.061 when including the crisis dummy and -0.063 when interacting gross household debt and crisis dummy as well as fiscal balance and crisis dummy as shown in Column B2 and B3. Interestingly, the effect of the crisis dummy reduces both the coefficient on the fiscal balance and increases the coefficient on the gross household debt. The results of the other determinants such as net foreign assets, relative income and GDP growth portray similar results to those shown in Column A1-A3. Again, the coefficient of the crisis dummy is 0.029 and insignificant outcome from the interaction between fiscal balance and crisis dummy. I also interact

gross household debt and the financial crisis dummy with the objective to explore the implication of the gross household debt during the financial crisis towards the current account balance. This interaction term indicates insignificant association with the current account balance.

In sum, the outcome from the pooled OLS regression shows that the fiscal balance remains an important determinant of the current account balance with or without gross household debt and the crisis dummy.

#### **1.4.4. Robustness Check**

##### **1.4.4.1. Panel Regression with Country Fixed Effects and Two-way Panel Regression with Period and Country Fixed Effects**

Table 1.5 portrays the additional findings of the fundamental determinants of current account balance from the perspectives of panel regression with country fixed effects and two-way fixed effects (period and country specific) for comparison purpose. Panel regression with period fixed effects is preferred than country fixed effect as indicated by Lane and Milesi-Ferretti (2012) and Gruber and Kamin (2007). This is due to the ability to capture the important information of the variation from the cross-country and this effect will diminish if controlling for country-specific. Columns A1 and A2 replicate the results of panel regression with period fixed effect as the core approach of this paper. Columns B1 and B2 depict the results of panel regression with country fixed effects with the inclusion of gross household debt in Column B1 and with gross household debt and the crisis dummy in Column B2. Column C1 and C2 show the empirical results for panel regression with period and country fixed effects.

The panel regression with country fixed effects with the inclusion of gross household debt as well as crisis dummy, as shown in Column B1 and B2, show that existence of positive association between fiscal balance and current account balance with coefficient of 0.322. Moreover, there is also a significant negative relationship between gross household debt and current account balance with coefficient of -0.081. The inclusion of the dummy crisis in the model (along with country fixed effects) indicates that the fiscal balance becomes insignificant, but the gross household debt remains an important determinant of current account balance with greater negative impact of coefficient -0.129. With regards to the other determinants, only GDP growth has significant association with the current account balance, while age dependency of the young becomes significant when including the crisis dummy in the model. Similarly, the results for two-way panel regression period and country fixed effects as shown in Columns C1 and C2, are consistent with the one-way panel regression with country fixed effects. Note that the gross household debt becomes negative and significant when considering country and period fixed effects. But the fiscal balance is no longer significant, consistent with arguments in Lane and Milesi-Ferretti (2012) and Gruber and Kamin (2007) where the country fixed effects may eliminate the importance of country variation.

In sum, the comparison between the panel regression with period versus country fixed effects provide important insight where cross variation information may be lost by controlling for the country fixed effect. Most of the fundamental determinants of current account balance such as net foreign assets and relative income become insignificant. The fiscal balance also becomes insignificant when including the crisis dummy in the model, but is significant when excluding the crisis dummy.

#### **1.4.4.2. Dynamic Generalized Method of Moment (GMM) Estimators Results**

The dynamic GMM panel estimator is adopted in order to accommodate the dynamic view of the relationship between current account balance and its determinants. Table 1.6 shows the results of the system GMM estimators of the drivers of the current account balance with household indebtedness. The purpose of including the GMM estimators in this paper is to provide a broader view by encompassing the dynamic perspective instead of the static view only. Column A portrays the estimations of standard determinants of current account balance while similar specification model but with gross household debt in Column B. The lagged current account balance is used as instrument in the model and depicts significant results.

The empirical results from the GMM estimation show consistent results with the static panel regression estimation. The fiscal balance has a significant positive association of 0.424 with current account balance in Column A and a significant positive association of 0.452 with inclusion of gross household debt. Meanwhile, the gross household debt shows negative relationship with the dependent variable with the magnitude of -0.069. The other determinants such as net foreign assets and relative income indicate positive implication towards current account balance while inverse association for economic growth. Nevertheless, the age dependencies remain insignificant

With regards to the validity of the instrument used, the Sargan tests indicate the non-rejection of the null hypothesis and the instrument used has no over-identifying restriction. The AB serial correlation test depicts significant in the first-order serial

correlation while insignificant in the second-order serial correlation. This means that the residuals are uncorrelated with the disturbance error.

In sum, the GMM estimators which consider the dynamic view and the importance of the lagged dependent variable also provide consistent results with the panel regression fixed effects.

### **1.5. Threshold Effects: Fiscal Deficits, Public Debt and Gross Household Debt**

The main aim of the classification of countries based on thresholds is to examine the effect of the household debt towards the Twin Deficits phenomenon. This is due to the fact that household may behave differently when a country experience fiscal deficit, public debt or gross household debt either above or below the respective threshold levels. The classification of the countries is based on the average fiscal balance from 1981 to 2012 where countries with fiscal deficit over -3% to GDP ratio are considered the high fiscal deficit countries and those with fiscal deficit less than -3% to GDP ratio are referred as low deficit countries. Countries with public debt more than 60% to GDP ratio and with household debt more than 73% to GDP ratio are considered as high public debt countries and high household debt countries, respectively. These threshold levels are chosen exogenously where the fiscal deficit threshold level is -3% to GDP and public debt threshold level is 60% to GDP, which are based on the criteria imposed by the Maastricht Treaty and Stability Growth Path. Meanwhile, the gross household debt threshold level is based on the 75<sup>th</sup> percentile of the sample.

The threshold effects are depicted in Table 1.7 (fiscal deficit threshold), Table 1.8 (public debt threshold) and Table 1.9 (household debt threshold), with the objective to

provide more information on the behavior of the household in different levels of fiscal deficit, public debt and household debt. The impact of the fiscal balance and gross household debt on current account balance will be discussed in this section since they are the main interest of the study. The list of countries classification is depicted in the Appendix 1.3.

### **1.5.1. Threshold Effects: Fiscal Deficits**

When I consider countries above or below the fiscal deficit threshold, the results in Table 1.7 show that there is an insignificant relationship between current account balance and fiscal balance, even when including the gross household debt in the model. The coefficient of the household debt also depicts insignificant result. This means that there is no evidence of Twin Deficits in the high fiscal deficit countries. Moreover, the insignificant negative coefficient of the fiscal balance may indicate the existence of the Ricardian equivalence, suggesting that an increase in the fiscal deficit does not lead to an increase in the current account deficit. On the other hand, there is a significant association between current account balance and fiscal balance in the low fiscal deficit countries in the model with gross household debt as one of the drivers of current account balance. The coefficients of the fiscal balance and gross household debt are significant with positive magnitude of 0.305 and with negative magnitude of 0.078, respectively. This implies evidence of Twin Deficits can be observed where fiscal balance and household debt have essential implication on the current account balance in those countries. These empirical findings are inconsistent with the findings from Forte and Magazzino (2013). Their GMM method results showed that the Twin Deficits only can be observed in the high fiscal deficit countries with coefficient of 0.373. This may due to the different model specification used by Forte and Magazzino (2013) where fiscal

balance, fiscal spending, real effective exchange rate, total factor productivity and GDP growth are identified as determinants of current account balance, despite sample period from 1970 to 2010. Moreover, their countries classification into high or low fiscal deficits is based on a shorter period from 2000 to 2008 whereas in this study, longer period (1981-2012) is used for the country classification purpose. The longer coverage period may provide useful information on the behavior of the fiscal balance.

When comparing to the baseline results in Table 1.3, the evidence of the Twin Deficits can be observed in the low fiscal deficit countries, instead of high fiscal deficit countries. The inclusion of the household debt in the model does not change the effect on Twin Deficits. Although, the coefficient of the fiscal balance is lower (0.305 in Table 1.7 versus 0.422 in Table 1.3), however, the coefficient of the household debt is higher (-0.078 in Table 1.7 versus -0.056 in Table 1.3). This indicates that both the fiscal balance and household debt play essential role in influencing the current account balance in the low fiscal deficit countries. Thus, non-Ricardian equivalence behavior may be observed in the low fiscal deficit countries while Ricardian equivalence behavior in the high fiscal deficit countries.

### **1.5.2. Threshold Effects: Public Debt**

Similar results are obtained from the perspective of public debt threshold as shown in Table 1.8. There is an insignificant association between the current account balance and fiscal balance in the high public debt countries. Moreover, the coefficient of the household debt also shows insignificant result. This means that the increase in the fiscal deficit and household debt does may not lead to the increase in the current account deficit. However, the relationship becomes significant in the low public debt countries.

The coefficient of the fiscal balance is 0.365 while gross household debt shows coefficient of -0.057. This indicates that the Twin Deficits evidence in the low public debt countries. These results are consistent with the results from Nickel and Vansteenkiste (2008) although they used 80% public debt as their threshold for eleven Euro Area countries. Their empirical results indicate that positive association between the current account balance and fiscal balance with 0.360 coefficient (public debt threshold: < 54% of GDP), 0.140 coefficient (public debt threshold: 54-80% of GDP) and -0.610 coefficient (public debt threshold: > 80% of GDP).

When comparing to the baseline results in Table 1.3, the evidence of the Twin Deficits can be observed in the low public debt countries, instead of high public debt countries. The inclusion of the household debt in the model does not alter the Twin Deficits. Similarly, the coefficient of the fiscal balance is lower (0.365 in Table 1.8 versus 0.422 in Table 1.3) and the coefficient of the household debt stay constant (-0.057 in Table 1.8 versus -0.056 in Table 1.3). This indicates that both the fiscal balance and household debt may affect the current account balance in the low fiscal deficit countries. Thus, non-Ricardian equivalence behavior can be observed when in the low public debt countries, but no effect of the fiscal balance on current account balance in high public debt countries. The household debt does not affect the Twin Deficits phenomenon in high public debt countries.

### **1.5.3. Threshold Effects: Household Debt**

The results for the household debt threshold are shown in Table 1.9. There is an insignificant relationship between the current account balance and fiscal balance in the high gross household debt countries. In addition, the coefficient of the household debt



also shows insignificant result. This means that any changes in the fiscal deficit and household debt may not lead to the changes in the current account deficit. There is a significant relationship between fiscal balance and current account balance with coefficient of 0.539 and gross household debt with coefficient of -0.073 in the low gross household debt countries. Similarly, both fiscal balance and household debt play essential role in influencing the current account balance in the low gross household debt countries, but not in the high gross household debt countries.

Comparing to the results in Table 1.3, there is evidence of the Twin Deficits in the low gross household debt countries but is not applicable in the high gross household debt countries. The overall results remain unchanged even with the inclusion of the household debt in the model. The coefficient of the fiscal balance is higher (0.518 in Table 1.9 versus 0.422 in Table 1.3) and the coefficient of the household debt is also higher (-0.078 in Table 1.7 versus -0.056 in Table 1.3). This indicates that the effect of the household debt on the Twin Deficits is greater in those countries with low gross household debt. This may due to the interaction between fiscal policy and debt leveraging effort among the household. In the countries with low gross household debt, households are sensitive to the fiscal policy adopted by the government. Any fiscal expansionary may lead to the ease in the debt leveraging effort while fiscal contraction may dampen the debt reducing effort among the households. This phenomenon diminishes in the countries with high gross household debt.

#### **1.5.4. Summary of Threshold Effects**

The purpose of the classification of countries into high and low level of fiscal deficit, public debt and household debt is to investigate the effect of the household debt on the

Twin Deficits phenomenon. In a nutshell, the fiscal balance and household debt act as prominent determinants only for those below the fiscal deficit, public debt and household debt thresholds. In terms of the association between the fiscal balance and current account balance, Twin Deficits phenomenon can be observed in those countries. Increase in the fiscal deficit (surplus) will lead to increase in current account deficit (surplus). Inclusion of the gross household debt in the model indicates that the household debt has marginal impact on the Twin Deficits in those countries. Moreover, there is a significant negative linkage between gross household debt and current account balance in the countries with low fiscal deficit, public debt and household debt countries. On the other hand, there is no effect of the fiscal balance on the current account balance in high fiscal deficit, public debt and household debt countries. Inclusion of the household debt does not change the result where there is an insignificant negative association between the gross household debt and current account balance in the high fiscal deficit, public debt and household debt countries. This may imply evidence of Ricardian equivalence behavior in those countries with high fiscal deficit, high public debt and high gross household debt. Intuitively, household in the countries with high fiscal deficit, public debt and household debt may behave cautiously in view with the perception of the countries fiscal strength and household debt level. They may view that governments may encounter impediments in managing the large fiscal deficit and mounting public debt and household debt levels in the future, which may lead to drastic implementation of contractionary fiscal policy. As a result, household may adopt precautionary behavior by increasing their savings in the circumstances where the fiscal deficit, public debt and household debt are above the threshold levels. Thus, this eventually will lead to no implication on the current account due to the offsetting between the private saving and the public saving.

### **1.5.5. Robustness Check with Investment Variable**

The inclusion of the investment variable as a determinant of the current account serves as a robustness check from the view of the theoretical component of current account. The benchmark literatures such as Lane and Milesi-Ferretti, (2012), Gruber and Kamin (2007) and Chinn and Prasad (2003) do not include this investment variable in their model, although Brissimis et al. (2013) and Bussière et al. (2004) do. The results of the panel regression with fixed effects are presented in Table 1.10 and the threshold effects are presented in Table 1.11 (fiscal deficit threshold), Table 1.12 (public debt threshold) and Table 1.13 (household debt threshold).

In Table 1.10, there is a significant positive association between fiscal balance and current account balance with coefficient of 0.527 (without gross household variable in the model) and coefficient of 0.542 (with gross household variable in the model) as shown in Column A1 and A2, respectively. The interaction of the investment variable with the current account balance shows expected negative relationship. Meanwhile, the relationship between the gross household debts with the current account balance is also negative. These results indicate that there is no major changes in the interaction of the parameters of interest either with or without the investment variable in the model as compared to Table 1.3. Therefore, the evidence of the Twin Deficits phenomenon can be observed in this model specification.

In terms of the fiscal deficit threshold effect as shown in Table 1.11, there is no significant relationship between the fiscal balance and current account balance in the high fiscal deficit countries. However, the positive association between fiscal balance and current account balance with coefficients around 0.31 and 0.39, can be noted in the

low fiscal deficit countries. Both the investment and gross household debt have negative interaction with the current account in the low fiscal deficit countries. In terms of the public debt threshold effect as shown in Table 1.12, similarly there is a significant positive relationship between fiscal balance and current account balance with coefficients around 0.52 and 0.53 in the countries with low level of public debt. On the other hand, there is no evidence of significant relationship between fiscal balance and current account balance in the countries with high public debt. In view of the household debt threshold as shown in Table 1.13, positive interaction between fiscal balance and current account balance can be observed only in the low household debt countries with greater coefficient of around 0.60, but insignificant association between gross household debt and current account balance.

In summary, inclusion of the investment variable in the model specification does not change the results when taking into consideration the threshold effects. Evidence of the Twin Deficits can be observed in the countries with low levels of fiscal deficit, public debt and household debt. This may imply that households behave as Ricardian in the countries with high level of fiscal deficit, public debt and household debt where the fiscal policy may not have major impact on the current account.

## **1.6. Conclusion**

The Twin Deficits hypothesis is a prolonged phenomenon encountered by developed and developing countries. European countries are one of the regions confronted with challenging tasks in achieving growth while maintaining optimal fiscal balance. Besides that, the formation of the EU in 1994 and introduction of the Euro currency further push the economy of the EU members towards higher degree of economic and

financial integration. This study investigates the role of the household effect in term of the household indebtedness in moderating or contributing to the Twin Deficits hypothesis in the European countries.

The panel regression with fixed effects method and GMM estimators show parallel results on the determinants of current account balance as well as the interaction of the household indebtedness. The main empirical findings indicate the existence of Twin Deficits in the European countries where there is evidence of positive co-movement between current account balance and fiscal balance with magnitude around 0.400 This shows that the fiscal policy remain a crucial tool in influencing the current account balance in the EU region. Interestingly, the effect of the Twin Deficits is marginally affected with magnitude around 0.420 with the inclusion of the gross household debt. Furthermore, the gross household debt exhibits negative association with the current account balance with the magnitude around 0.056.

With regards to the other determinants of the current account balance, the empirical results are mostly compatible with previous studies. Net foreign assets and relative income per capita in the EU region play significant role towards affecting the trend of the current account balance. Evidence of positive association is observed between both determinants towards the current account balance. This means that the convergence in the EU region eventually contribute to reducing the current account deficit experienced by most of the EU countries. Economic growth also contributes to the changes to the current account balance in term of inverse association. This is due to the need to accommodate large volume of investments as the countries grow. Age dependencies of

the old and young do not have significant impact on the current account balance considering the standard determinants of current account balance in the model.

In terms of the fiscal deficit, public debt and household debt thresholds perspectives, fiscal balance and household debt play important role as determinant of current account balance only in the low fiscal deficit, public debt and household debt countries. Furthermore, the inclusion of the household debt has marginal impacts on the Twin Deficits in low fiscal deficit and public debt countries compared to countries with low gross household debt. This indicates that no evidence of Twin Deficits phenomenon in the high fiscal deficit, public debt and household debt countries.

These show that despite the importance of the fiscal policy in managing the current account deficits, the mounting of the household liabilities also contribute to the behavior of the current account deficit experienced by the EU countries. The results from this study will be reflective of the contemporary issues of the mounting volume of the household indebtedness despite facing challenging task in governing the fiscal deficit in the region. Therefore, appropriate economic policies adopted by the EU countries should take into consideration the contemporary issue particularly the household indebtedness, in addition to fiscal policy in the effort to shrink the current account deficit.

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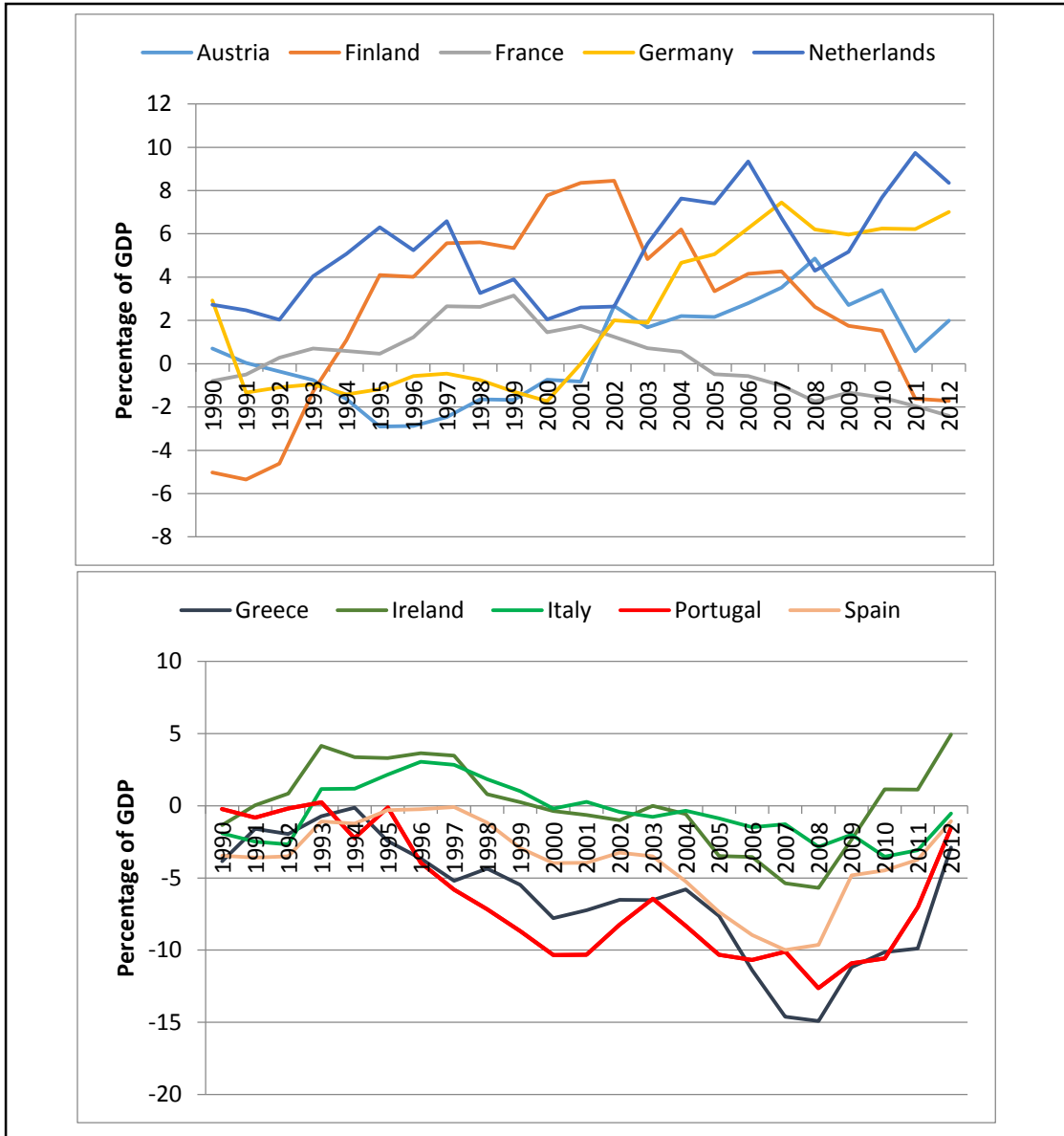
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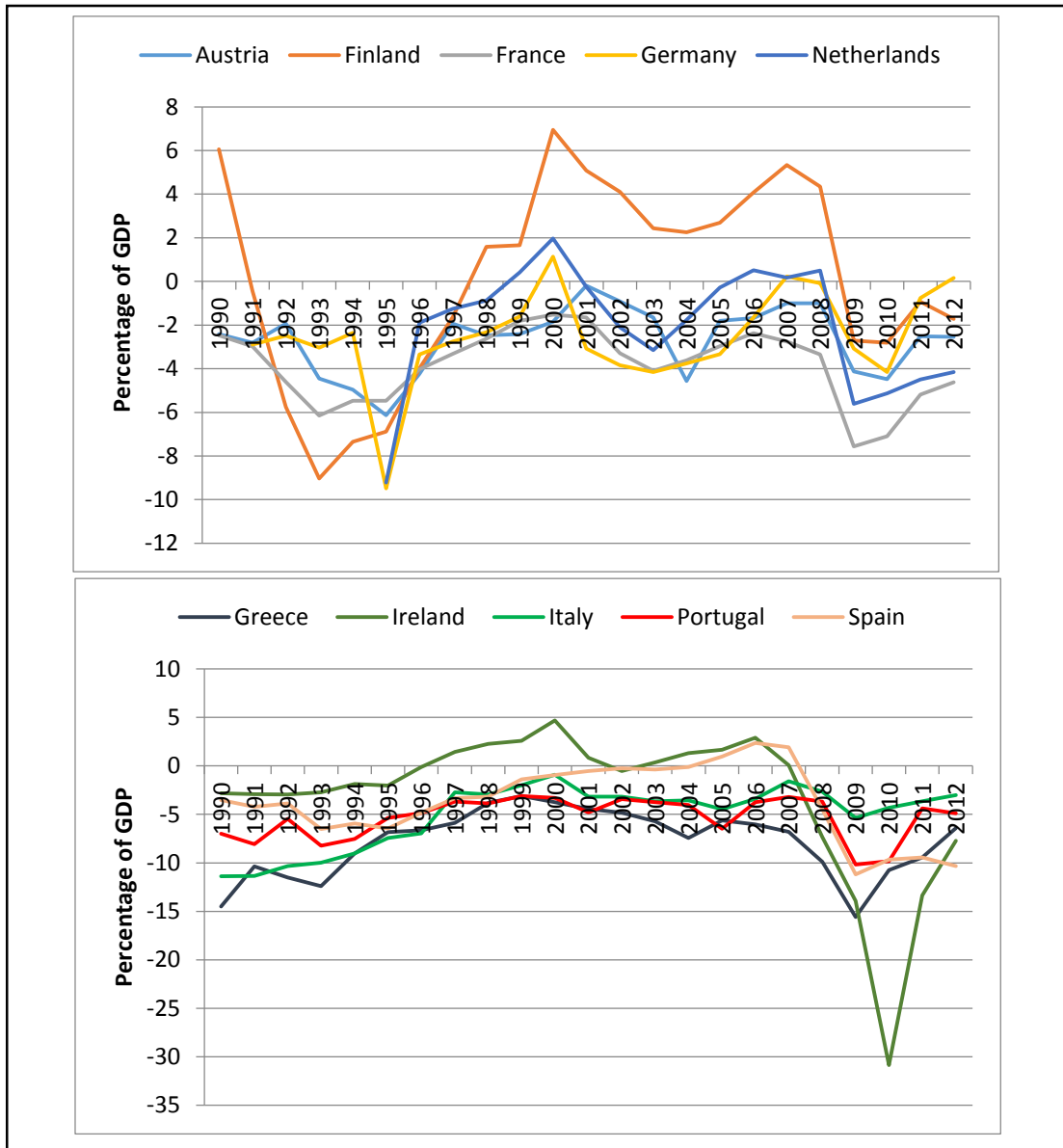
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**Figure 1.1: Current Account Balance of Selected European Union Countries (% of GDP)**



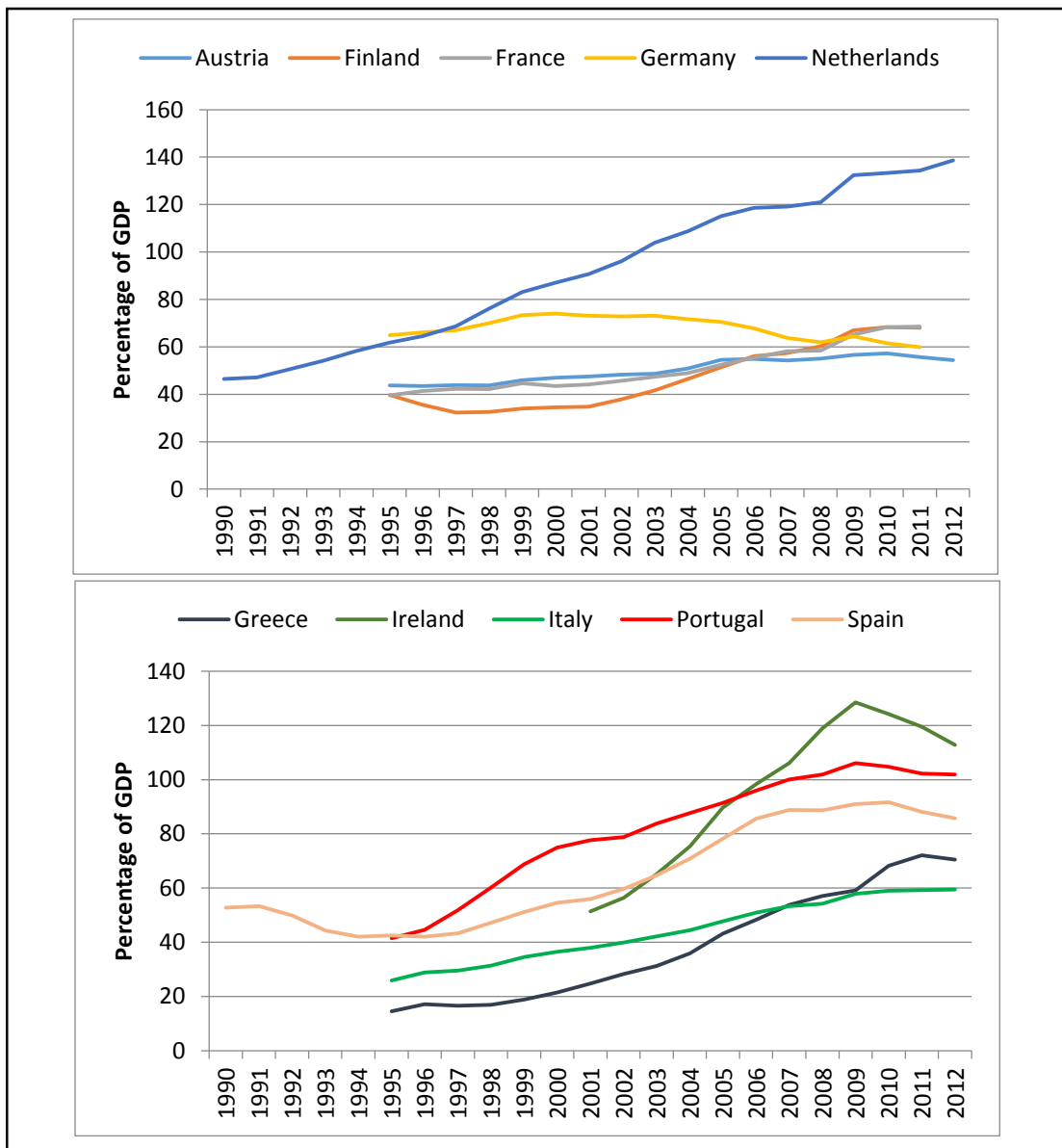
Source: World Economic Outlook & Eurostat.

**Figure 1.2: Fiscal Balance of Selected European Union Countries (% of GDP)**



Source: World Economic Outlook & Eurostat.

**Figure 1.3: Household Debt of Selected European Union Countries (% of GDP)**



Source: Eurostat. Most of the gross household debt data are available from 1995 onward, except for Austria and the Netherlands.

**Table 1.1: Summary Statistics**

	Sample Periods							
	1981 – 1984	1985 – 1988	1989 – 1992	1993 – 1996	1997 – 2000	2001 – 2004	2005 – 2008	2009 – 2012
CAB (% of GDP)	-2.49	-0.95	-0.80	-0.74	-1.95	-1.92	-4.31	-0.47
FB (% of GDP)	-5.51	-4.66	-4.23	-4.52	-1.74	-2.17	-1.11	-4.93
NFA (% of GDP)	-10.12	-14.64	-14.25	-11.05	-16.83	-20.50	-27.37	-38.22
RI (ratio to GDP)	0.47	0.51	0.59	0.53	0.46	0.49	0.63	0.64
GDPG (% growth)	2.03	3.36	-0.75	2.39	3.75	3.31	3.84	-0.06
ADY (% of population)	33.91	32.22	30.90	29.25	27.36	25.34	23.82	23.34
ADO (% of population)	18.69	18.38	19.53	20.59	21.53	22.46	23.35	25.51
GHD (% of GDP)	-	-	45.85	36.14	39.49	49.96	64.68	67.19

Note: CAB = Current Account Balance, FB = Fiscal Balance, NFA = Net Foreign Assets, RI = Relative Income, GDPG = GDP growth, ADY = Age Dependency of Young, ADO = Age Dependency of Old, GHD = Gross Household Debt. Variables shown are in un-weighted GDP average measurement. Data on Gross Household Debt commences from the year 1991 and obtained from Eurostat.

**Table 1.2: Correlation Matrix of Major Variables**

	<b>CAB</b>	<b>FB</b>	<b>NFA</b>	<b>RI</b>	<b>GDPG</b>	<b>ADY</b>	<b>ADO</b>	<b>GHD</b>	<b>FB*Crisis</b>	<b>GHD*Crisis</b>
CAB	1.000									
FB	0.299	1.000								
NFA	0.439	0.106	1.000							
RI	0.674	0.183	0.475	1.000						
GDPG	-0.276	0.082	-0.033	-0.304	1.000					
ADY	0.199	0.033	0.188	0.284	0.039	1.000				
ADO	0.213	0.129	0.165	0.299	-0.228	-0.397	1.000			
GHD	0.330	0.075	0.207	0.672	-0.268	0.386	-0.001	1.000		
FB*Crisis	0.187	0.615	0.147	-0.029	0.078	-0.185	0.206	-0.131	1.000	
GHD*Crisis	0.066	-0.132	0.055	0.271	-0.078	0.291	-0.078	0.529	-0.239	1.000

Notes: CAB = Current Account Balance, FB = Fiscal Balance, NFA = Net Foreign Assets, RI = Relative Income, GDPG = GDP growth, ADY = Age Dependency of Young, ADO = Age Dependency of Old, GHD = Gross Household Debt; Variables shown are expressed as demeaned with weighted GDP average except Current Account Balance and Net Foreign Asset.

**Table 1.3: Period-Fixed Effects Estimation - Fundamental Determinants of Current Account Balance (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	A1 [Without GHD]	A2 [With GHD]
Constant	-0.009 (0.009)	-0.012 (0.009)
Fiscal Balance	0.404*** (0.131)	0.422*** (0.123)
Net Foreign Asset	0.029** (0.012)	0.022* (0.012)
Relative Income	0.087*** (0.014)	0.128*** (0.017)
GDP Growth	-0.441** (0.211)	-0.583*** (0.200)
Age Dependency Ratio – Young	0.021 (0.131)	0.133 (0.126)
Age Dependency Ratio – Old	-0.066 (0.121)	-0.163 (0.116)
Gross Household Debt	-	-0.056*** (0.014)
R-Squared	0.5803	0.6365
Number of Countries	28	28
Number of Observations	115	115

Asterisks \*, \*\* and \*\*\* denote significance levels: 10%, 5% and 1%; Standard errors in parentheses. GHD denotes Gross Household Debt.

**Table 1.4: Pooled OLS Estimation - Fundamental Determinants of Current Account Balance (Dependent variable: Current Account Balance as ratio to GDP)**

<b>Explanatory</b>	<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>
Constant	-0.011* (0.006)	-0.015** (0.006)	- 0.016*** (0.006)	-0.013** (0.005)	-0.017** (0.005)	- 0.018*** (0.006)
Fiscal Balance	0.432*** (0.133)	0.383*** (0.131)	0.322** (0.156)	0.468*** (0.126)	0.413*** (0.122)	0.381** (0.148)
Net Foreign Asset	0.026** (0.012)	0.033*** (0.012)	0.031** (0.013)	0.016 (0.012)	0.024** (0.012)	0.023* (0.012)
Relative Income	0.084*** (0.014)	0.082*** (0.014)	0.085*** (0.014)	0.126*** (0.018)	0.128*** (0.017)	0.129*** (0.017)
GDP Growth	-0.513** (0.214)	-0.426** (0.212)	-0.432* (0.213)	- 0.679*** (0.208)	- 0.593*** (0.201)	- 0.605*** (0.206)
Age Dependency Ratio – Young	0.052 (0.072)	0.065 (0.071)	0.071 (0.072)	0.137* (0.072)	0.161** (0.069)	0.166** (0.071)
Age Dependency Ratio – Old	-0.051 (0.078)	-0.044 (0.076)	-0.063 (0.081)	-0.166** (0.079)	-0.169** (0.076)	-0.180** (0.081)
Crisis Dummy	-	0.024** (0.009)	0.023** (0.009)	-	0.029*** (0.009)	0.027*** (0.009)
Fiscal Balance*Crisis Dummy	-	-	0.206 (0.289)	-	-	0.138 (0.274)
Gross Household Debt	-	-	-	0.055*** (0.015)	0.061*** (0.014)	0.063*** (0.017)
Gross Household Debt*Crisis Dummy	-	-	-	-	-	0.006 (0.023)
R-Squared	0.5467	0.5726	0.5747	0.5978	0.6347	0.6357
Number of Countries	28	28	28	28	28	28
Number of Observations	115	115	115	115	115	115

Asterisks \*, \*\* and \*\*\* denote significance levels: 10%, 5% and 1%; Standard errors in parentheses.



**Table 1.5: Comparison of Estimations (Period-Fixed Effects versus Country-Fixed Effects) - Fundamental Determinants of Current Account Balance with Household Indebtedness (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	A1	A2	B1	B2	C1	C2
Constant	-0.009 (0.009)	-0.012 (0.009)	- 0.028*** (0.008)	- 0.032*** (0.008)	0.094 (0.104)	0.121 (0.109)
Fiscal Balance	0.404*** (0.131)	0.422*** (0.123)	0.322** (0.151)	0.119 (0.175)	0.199 (0.143)	0.166 (0.174)
Net Foreign Asset	0.029** (0.012)	0.022* (0.012)	-0.012 (0.018)	0.003 (0.019)	0.003 (0.017)	-0.005 (0.019)
Relative Income	0.087*** (0.014)	0.128*** (0.017)	-0.013 (0.051)	-0.018 (0.049)	-0.044 (0.057)	-0.057 (0.059)
GDP Growth	-0.441** (0.211)	- 0.583*** (0.200)	- 0.677*** (0.231)	- 0.613*** (0.222)	- 0.627*** (0.213)	- 0.684*** (0.231)
Age Dependency Ratio – Young	0.021 (0.131)	0.133 (0.126)	0.191 (0.161)	0.2947* (0.153)	0.137 (0.188)	0.133 (0.193)
Age Dependency Ratio – Old	-0.066 (0.121)	-0.163 (0.116)	0.055 (0.248)	-0.073 (0.234)	-0.269 (0.314)	-0.344 (0.326)
Gross Household Debt	-	- 0.056*** (0.014)	-0.081** (0.035)	- 0.129*** (0.040)	- 0.122*** (0.035)	- 0.133*** (0.042)
Crisis Dummy	-	-	-	0.037*** (0.009)	-	-0.076 (0.096)
Fiscal Balance*Crisis Dummy	-	-	-	0.157 (0.285)	-	0.236 (0.284)
Gross Household Debt*Crisis Dummy	-	-	-	0.006 (0.023)	-	0.013 (0.024)
R-Squared	0.5803	0.6365	0.1777	0.3378	0.8024	0.8047
Period Fixed Effect	Yes	Yes	No	No	Yes	Yes
Country Fixed Effect	No	No	Yes	Yes	Yes	Yes
Number of Countries	28	28	28	28	28	28
Number of Observation	115	115	115	115	115	115

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

**Table 1.6: Dynamic System GMM Estimation of the Determinants of Current Account Balance (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	A [Without GHD]	B [Without GHD]	C [With GHD]	D [With GHD]
L.1 Current Account Balance	-0.149** (0.069)	-0.132* (0.074)	-0.097 (0.073)	-0.046 (0.075)
L.2 Current Account Balance	-	0.068 (0.076)	-	0.177** (0.071)
Fiscal Balance	0.424*** (0.136)	0.424*** (0.138)	0.468*** (0.131)	0.452*** (0.131)
Net Foreign Asset	0.032*** (0.012)	0.037*** (0.013)	0.021* (0.012)	0.038*** (0.013)
Relative Income	0.080*** (0.015)	0.079*** (0.015)	0.122*** (0.019)	0.131*** (0.018)
GDP Growth	-0.513** (0.214)	-0.429** (0.214)	-0.638*** (0.213)	-0.579*** (0.203)
ADR – Young	0.085 (0.137)	0.084 (0.137)	0.165 (0.133)	0.186 (0.128)
ADR – Old	0.002 (0.129)	-0.031 (0.136)	-0.089 (0.134)	-0.243* (0.137)
Gross Household Debt	-	-	-0.057*** (0.015)	-0.069*** (0.015)
<i>Diagnostic Checking:</i>				
Sargan Test	80.115 [0.807]	74.757 [0.822]	83.315 [0.500]	73.588 [0.557]
AB(1)	-4.845 [0.000]	-4.814 [0.000]	-4.469 [0.000]	-4.412 [0.000]
AB(2)	0.346 [0.729]	0.125 [0.900]	0.896 [0.370]	1.341 [0.180]
Number of Countries	28	28	28	28
Number of Observation	99	95	92	85

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses and *p*-value in bracket. L.1 denotes lagged one, L.2 denotes lagged two and GHD refers to Gross Household Debt.

The Sargan chi-square statistic examines the null hypothesis that instruments and the residuals are not correlated. The Arellano Bond (AB) Z-statistic examine the null hypothesis that the residuals are correlated in first-order AB(1) and uncorrelated in second-order AB(2).

**Table 1.7: Fiscal Deficits Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Fiscal Deficit		Low Fiscal Deficit	
	A1	A2	B1	B2
Constant	-0.029 (0.021)	-0.029 (0.021)	-0.018 (0.011)	-0.019* (0.010)
Fiscal Balance	-0.285 (0.189)	-0.269 (0.199)	0.209 (0.199)	0.305* (0.180)
Net Foreign Asset	0.057*** (0.016)	0.054*** (0.019)	0.013 (0.017)	0.017 (0.015)
Relative Income	0.127*** (0.033)	0.128*** (0.034)	0.092*** (0.017)	0.150*** (0.021)
GDP Growth	-0.435 (0.352)	-0.428 (0.359)	-0.609** (0.251)	-0.771*** (0.229)
Age Dependency Ratio - Young	-0.135 (0.192)	-0.109 (0.217)	0.252 (0.176)	0.475*** (0.168)
Age Dependency Ratio - Old	0.023 (0.196)	0.024 (0.199)	0.131 (0.163)	-0.093 (0.157)
Gross Household Debt	-	-0.006 (0.024)	-	-0.078*** (0.019)
Threshold Level	> 3% Fiscal Deficit	> 3% Fiscal Deficit	< 3% Fiscal Deficit	< 3% Fiscal Deficit
R-Squared	0.7608	0.7615	0.6374	0.7111
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	8	8	20	20
Number of Observation	39	39	76	76

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

**Table 1.8: Public Debts Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Public Debt		Low Public Debt	
	B1	B2	B1	B2
Constant	0.009 (0.068)	-0.011 (0.096)	-0.012 (0.011)	-0.014 (0.009)
Fiscal Balance	0.401 (0.540)	0.418 (0.581)	0.349** (0.149)	0.365*** (0.139)
Net Foreign Asset	-0.035 (0.073)	-0.033 (0.079)	0.039*** (0.015)	0.035*** (0.013)
Relative Income	0.189 (0.116)	0.215 (0.149)	0.086*** (0.015)	0.125*** (0.017)
GDP Growth	-0.943 (0.655)	-0.967 (0.707)	-0.194 (0.250)	-0.362 (0.235)
Age Dependency Ratio - Young	-0.123 (0.968)	-0.292 (1.169)	0.068 (0.136)	0.205 (0.131)
Age Dependency Ratio - Old	-0.313 (1.006)	-0.002 (1.469)	-0.015 (0.128)	-0.099 (0.121)
Gross Household Debt	-	-0.108 (0.344)	-	-0.057*** (0.015)
Threshold Level	> 60% Public Debt	> 60% Public Debt	< 60% Public Debt	< 60% Public Debt
R-Squared	0.7843	0.7877	0.5647	0.6320
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	4	4	24	24
Number of Observation	18	18	97	97

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

**Table 1.9: Household Debts Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Household Debt		Low Household Debt	
	A1	A2	B1	B2
Constant	-0.043 (0.025)	-0.030 (0.035)	-0.001 (0.010)	-0.010 (0.011)
Fiscal Balance	-0.070 (0.256)	-0.008 (0.285)	0.518*** (0.159)	0.539*** (0.155)
Net Foreign Asset	0.075** (0.029)	0.076** (0.029)	0.022 (0.013)	0.015 (0.013)
Relative Income	0.108*** (0.029)	0.111*** (0.031)	0.109*** (0.018)	0.143*** (0.023)
GDP Growth	-2.067** (0.863)	-2.254** (0.946)	-0.577** (0.225)	-0.649*** (0.222)
Age Dependency Ratio - Young	0.384 (0.274)	0.389 (0.279)	0.131 (0.156)	0.101 (0.152)
Age Dependency Ratio - Old	-0.082 (0.238)	-0.132 (0.259)	-0.306* (0.155)	-0.248 (0.153)
Gross Household Debt	-	-0.025 (0.047)	-	-0.073** (0.033)
Threshold Level	> 73% Household Debt	> 73% Household Debt	< 73% Household Debt	< 73% Household Debt
R-Squared	0.7358	0.7406	0.6300	0.6532
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	6	6	22	22
Number of Observation	29	29	86	86

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

**Table 1.10: Period-Fixed Effects Estimation with Investment - Fundamental Determinants of Current Account Balance (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	A1 [Without GHD]	A2 [With GHD]	Baseline (Table 3)
Constant	0.0243** (0.011)	0.021** (0.010)	-0.012 (0.009)
Fiscal Balance	0.527*** (0.119)	0.542*** (0.111)	0.422*** (0.123)
Net Foreign Asset	0.029*** (0.011)	0.022** (0.010)	0.022* (0.012)
Relative Income	0.067*** (0.013)	0.107*** (0.015)	0.128*** (0.017)
GDP Growth	-0.171 (0.195)	-0.314* (0.183)	-0.583*** (0.200)
Age Dependency Ratio - Young	-0.220* (0.126)	-0.106 (0.119)	0.133 (0.126)
Age Dependency Ratio - Old	-0.165 (0.109)	-0.255** (0.104)	-0.163 (0.116)
Investment	-0.513*** (0.099)	-0.499*** (0.091)	-
Gross Household Debt	-	-0.054*** (0.013)	-0.056*** (0.014)
R-Squared	0.6682	0.7198	0.6365
Number of Countries	28	28	28
Number of Observations	115	115	115

Asterisks \*, \*\* and \*\*\* denote significance levels: 10%, 5% and 1%; Standard errors in parentheses. GHD denotes Gross Household Debt.

**Table 1.11: Fiscal Deficits Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness and Investment (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Fiscal Deficit		Low Fiscal Deficit	
	A1	A2	B1	B2
Constant	-0.006 (0.036)	-0.005 (0.037)	0.009 (0.012)	0.005 (0.011)
Fiscal Balance	-0.186 (0.229)	-0.155 (0.245)	0.311* (0.179)	0.389** (0.161)
Net Foreign Asset	0.059*** (0.017)	0.055*** (0.019)	0.016 (0.015)	0.019 (0.013)
Relative Income	0.114*** (0.037)	0.114*** (0.038)	0.069*** (0.016)	0.125*** (0.019)
GDP Growth	-0.374 (0.363)	-0.358 (0.371)	-0.323 (0.234)	-0.494** (0.213)
Age Dependency Ratio - Young	-0.250 (0.243)	-0.222 (0.258)	0.013 (0.167)	0.236 (0.158)
Age Dependency Ratio - Old	-0.097 (0.251)	-0.106 (0.256)	0.072 (0.146)	-0.129 (0.139)
Investment	-0.162 (0.208)	-0.176 (0.214)	-0.488*** (0.116)	-0.450*** (0.104)
Gross Household Debt	-	-0.009 (0.024)	-	-0.071*** (0.017)
Threshold Level	> 3% Fiscal Deficit	> 3% Fiscal Deficit	< 3% Fiscal Deficit	< 3% Fiscal Deficit
R-Squared	0.7663	0.7677	0.7164	0.7777
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	8	8	20	20
Number of Observation	39	39	76	76

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

**Table 1.12: Public Debts Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness and Investment (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Public Debt		Low Public Debt	
	B1	B2	B1	B2
Constant	0.003 (0.028)	-0.025 (0.036)	0.023* (0.012)	0.020* (0.011)
Fiscal Balance	-0.025 (0.233)	-0.006 (0.226)	0.521*** (0.139)	0.534*** (0.126)
Net Foreign Asset	-0.009 (0.030)	-0.005 (0.029)	0.037*** (0.013)	0.032*** (0.012)
Relative Income	0.049 (0.053)	0.084 (0.059)	0.065*** (0.014)	0.103*** (0.016)
GDP Growth	0.321 (0.342)	0.299 (0.332)	-0.012 (0.228)	-0.180 (0.209)
Age Dependency Ratio - Young	-0.801 (0.413)	-1.044* (0.451)	-0.169 (0.132)	-0.031 (0.124)
Age Dependency Ratio - Old	1.879** (0.553)	2.339** (0.663)	-0.146 (0.118)	-0.228** (0.109)
Investment	-1.415*** (0.237)	-1.429*** (0.230)	-0.500*** (0.107)	-0.496*** (0.097)
Gross Household Debt	-	-0.151 (0.128)	-	-0.057*** (0.013)
Threshold Level	> 60% Public Debt	> 60% Public Debt	< 60% Public Debt	< 60% Public Debt
R-Squared	0.9689	0.9756	0.6540	0.7199
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	4	4	24	24
Number of Observation	18	18	97	97

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.



**Table 1.13: Household Debts Threshold Classification - Fundamental Determinants of Current Account Balance with Household Indebtedness and Investment (Dependent variable: Current Account Balance as ratio to GDP)**

Explanatory	High Household Debt		Low Household Debt	
	A1	A2	B1	B2
Constant	-0.035 (0.031)	0.002 (0.050)	0.037*** (0.011)	0.034*** (0.012)
Fiscal Balance	-0.006 (0.294)	0.196 (0.366)	0.601*** (0.128)	0.604*** (0.129)
Net Foreign Asset	0.073** (0.029)	0.074** (0.029)	0.024** (0.011)	0.022* (0.011)
Relative Income	0.103*** (0.032)	0.104*** (0.032)	0.086 (0.015)	0.095*** (0.021)
GDP Growth	-2.063** (0.883)	-2.438** (0.973)	-0.215 (0.189)	-0.245 (0.196)
Age Dependency Ratio - Young	0.332 (0.299)	0.283 (0.305)	-0.138 (0.132)	-0.136 (0.133)
Age Dependency Ratio - Old	-0.112 (0.250)	-0.249 (0.291)	-0.421*** (0.126)	-0.403*** (0.129)
Investment	-0.129 (0.268)	-0.285 (0.316)	-0.613*** (0.095)	-0.592*** (0.101)
Gross Household Debt	-	-0.052 (0.055)	-	-0.018 (0.029)
Threshold Level	> 73% Household Debt	> 73% Household Debt	< 73% Household Debt	< 73% Household Debt
R-Squared	0.7396	0.7540	0.7640	0.7652
Period Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	No	No
Number of Countries	6	6	22	22
Number of Observation	29	29	86	86

Asterisks \*, \*\* and \*\*\* denotes significance levels: 10%, 5% and 1%; Standard errors in parentheses.

### Appendix 1.1A: Summary of Literature Reviews Supporting Twin Deficit Hypothesis

Authors (Year)	Data / Methodology	Sample	Findings
Rosensweig and Tallman (1993)	<ul style="list-style-type: none"> <li>Quarterly data: 1961-1989</li> <li>VAR system</li> </ul>	<ul style="list-style-type: none"> <li>United States</li> </ul>	<ul style="list-style-type: none"> <li>Growing fiscal deficits lead to appreciation of the dollar and eventually contribute to trade deficit</li> </ul>
Vamvoukas (1999)	<ul style="list-style-type: none"> <li>Annual data: 1948-1994</li> <li>Cointegration, error-correction modelling and Granger trivariate causality</li> </ul>	<ul style="list-style-type: none"> <li>Greece</li> </ul>	<ul style="list-style-type: none"> <li>Existence of positive co-movement between fiscal deficit and current account deficit in the short-run and long-run and causal effect from fiscal deficit to current account deficit</li> </ul>
Leachman and Francis (2002)	<ul style="list-style-type: none"> <li>Quarterly data: 1948-1992</li> <li>Multi-cointegration method</li> </ul>	<ul style="list-style-type: none"> <li>United States</li> </ul>	<ul style="list-style-type: none"> <li>Evidence of the Twin Deficits is rather time specific and ECMs results indicated that the fiscal deficit contributed to the persistent current account deficit at the latter stage of the sample period</li> </ul>
Chin & Prasad (2003)	<ul style="list-style-type: none"> <li>Annual data: 1971-1995</li> <li>Panel regression with period fixed effects</li> </ul>	<ul style="list-style-type: none"> <li>18 industrial and 71 developing countries</li> </ul>	<ul style="list-style-type: none"> <li>Current account balances are positively correlated with government budget balances and initial stocks of net foreign assets</li> <li>Financial deepening are positively associated with current account balances while indicators of openness to international trade are negatively correlated with current account balances among developing countries</li> </ul>
Gruber and Kamin (2007)	<ul style="list-style-type: none"> <li>Annual data: 1982-2003</li> <li>Panel regression with period fixed effects</li> </ul>	<ul style="list-style-type: none"> <li>61 countries</li> </ul>	<ul style="list-style-type: none"> <li>Existence of positive relationship between fiscal balance and current account balance with smaller magnitude</li> </ul>

### Appendix 1.1B: Summary of Literature Reviews Supporting Twin Deficit Hypothesis

Authors (Year)	Data / Methodology	Sample	Findings
Bagnai (2010)	<ul style="list-style-type: none"> <li>Annual data: 1995-2006</li> <li>Panel cointegration</li> </ul>	<ul style="list-style-type: none"> <li>Central and Eastern European Countries (CEEC)</li> </ul>	<ul style="list-style-type: none"> <li>Countries such as Portugal, Ireland, Greece and Spain exhibit considerably weak existence of Twin Deficits</li> </ul>
Abbas et al., (2010)	<ul style="list-style-type: none"> <li>Annual data: 1985-2007</li> <li>Panel regressions and VARs</li> </ul>	<ul style="list-style-type: none"> <li>124 countries</li> </ul>	<ul style="list-style-type: none"> <li>Existent of the Twin Deficits and the association is stronger in the emerging and developing countries</li> </ul>
Lane and Milesi-Ferretti (2012)	<ul style="list-style-type: none"> <li>Annual data: 1969-2008</li> <li>Panel regression with period fixed effects</li> </ul>	<ul style="list-style-type: none"> <li>Developed countries and emerging economies</li> </ul>	<ul style="list-style-type: none"> <li>Evidence of Twin Deficits with magnitude around 0.24 in the full sample, 0.27 for developed countries and 0.26 for emerging economies</li> </ul>
Atoyan et al. (2013)	<ul style="list-style-type: none"> <li>Annual data: 2000-2012</li> <li>Ordinary Least Squared (OLS): Country dummies</li> </ul>	<ul style="list-style-type: none"> <li>28 European Countries</li> </ul>	<ul style="list-style-type: none"> <li>Strong private-sector led domestic demand soar lead to CA imbalances during pre-crisis years in EU region.</li> <li>In the case of emerging Europe, Rising investment has greater effect than declining savings in the emerging Europe countries, while CA imbalances are due to declining private saving in the periphery EU countries.</li> </ul>
Brissimis et al. (2013)	<ul style="list-style-type: none"> <li>Annual data: 1980 to 2008</li> <li>Panel estimation approaches, namely Fixed Effects method, Seemingly Unrelated Regression and Fully Modified OLS</li> </ul>	<ul style="list-style-type: none"> <li>12 European countries</li> </ul>	<ul style="list-style-type: none"> <li>Current account imbalances particularly the initial 12 EU members can be explained by the fundamental drivers</li> </ul>
Forte and Magazzino (2013)	<ul style="list-style-type: none"> <li>Annual data: 1970 to 2010</li> <li>Generalized Method of Moments (GMM) dynamic panel approach</li> </ul>	<ul style="list-style-type: none"> <li>33 European countries</li> </ul>	<ul style="list-style-type: none"> <li>Twin Deficits evidence can only be observed in the high fiscal deficit countries</li> </ul>

## Appendix 1.2: Data Source

Indicator	Description	Unit	Source
CABGDP	<ul style="list-style-type: none"> <li>Current account is all transactions other than those in financial and capital items. The major classifications are goods and services, income and current transfers. The focus of the BOP is on transactions (between an economy and the rest of the world) in goods, services, and income.</li> <li>CA surplus (+) or CA deficit (-)</li> </ul>	Ratio on GDP	Eurostat
FBGDP	Fiscal Balance derived from subtraction between: <ul style="list-style-type: none"> <li>Government Revenue and Government Expenditure (expressed in billions in national currency)</li> <li>FB surplus (+) or FB deficit (-)</li> </ul>	Ratio on GDP	Eurostat
NFA	Net Foreign Asset	Ratio on GDP	Lane and Milesi-Ferretti database
RGDPPC	Relative GDP Per Capita: Ratio on GDP per capita of United States	Ratio on GDP	World Bank
GDP	GDP growth	%	Eurostat
ADRO	Age Dependency Ratio – Old	% of working-age population	World Bank
ADRY	Age Dependency Ratio – Young	% of working-age population	World Bank
GDH	Gross debt Households: Loan and liabilities	% of GDP	Eurostat
INV	Investment	% of GDP	Eurostat

### Appendix 1.3: Threshold Levels Country Classification

Thresholds	High Fiscal Deficit (> 3%)	Average	High Public Debt (> 60%)	Average	High Household Debt (> 73%)	Average
Countries	Belgium	-5.39	Belgium	110.32	Cyprus	114.33
	France	-3.43	Hungary	87.01	Denmark	121.78
	Greece	-3.49	Latvia	71.75	Ireland	95.04
	Ireland	-7.95	Lithuania	82.84	The Netherlands	102.81
	Italy	-4.22			Portugal	81.77
	Portugal	-4.55			United Kingdom	87.91
	Spain	-3.78				
	United Kingdom	-3.49				

Thresholds	Low Fiscal Deficit (< 3%)	Average	Low Public Debt (< 60%)	Average	Low Household Debt (< 73%)	Average
Countries	Austria	-2.89	Austria	48.69	Austria	50.23
	Bulgaria	0.13	Bulgaria	13.19	Belgium	45.40
	Croatia	-0.62	Croatia	12.89	Bulgaria	20.91
	Cyprus	-1.83	Cyprus	34.63	Croatia	-
	Czech Republic	-2.44	Czech Republic	14.07	Czech Republic	20.48
	Denmark	-1.19	Denmark	33.51	Estonia	31.84
	Estonia	0.12	Estonia	3.21	Finland	46.79
	Finland	0.88	Finland	34.91	France	50.93
	Germany	-1.72	France	51.09	Greece	38.54
	Hungary	-2.28	Greece	15.64	Germany	67.75
	Latvia	-1.25	Germany	41.51	Hungary	22.19
	Lithuania	-1.28	Ireland	48.41	Ireland	95.04
	Luxembourg	0.97	Italy	31.94	Italy	44.21
	Malta	-1.72	Luxembourg	8.32	Luxembourg	-
	The Netherlands	-1.11	Malta	9.78	Malta	-
	Poland	-2.49	The Netherlands	5.30	Poland	17.79
	Romania	-1.39	Poland	32.15	Portugal	81.77
	Slovak Republic	-2.15	Portugal	33.01	Romania	15.89
	Slovenia	-0.91	Romania	32.38	Slovak Republic	19.71
	Sweden	-1.35	Slovak Republic	25.07	Slovenia	27.62
			Slovenia	45.33	Spain	68.40
			Spain	47.23	Sweden	65.38
			Sweden	9.46		
			United Kingdom	19.29		

The thresholds for fiscal deficit and public debt are based on the Stability Growth Path (SGP) of European Union at 3% fiscal deficit and 60% public debt. The threshold for the household debt is based on the level of 75<sup>th</sup> percentile of household debt data.

## **Chapter 2:**

### **Twin Deficits of Eleven Euro Area Countries - Endogenous Threshold Effects**

#### **2.1. Introduction**

The Twin Deficits hypothesis remain a debatable issues and serve as an essential economic indicator. These deficits, namely current account deficit and fiscal deficit emerge as key challenge among the policy makers in this globalization era. In view of the intertemporal perspective, a country may run a deficit to promote long-run economic growth. Countries may internalize the effects of the temporary economic slump by experiencing deficits in the short-run with the expectation that the deficits will turn into surpluses in the future. Since experiencing these deficits by most of the countries are inevitable, the sustainability of these deficits has become an indicator regarding the ability of a country to finance its debts. Thus, the prolong of these deficits experienced by most of the countries, particularly the United States and European countries, may lead to economic turbulences if they are not well managed.

Fundamentally, the Twin Deficits hypothesis indicates that there is positive association between fiscal deficit and current account deficit. This implies that increase (decrease) in the fiscal deficit may lead to increase (decrease) in the current account deficit. There are a number of studies in the 2000s that support this hypothesis such as Leachman and Francis (2002), Chinn and Prasad (2003), Gruber and Kamin (2007), Bagnai (2010), Lane and Milesi-Ferretti (2012) and Brissimis et al. (2013). Nevertheless, there are some studies such as Evans and Hasan (1994), Kaufmann et al. (2002) and Kim and Roubini (2008) who provide contrary view on this hypothesis. The former two studies

indicate that changes in the fiscal deficit has no impact on the current account deficit. While the latter study reveals a negative relationship between fiscal deficit and current account deficit. This implies that increase (decrease) in the fiscal deficit may lead to decrease (increase) in the current account deficit.

The core argument of the Twin Deficit hypothesis is the behavior of the household in response to the fiscal policy as either Ricardian equivalence or Keynesian assumption. Under the Ricardian equivalence assumption, there is no significant impact of fiscal policy on the private consumption. In the event of the fiscal expansionary such as increase in the public expenditure, the household will internalize the government budget constraint by increasing their private saving instead of expanding their consumption level. This is due to the precautionary saving among the household to face the possible increase in the taxation in the future. Thus, increase in the fiscal deficit via expansion in the public expenditure may eventually lead to no changes on the current account balance. On the other hand, increase in the public expenditure level may lead to the increase in the level of private consumption under the Keynesian assumption. As a result, the higher fiscal deficit contributes to higher level of current account deficit.

This study aims to investigate the Twin Deficits hypothesis in the European countries from the perspective of threshold effects. Kueh (2015) shows that countries below the threshold level for fiscal deficit, public debt and household debt are the ones that show Twin Deficits behavior between the current account deficit and fiscal deficit. The thresholds chosen however, are exogenous thresholds as given by previous agreements, including the Maastricht Treaty and Stability Growth Path of -3% to GDP for fiscal deficit and 60% to GDP for public debt. Meanwhile, the household debt threshold is

73% to GDP, which is based on the 75<sup>th</sup> percentile of the sample. Endogenous thresholds for those values may be important in determining this relationship more directly. Several relevant thresholds indicators such as level of the public debt, fiscal deficit, household debt, trade openness and financial development are chosen as threshold indicators. The main reason is to examine the evidence of the Twin Deficits phenomenon if the countries experiencing above or below the level of the public debt, fiscal deficit, household debt, trade openness and financial development. Other studies such as Abbas et al. (2010) and Forte and Magazzino (2013) utilized such exogenous thresholds as well. The exogenous thresholds used by Abbas et al. (2010) are the level of development (developed, emerging or developing countries), output level and trade openness where strong evidence of Twin Deficits can be observed in the emerging and developing countries compared to advanced countries, countries that experience output level above the potential output level and countries exhibit higher level of trade openness. Meanwhile, Forte and Magazzino (2013) emphasize on one threshold that is the fiscal deficit threshold of -2% to GDP and discover that evidence of Twin Deficits only in the high fiscal deficit countries. Nickel and Vansteenkiste (2008) consider endogenous thresholds but they only study the public debt threshold.

Therefore, it is interesting to examine the Twin Deficits phenomenon in the case where the thresholds are endogenous, instead of pre-determined. This is due to the dissimilarity behavior may be observed when below or above certain threshold level. Despite that, understanding the threshold effects may provide crucial indication or signal to the policy makers. For instance, public debt threshold may become important indicator regarding the debt amount level experienced by a country. If the public debt level of a country reach above certain threshold level, this may provide indication that



the country may experience impediment in financing its debt in the future. On the other hand, if the public debt level of a country is below certain threshold level, then this implies that the country may not experience difficulty in the managing its debt. Identifying the threshold endogenously also play important role as it may provide more reflective information regarding the behavior of the parameters of interest. The endogenous thresholds are determined based on the interaction between the threshold indicator and the parameters of interest and thus reflect the contemporary behavior of the parameters of interest. In contrast, exogenous threshold is pre-determined and may not reflect the actual or contemporary trend of the parameters of interest.

To find the endogenous thresholds, I use the sample splitting approach introduced by Hansen (2000). I capture the interaction between the current account deficit and the fiscal deficit while taking into account the threshold effects. In general, the least squares estimator method is used to analyze the interaction between the parameters of interest and all the possible values of the threshold indicators. The predicted threshold levels are determined by selecting the one that minimizes the sum of squared residuals. Subsequently, the bootstrapping method is used to estimate the threshold regression, where the coefficients of the parameters of interest are attained for the samples, either above or below the threshold values.

The contributions of this paper are as follow: First, this study provides analysis on the Twin Deficits hypothesis from the perspective of the endogenous threshold, instead of a pre-determined threshold level. For instance, Forte and Magazzino (2013) use a threshold for the fiscal deficit of 2% of GDP (after adjusting for the inflation effect), which is imposed in the Stability Growth Path (SGP) criteria. The countries with the

fiscal deficit exceed 2% of GDP are classified into high fiscal deficit countries group while the countries with the fiscal deficit less than 2% of GDP are classified into low fiscal deficit countries group. Kueh (2015) chooses the threshold indicators (fiscal deficit, public debt and household debt) exogenously for 28 European countries. The threshold levels for the fiscal deficit is -3% of GDP and 60% of GDP for public debt where both threshold levels are based on the benchmark stated in the Stability Growth Path (SGP). Meanwhile, the threshold level for the household debt is 73% of GDP and is based on the 75<sup>th</sup> percentile of the sample. Abbas et al. (2010) used threshold for the level of development (developed, emerging or developing countries) and the level of trade openness based on the median values.

My study adopts the sample splitting method introduced by Hansen (2000) to determine the endogenous threshold level of various indicators. The estimations obtained from the threshold regression provide useful information regarding the behavior of the countries in two different samples (above or below the threshold level). Second, this study includes multiple threshold indicators in analyzing the behavior of the Twin Deficits hypothesis in the Euro Area countries. The only study that I know of that applied the endogenous threshold in examining this phenomenon in the Euro region is Nickel and Vansteenkiste (2008). However, their study only emphasized one threshold indicator, which is the public debt. They adopted the dynamic fixed effects panel threshold model to examine the Twin Deficits hypothesis for 22 industrialized countries, including the Euro Area countries with data covering the period 1981 to 2005. This study differs in that several potential economic indicators are examined, including gross household debt, fiscal deficit, trade openness and financial development as possible threshold indicators. I also examine threshold public debt level as previous work. This is crucial

as to reflect the contemporary trend in the European region, particularly the effects of the mounting household debt and global financial crisis in the late 2000s. This study also differs in the measurement approach. All the variables of parameters interests are expressed in the form of difference from the GDP weighted average while the variables used by Nickel and Vansteenkiste (2008) are in levels. The main reason for this practice is to capture the local effect instead of the global effect and eliminate the existence of common factors as indicated by Gruber and Kamin (2007).

### **2.1.1. Twin Deficits Hypothesis and Threshold Effects**

The behavior of the Twin Deficits phenomenon can be further analyzed by taking into consideration the threshold effects. Exploring the behavior of the current account deficit and fiscal deficit from the view of thresholds such as public debt, fiscal deficit, household debt, trade openness and financial development provides more insight on the Twin Deficits phenomenon. This is due to the variation in the responses of the countries depending on either below or above the thresholds level. Fiscal deficit, public debt and household debt can be important threshold indicators as these deficit and debts are the problem experienced by most of the countries, particularly the European countries. Meanwhile, trade openness and financial development thresholds also prominent and should be taking into consideration where the international trade activities are expanding and the domestic financial markets are experiencing deeper financial development in the region. Thus, these threshold indicators may exacerbate or mitigate the Twin Deficits phenomenon. Furthermore, the effect of the household debt in affecting the Twin Deficits also being investigated from the perspective of the endogenous threshold effects. The following section provides discussion on the threshold indicators.

### Public Debt

Public debt is among one of the important indicator that is chosen as threshold candidate. One of the well-known studies, Reinhart and Rogoff (2010) explores the implications of the different public debt levels towards economic growth. They discovered that countries may experience lower economic growth when the public debt level reaches 90% debt to GDP ratio. This implies that accumulation of public debt serve as an important threshold in affecting the long-run economic growth. Besides that, the Maastricht Treaty criteria enhanced via the Stability Growth Path (SGP) has outline two main thresholds for the European members in order to preserve the stability of the economic growth in the region. The thresholds are public debt to GDP ratio below 60% debt to GDP and fiscal deficit to GDP ratio below 3% to GDP.

There are several studies that specifically explore the implications of the fiscal policy on the behavior of the private sector, such as Perotti (1999), Berben and Brosens (2007), Nickel and Vansteenkiste (2008) and Kueh (2015). They select public debt as the threshold indicator to investigate the implication of fiscal policy on private sector whether a country experience low or high level of public debt. This is due to the dissimilarity responses of private sector upon fiscal policy implemented by the government in the country with low public debt level or high public debt level. The linkage between the private sector and fiscal policy lies on the assumption of the household behavior, either Ricardian Equivalence or Keynesian views. In the countries with low level of public debt, fiscal expansionary policy such as increase in the public expenditure may influence the behavior of the household where private consumption will increase as well, parallel with Keynesian view. However, the behavior of the household may alter as level public debt increase until certain threshold. This means

that countries with high level public debt, saving level of the household may surge due to the precautionary purpose to overcome the possibility of increase in taxation in the future. In this case, the household are considered acting according to the Ricardian Equivalence behavior.

### Household Debt

The other potential threshold is the household debt, which has emerged as one of the fast growing debt particularly in the European region in the 2000s, despite the public debt. For instance as a consequences of the global financial crisis in 2008, the household debt in Ireland the Netherlands and Portugal escalated severely and breaking the 100% of GDP in 2012. The household debt for Ireland rose from 52% of GDP in 2000 to 113% of GDP in 2012, the Netherlands recorded 87% of GDP in 2000 to 139% of GDP in 2012, while Portugal experienced household debt of 75% of GDP in 2000 to 102% of GDP in 2012. Besides from the data observation, the household debt has indirect linkage with current account balance via the fiscal policy. Eggertsson and Krugman (2012) indicate that there is a negative relationship between fiscal balance and household debt. Their argument is based on the fact that household may experience obstacles in deleveraging their debts when the government implement fiscal tightening in order to shrink the fiscal deficit. Fiscal contraction policy such as reducing public expenditure or increase taxation may contribute to reduction in the disposable income among the household. As a result, effort in deleveraging the household debt will be dampened. In the case of fiscal expansionary policy such as increase public expenditure or reduce taxation which lead to higher level of disposable income available among the household will provide them the opportunity to reduce their debts. Therefore, it will be

interesting to further investigate to what extent the household debt level may affect the Twin Deficits phenomenon in the European region.

### Trade openness

In this globalization era, countries are interconnected via the international trade activities that serve as an important growth source. Abbas et al. (2010) indicates that levels of trade openness may influence the fiscal balance and eventually the current account balance. In general, the association between current account deficit and fiscal deficit is stronger in the countries with higher level of trade openness in comparison to lower linkage between the two deficits in the countries with lower level of trade openness. In the standard Keynesian models, fiscal deficit may exhibit lesser impact on the current account deficit in the country that experience low level of trade openness or considered as closed economy. In contrast, the effect of the fiscal deficit on the current account deficit may intensify in the country that experience higher degree of trade openness. This is due most of the implication of the fiscal deficit (for example fiscal expansionary) tends to slip out on imported products. This eventually will worsen the current account deficit.

### Financial Development

Financial development also plays significant roles in contributing to the economic growth (Rajan and Zingales, 1998; Levine, 2005). Deeper financial development leads to increasing saving and investment level via efficiency of capital allocation, lowering cost of capital, diversification of risks, decreasing transaction cost, while increasing returns. Chinn and Ito (2007) argue that the effect of the financial development on saving and investment is ambiguous. In view of conventional argument, deeper

financial development may generate more savings in the countries and this implies positive relationship between level of financial development and savings. Notwithstanding, higher degree of financial development may discourage savings due to the weakening need for precautionary savings among the household. This implies that existence of inverse association between level of financial development and savings. Thus, the financial development threshold effect on the association between fiscal deficit and current account deficit may depends on the strength of the precautionary behavior among the households. If the precautionary behavior among the households is strong, then there is no evidence of Twin Deficits.

In a nutshell, the threshold effects serve as an essential aspect in understanding the behavior of the private sector and their interaction with the fiscal policy. This implies that the households may behave in a different way in view with the fiscal policy when a country is experiencing high or low level of public debt, household debt, trade openness and financial development such that they may save more or increase their consumption when the fiscal deficit worsen. Therefore, this study intends to investigate the Twin Deficits hypothesis by considering the threshold effects for Euro Area countries. Moreover, the implication of the household debt in affecting the Twin Deficits also being examined from the perspective of the threshold effects.

The remainder of the paper is structured as follows: In section 2.2, related literature reviews of the Twin Deficits hypothesis and interaction with the threshold effects are presented. In section 2.3, I present the estimation techniques and model specification adopted in this study. Empirical findings and discussion are shown in section 2.4 while conclusions in sections 2.5.

## 2.2. Literature Reviews

This section provides discussions on previous studies regarding the evidence of Twin Deficits and the interaction between the Twin Deficits with the threshold indicators. In terms of threshold effects, some studies such as Nickel and Vansteenkiste (2008), Abbas et al. (2010) and Forte and Magazzino (2013) conducted investigation directly on the Twin Deficits hypothesis and threshold indicator. On the other hand, several studies such as Perotti (1999) and Berben and Borsen (2007) aim at examining the sensitivity of the fiscal policy when considering the threshold effects for instance via the responsiveness of the fiscal multiplier.

There are several previous studies that investigated the Twin Deficits phenomenon in the 2000s. Chinn and Prasad (2003) perform a study on exploring the macroeconomic drivers of the current accounts from a medium-term perspective for 18 developed countries and 71 developing countries covering a period of 1971 to 1995. They adopted both cross-sectional analysis and panel data fixed effect methods in their study using 5 years non-overlapping averages of annual data in order to eliminate the business cycle fluctuations. Their findings indicate that there is evidence of Twin Deficits in the full sample with a magnitude around 0.31 percentage point of GDP. In addition, their empirical results from the panel data fixed effect indicate that the positive relationship between current account and fiscal balance can be observed in the developing countries. However, there is no empirical evidence of fiscal balance affecting the current account behavior in the developed countries.

Gruber and Kamin (2007) adopt the main approach used by Chinn and Prasad (2003) with a few modifications on the model specification and measurements of the variables.



They examine the Twin Deficits behavior for 61 countries from 1982 to 2003 using panel data fixed effect method. They use the standard drivers of the current account balance such as fiscal balance, net foreign assets, relative income, GDP growth and age dependencies, despite inclusion with level of financial development and the quality of the institutions in the model specification. Besides that, they also measure several of the drivers of the current account balance as the demean from the GDP weighted average from the sample. They discover that there is a positive association between current account balance and fiscal balance with magnitude around 0.11 percentage point of GDP. Comparatively, this coefficient is rather smaller than the result obtained from Chinn and Prasad (2003).

Lane and Milesi-Ferretti (2012) explore the trend of the current account adjustment for developed and emerging economies from 1969 to 2008 by emphasizing the financial crisis effect. They adopt similar approach to Gruber and Kamin (2007), where several drivers of the current account are expressed as difference to a weighted average. However, the only difference is instead of using GDP weighted average, they select difference from country  $i$ 's trading partner. Their findings show that there is positive relationship between current account balance and fiscal balance, where specifically with coefficient of 0.24 percentage point of GDP in the full sample, 0.27 percentage point of GDP for developed countries and 0.26 percentage point of GDP for emerging economies.

There are several essential aspects among this three papers that deserve supplementary discussion. First, panel data period fixed effect has been the choice adopted by the three studies instead to panel data country fixed effect. This is due to the omission of

important cross-country variation in the current account behavior based on panel data country fixed effect. Second, the weighted average measurement applied to most of the exogenous variables by Gruber and Kamin (2007) and Lane and Milesi-Ferretti (2012) enable to capture the real local effects relatively to global effects despite eliminating the common factors across countries in the sample.

Bagnai (2010) adopt the panel cointegration method to examine the linkage between current account balance and fiscal balance for Central and Eastern European Countries (CEEC) from 1995 to 2006. The empirical findings depict evidence of Twin Deficits behavior in the sample countries, but with marginal effect. Moreover, there is weak evidence of Twin Deficits in the peripheral countries such as Portugal, Ireland, Greece and Spain.

Brissimis et al. (2013) apply panel estimation approaches such as panel data fixed effects method, Seemingly Unrelated Regression (SUR) and Fully Modified Ordinary Least Squared (FMOLS) to examine the determinants of the current account in the 12 Euro area countries from 1980 to 2008. Their results indicate that fiscal balance is one of the important determinant of the current account. There is positive relationship between current account balance and fiscal balance where increase in 1 percentage point of GDP increase in fiscal balance will lead to current account improvement by around 0.20 to 0.29 percentage point of GDP.

The following section presents the previous studies that taking into consideration the threshold effects in investigating behavior of the Twin Deficits. Perotti (1999) examine the effect of the fiscal policy in 19 Organization for Economic Co-operation and

Development (OECD) countries from 1965 to 1994. The findings of the study denote that the expenditure shocks have a positive Keynesian effects in countries with low level fiscal deficit or public debt. This implies that existence of positive correlation between government expenditure and private consumption in normal period and negative linkage (non-Keynesian effects) in the bad period. Nevertheless, the similar effects are weak in the tax shock circumstance. The core of the argument is that the expectation among the private sector play important roles in their behavior upon the changes in the fiscal policy.

Berben and Borsen (2007) interested in studying the role of the public debt as factor affecting the level of private consumption for 17 OECD countries. They adopt the panel cointegration and pooled mean group estimator methods to investigate the non-linear association between private consumption and government debt for time period covering 1983 to 2003. Their findings reveal that the level of private consumption is less responsive to the variations in public debt level in the OECD countries that experiencing low level of debt with 55% of GDP as the benchmark. Notwithstanding, there is an inverse association between private consumption and public debt in the OECD countries with high level of public debt with 75% of GDP as the turning point. For instance, fiscal expansionary that may increase the level of public debt may lead to the deterioration in the level of private consumption.

Nickel and Vansteenkiste (2008) perform a study to examine the relationship between current account deficit and fiscal deficit for 22 industrialized countries from 1981 to 2005. They adopt the dynamic panel threshold and select the public debt to GDP ratio as the threshold variable. Their findings indicate that Twin Deficits behavior can be

observed in the countries with public debt to GDP ratio below 90% level. Intuitively, higher (lower) fiscal deficit will contribute to the higher (lower) current account deficit. Notwithstanding, the linkage between current account deficit and fiscal deficit become insignificant for countries that experience public debt to GDP ratio exceeding the 90% level. This implies that Ricardian equivalence behavior among the household in the high public debt countries. In addition, they also discover that the public debt threshold for 11 Euro area countries is 80% of GDP ratio threshold where no evidence of Twin Deficit behavior beyond that level. There is evidence of positive association between current account deficit and fiscal deficit with magnitude of 0.36 when public debt is below 54% of GDP ratio, 0.14 when public debt is between 54% - 80% of GDP ratio and become insignificant when exceeding the 80% to GDP ratio.

Abbas et al. (2010) conduct study on the relationship between current account balance and fiscal policy for 124 countries from 1985 to 2007 using panel regression and panel vector autoregressive (VAR) methods. Their findings indicate evidence of Twin Deficits in the sample countries with improvement in current account balance around 0.2 to 0.3 percentage point of GDP upon 1 percentage point of GDP increase in the fiscal balance. Their study also include analyzing the behavior of the Twin Deficits when splitting the sample countries into several classifications. The relationship between current account balance and fiscal balance is stronger in emerging and developing countries compared to advanced countries with 0.31 against 0.24. In terms of output gap, countries that exhibit output level above their potential output level indicate higher degree of association between current account balance and fiscal balance with 0.46 in relative to 0.26 for countries that exhibit output level below their potential output level. They also take into consideration the trade openness aspect by

splitting the sample countries into either high or low level of trade openness, which is based on the median values. Their results denote that stronger relationship between current account balance and fiscal balance can be observed in the countries that experience higher degree of trade openness with magnitude of 0.32 percentage point of GDP, compared to countries with lower degree of trade openness with magnitude of 0.22 percentage point of GDP on current account balance.

Forte and Magazzino (2013) investigate the interaction between current account deficit and fiscal deficit for a sample countries covering 33 European countries from 1970 to 2010. They use the Generalized Method of Moments (GMM) dynamic panel approach and select fiscal deficit of 2% of GDP as the threshold based on the Stability Growth Path (SGP) after taking into account the inflation effect. The countries are categorized into high fiscal deficit countries group where the fiscal deficit is greater than 2% of GDP and low fiscal deficit countries group for the countries with fiscal deficit less than 2% of GDP. Their results indicate significant positive relationship between current account deficit and fiscal deficit in high fiscal deficit countries.

Kueh (2015) examines the Twin Deficits phenomenon by taking into consideration the threshold effects (fiscal deficit, public debt and household debt) exogenously for 28 European countries from 1981 to 2012. The study adopts panel regression fixed effects and to investigate the implication of the fiscal deficit and household debt on the current account deficit. The estimations are based on countries classification of either above or below the exogenous threshold indicators. The threshold levels for the fiscal deficit are -3% of GDP and 60% of GDP for public debt where both thresholds levels are based on the benchmark stated in the Stability Growth Path (SGP). Meanwhile, the threshold

level for the household debt is 73% of GDP and is based on the 75<sup>th</sup> percentile of the sample. The empirical results on the threshold effects indicate that evidence of the Twin Deficits is only observed in the countries below the fiscal deficit threshold, public debt threshold and household debt threshold. There is an insignificant relationship between the fiscal deficit and current account deficit in the countries with high fiscal deficit, public debt and household debt.

## **2.3. Methodology and Estimation Strategy**

### **2.3.1. Data and Estimation Approach**

This study intends to investigate the Twin Deficits hypothesis of eleven Euro Area countries from the threshold perspective from 2000 to 2012. All the data are annual obtained from several sources such as Eurostat, World Development Indicator of World Bank and Lane and Milesi-Ferretti database. The selection of sample countries is based on the availability of the data due to the requirement of the threshold regression method, which is a balanced panel. Thus, the period considered is shorter than in Kueh (2015). Analyzing the Twin Deficits phenomenon from the perspective of endogenous threshold is important due to the fact that the results may reflect the contemporary behavior of the parameters of interest. In contrast to exogenous threshold, the results may be bounded by the restriction of the pre-determined or chosen threshold level. Thus, the dissimilarity response from the countries can be observed in a more holistic manner by choosing the threshold endogenously.

Table 2.1 indicates the descriptive statistic regarding the parameters of interest in the model from 2000 to 2012 based on the classification of the 11 Euro Area countries as full sample countries, 5 peripheral Euro Area countries and 6 non-peripheral Euro Area

countries. In terms of the 11 Euro Area countries, the mean of the current account deficit and fiscal deficit stood at -0.75% of GDP and -3.01% of GDP, respectively. Meanwhile, the means of the threshold variables are 73.25% of GDP for public debt, 68.19% of GDP for household debt, 92.25% of GDP for trade openness and 120.53% of GDP for financial development variable. Considering the SGP benchmark of -3% of GDP for fiscal deficit and 60% of GDP for public debt, the fiscal deficits of the Euro Area countries are at the SGP's threshold while the public debts are higher than the threshold in the sample period 2000 to 2012. The classification of the Euro Area countries into two main groups provides interesting outcomes regarding the performance of the macroeconomic indicators. It is obvious that the current account deficits and fiscal deficits for the 5 peripheral Euro Area countries are higher compared to the 6 non-peripheral Euro Area countries with -5.18% of GDP versus surplus of 2.94% of GDP for current account and -4.76% of GDP versus -1.54% of GDP for fiscal deficits. In terms of the threshold variables, the 5 peripheral Euro Area countries exhibit higher level compared the 6 non-peripheral Euro Area countries in the public debt, gross household debt and financial development variable, except for the trade openness.

This section provides discussion on the estimation strategy and model specification adopted in this study. Threshold models have been developed in depth by researchers such as Tong (1990), Chan (1993), Hansen (1996; 1999; 2000) and Caner (2002). This study adopts the threshold regression by Hansen (2000) where one of the advantage of the approach is the inferences feature. Hansen is the pioneer in examining the likelihood ratio tests for the threshold variable. The threshold variable is used to divide the sample into two regimes.

The general structural equation is as followed:

$$y_i = \omega'_1 x_i + e_i, \quad q_i \leq \gamma \quad (2.1)$$

$$y_i = \omega'_2 x_i + e_i, \quad q_i > \gamma \quad (2.2)$$

Equation (2.1) and (2.2) can be written in the form as shown below:

$$y_i = \omega'_2 x_i 1(q_i \leq \gamma) + \omega'_1 x_i 1(q_i > \gamma) + e_i \quad (2.3)$$

where  $y_i$  is the dependent variable,  $x_i$  is the set of independent variables,  $q_i$  refers to the threshold variable,  $1(\cdot)$  is the function of  $q(x_i)$  and have a continuous distribution,  $\gamma$  denotes threshold level,  $\omega'_1$  refers to coefficients of parameter interest if threshold variable below the estimated threshold level and  $\omega'_2$  is the coefficients of parameter interest if threshold variable above the estimated threshold level.

The parameters of interest in this study are the interaction between the current account balance (as the dependent variable) and the fiscal balance (as the independent variable). In order to capture the Twin Deficits behaviors in the view of threshold effects, the condition is the existence of the significant positive association between the fiscal balance and the current account balance for the observations (countries) that are either above or below the threshold level. Hence, the estimation of the coefficients can be obtained simultaneously for both samples above and below the threshold.

In general, there are two components that need to be performed in this threshold regression analysis. First, to test the significance of the existence of the threshold. Initially, one of the potential threshold indicators is chosen and analyzed with the parameters of interest using the least squares estimator for all possible threshold values.



Then, the estimated threshold value is obtained by choosing the one that minimizes the sum of squares residuals. Second, the estimation of the threshold regression is attained via bootstrapping method. The estimation coefficients of the parameters of interest are obtained based on the sample splitting or regimes (above the regime or below the regime).

### **2.3.2. Model Specification**

The model description of the Twin Deficits hypothesis is established based on the threshold regression model as shown in Equation (2.3). I follow closely the model specification from Chinn and Prasad (2003), Gruber and Kamin (2007), Lane and Milesi-Ferretti (2012) and Kueh (2015) in selection of the fundamental drivers of the current account balance. This is due to the features of the designated standard drivers of current account balance that reflect intertemporal behaviors. For instance the convergence or catching-up among the countries captured by the relative income variable and behaviors of savings and investment among the young and old generation as proxy by the age dependencies. The parameters of interest are the current account balance expressed as the ratio to GDP as the dependent variable and fiscal balance expressed as the ratio to GDP as the independent variable. In addition, several control variables are included in the model such as initial net foreign assets, relative income per capita, GDP growth, age dependencies (young and old), investment and gross household debt. The threshold variables used are the public debt, household debt, fiscal balance, trade openness and financial development. These threshold variables are chosen as to mirror the current trend in the European region and also the consequences of the global financial crisis in 2008. The public debt, household debt and fiscal balance are expressed as percentage of GDP. Trade openness is defined as sum of exports and

imports and expressed as percentage of GDP. The private credit expressed as percentage of GDP is used as proxy for financial development.

One of the important point in the estimation strategy is the measurement of all the parameters of interests. All the variables (dependent and independent variables) are measured as the deviation from their respective GDP weighted average. The main purpose is to eliminate the common factors across the countries while capturing the local effects, instead of merely global effects. Furthermore, this may serve as an approach alike panel data fixed effects via omitting the mutual factors across the countries, but adapt it into the sample-splitting method and estimate through the threshold regression. The specific model specification is as shown in Equation (2.4).

$$CABGDP_i = \alpha X_i + \begin{cases} \beta_1 FBGDP_i + e_i & , \quad q_i \leq \gamma \\ \beta_2 FBGDP_i + e_i & , \quad q_i > \gamma \end{cases} \quad (2.4)$$

where  $CABGDP$  refers to the current account balance as percentage of GDP over the period of 2000-2012,  $FBGDP$  is the fiscal balance as percentage of GDP,  $X$  represents the vector of control variables such as initial net foreign assets, relative GDP per capita, GDP growth and age dependencies despite inclusion of the investment as percentage of GDP and gross household debt as percentage of GDP.  $e_i$  is the error term,  $q_i$  is the threshold variable while  $\gamma$  refers to the threshold level. The threshold variables such as public debt, household debt, fiscal balance, trade openness and financial openness are used in the model as the sample-splitting variables or the threshold level. The implication of the fiscal balance on the current account balance, which is the parameter of interest in this study, can be examined in two different values or regimes. This means that the behavior of the Twin Deficits whether the public debt, household debt, openness or financial openness is larger or smaller than the threshold level,  $\gamma$ . Thus, the

impact of the fiscal balance on the current account is captured in the coefficients of  $\beta_1$  for countries in low regime  $\beta_2$  for countries in high regime.

Based on the strategy by Hansen (2000), there are two elements that need to be implemented in order to investigate the Twin Deficits behavior of the eleven Euro Area countries. First, identifying the threshold level by performing a series of least square minimization and estimate Equation (2.4) based on all the possible values of  $q_i$ . Subsequently, the threshold level  $\gamma$  is determined based on the criteria that the one minimizes the sum of squares residuals. Second, the evidence of threshold effect is tested prior to estimating the implication of the parameters of interest, where heteroskedasticity-consistent Lagrange multiplier test is adopted to test the significance of the threshold level,  $\gamma$ . Since the threshold level,  $\gamma$  is not identified under the null hypothesis of no threshold effect as indicated by Davies (1977; 1987), bootstrap method is adopted for inferences purpose via simulation. The properties and validity of the bootstrapping approach have been proven by Hansen (1996) where he generates asymptotically correct  $p$ -values. Thus, the asymptotic null distribution of the heteroskedasticity adjusted test statistic is adopted to test for the significance of the threshold as shown in Appendix 2.1.

## **2.4. Results and Discussions**

### **2.4.1. Threshold Test and Threshold Estimates Results**

The results of the likelihood ratio test are presented in Figure 2.1 (public debt threshold), Figure 2.2 (household debt threshold), Figure 2.3 (fiscal balance threshold), Figure 2.4 (trade openness threshold) and Figure 2.5 (financial development threshold). The likelihood ratio test is alternative options for inferences purposes. In other words, it

determines the coefficients of the parameters of interest which maximizing the values of the likelihood function and thus have the ability to conjecture the distribution of the whole sample. Figure 2.1 depicts the graph of normalized likelihood ratio sequence  $LR_n^*(\gamma)$  as a function of the threshold. The least squares estimate of the threshold is the value that minimizes the graph at public debt level of 55.59% of GDP where  $LR_n^*(\gamma)$  crosses the dotted line. Similarly, the normalized likelihood ratio sequence crosses the dotted line and minimizes the graph at household debt of 73.96% of GDP in Figure 2.2, fiscal deficit of -1.84% of GDP in Figure 2.3, trade openness of 78.01% of GDP in Figure 2.4 and financial development of 125.99% of GDP in Figure 2.5.

There is evidence of threshold effect, the estimated thresholds can be obtained as shown in Table 2.2. The test for thresholds and thresholds estimates are presented in Table 2.2 for thresholds indicators, namely public debt, household debt, fiscal balance, trade openness and financial development. Based on the LM-test, there is strong evidence showing existence of threshold effects where the bootstrap  $p$ -values are significant for public debt, household debt and fiscal balance. The number of bootstrap replications is 5,000 with 15% trimming. In terms of the public debt, the estimated threshold is 55.59% of GDP with 95% confidence interval within 53.34% to 62.31% of GDP. The threshold estimate of the household debt is 73.96% of GDP with 95% confidence interval within 73.96% to 87.65% of GDP, while the threshold estimate for the fiscal deficit is -1.84% of GDP within the confidence interval of -2.67% to -0.99% of GDP. The gap of the asymptotic 95% confidence interval is small and thus implies minimal uncertainty of the distributions. Meanwhile, the estimated threshold for trade openness is 78.01% of GDP and the threshold estimate for the financial development is 125.99% of GDP.

Intuitively, the public debt threshold of 55.59% of GDP indicates that the non-linear effect can be observed when the public debt of the country breach the threshold level. This threshold is based on the 11 eleven Euro Area countries within the sample period of 2000 to 2012. It is rather low compared to the average public debt level of 73.25% of GDP in the sample as shown in Table 2.1. Besides that, the public debt threshold of 55.59% of GDP is comparably lower than the public debt threshold of 80% of GDP (high debt level) but closer to the 54% of GDP (low debt level) as obtained by Nickel and Vansteenkiste (2008). The possible reasons for the inconsistency threshold level may be due to the sample period and econometric approach adopted. The sample period used in the study by Nickel and Vansteenkiste (2008) range from 1981 to 2005 without taking into account the implications of the global financial crisis in 2008. They adopt the dynamic panel threshold method for their estimation with the aim to overcome the possibility of endogeneity problem. Nevertheless, the public debt threshold obtained from this study is viewed as more reflective of the current development in the European region with the sample period covering from 2000 to 2012. In terms of the econometric approach, this study adopts the sample splitting method while measuring all the variables as difference from the GDP weighted average. Thus, this may reduce the effect of the possibility of endogeneity problem. As for the other threshold variables, it is incomparable since there are still lack of studies venturing into the endogenous threshold effect for household debt, fiscal deficit, trade openness and financial development threshold.

#### **2.4.2. Threshold Estimates: Country and Year Specific Distribution**

Table 2.3A shows the percentage of countries that lie in each regime according to the year and based on average values of the public debt. It is obvious that majority of the

eleven Euro Area countries experience high level of public debt from 2000 to 2012 with around more than 64% of the sample countries against around 36% of the sample countries. The implications of the global financial crisis in 2008 had cause more countries in the sample to move into high public debt regime. Table 2.3B depicts the percentage of year in each regime by countries perspective from 2000 to 2012. Based on the public debt threshold of 55.59% of GDP, Finland, Ireland, the Netherlands and Spain experience low public debt. This means that majority of the Euro Area countries experience high level of public debt from 2000 to 2012.

The classification based on the countries in each regime by year for household debt is presented in Table 2.3C. Most of the household debt level of the countries in the Euro Area are categorized below the 73.96% of GDP threshold from 2000 to 2012. The trajectory of the household debt level provides interesting point where the number of countries fall into the above regime are intensifying since 2004. In view of the percentage of year in each regime by countries perspective as shown in Table 2.3D, similarly most of the countries in the sample experience low level of household debt. Only three countries such as Ireland, the Netherlands, Portugal and Spain have average household debt level beyond the threshold during the sample period.

Table 2.3E indicates the average fiscal deficit based on countries in each regime by year with -1.84% of GDP as threshold level. The below regime of fiscal deficit denotes large fiscal deficit or worsening fiscal deficit while the above regime refers to the fiscal surplus or improvement in the fiscal deficit. Most of the Euro Area during the sample period 2000 to 2012 exhibit fiscal deficits below the threshold in most of the year while fiscal surpluses are less. In addition, all the countries in the region experienced large

fiscal deficit during the global financial crisis period (2009-2010) with the highest average fiscal deficit of -8.45% of GDP in 2010. Looking from the country specific as shown in Table 2.3F, several countries namely Austria, France, Greece, Italy and Portugal experienced large fiscal deficits as their average fiscal deficit fall into the below regime with none observations above the threshold regime for Greece and Portugal.

In term of the trade openness with 78.01% as the threshold level, Table 2.3G shows the countries classification based on average trade openness by year. In the below regime of trade openness threshold, most of the countries experienced trade openness level below the threshold from 2000 to 2004 where the percentage of countries in the regime stood around 63.64%. However, the trend of the trade openness level in the sample countries becomes ambiguous due to mixture of countries experienced trade openness level either above or below the threshold. Table 2.3H indicates the average trade openness based on countries classification. Countries such as Austria, Belgium, Finland, Germany, Ireland and the Netherlands have level of trade openness above the threshold from 2000 to 2012. In contrast, France, Greece, Italy, Portugal and Spain exhibit trade openness below the threshold in same period.

Table 2.3I presents the percentage of countries in each regime by year with 125.99% of GDP as the financial development threshold from 2000 to 2012. The below regime denotes less in depth level of financial development and the above regime indicates deeper level of financial development. The degree of financial development in the Euro Area countries exhibit an upward trend or progressing to higher level. This can be seen from the descending percentage of countries in the below regime from 81.82% in 2000

to 63.64% in 2012 while the percentage of countries in the above threshold regime is increasing. In view of country specific classification as shown in Table 2.3J, majority of the countries in the region experience high degree of financial development such as Ireland, the Netherlands, Portugal and Spain with percentage of distribution more than 50%. Meanwhile, Austria, Belgium, Finland, France, Germany, Greece Ireland and Italy exhibit level of financial development below the threshold with percentage of distribution more than 50%.

### **2.4.3. Threshold Regression Results**

Since the main focus of this study is on the Twin Deficits hypothesis, the following discussions are based on the interaction between the fiscal balance and current account balance using the different threshold indicators. This is essential as different behaviors can be observed in the countries that are below or above the threshold regimes. The threshold regression of the parameters of interest are presented in Table 2.4 and Table 2.5. There are two regimes for each threshold indicator. The below threshold denotes results for observations below the threshold level while the above threshold indicate results for observations exceeding the threshold level. Specifically, Table 2.4 indicates the empirical threshold regression for the public debt, household debt and fiscal deficit thresholds. As the baseline results that is without the threshold effect, there is significant positive relationship between fiscal balance and current account balance with magnitude around 0.43. This means that increase (decrease) of 1 percentage point of GDP in fiscal balance leads to increase (decrease) of the current account balance by 0.43 percentage point of GDP. The association between the investment and current account deficit indicate expected significant negative coefficient of -0.98 while there is a significant positive relationship between the gross household debt and current account



deficit with coefficient of 0.03. The results based on the threshold effects provide more insight on the behavior of the Twin Deficits.

The endogenous public debt threshold is 55.59% of GDP where the mean of the public debt is 73.25% of GDP. There is a significant positive association between fiscal balance and current account balance in both below and above the public debt threshold regimes of 55.59% of GDP. The coefficient of the interaction between fiscal balance and current account balance is around 0.74 for countries below the threshold level while around 0.23 for countries above the threshold level. Thus, the effect of the fiscal balance on current account balance is relatively greater for the countries below the threshold level. Intuitively, the results show that fiscal policy is considered more responsive in the countries with lower levels of public debt (below 56% of GDP) where evidence of the Keynesian behavior can be observed. For instance in the case of fiscal expansionary policy via increase in the public expenditure, private sector may also increase their consumption level and eventually lead to expansion of the current account deficit. The results for the strong evidence of Twin Deficits in the countries below the threshold are in line with studies such as Perotti (1999), Berben and Brosens (2007) and Nickel and Vansteenkiste (2008). In term of the public debt threshold, the estimated threshold in this study is around 56% of GDP compared to 80% of GDP threshold obtained in study by Nickel and Vansteenkiste (2008). The factors that contribute to the dissimilar threshold may be the sample period used where they examine a longer time span from 1981 to 2005, but prior to the global financial crisis in 2008. Although this study investigates a shorter time span from 2000 to 2012, however the inclusion of the major crisis period that severely affects the European region provide more contemporary findings. The interaction between the investment and current account deficit indicates

a significant negative coefficients in both regimes and gross household debt only has significant implication on current account deficit in countries above the threshold level with coefficient of 0.03.

In terms of the household debt threshold, the threshold is 73.96% of GDP with mean household debt in the sample of 68.19% of GDP. There is evidence of Twin Deficits in the countries below the threshold regime. The coefficient of the relationship between fiscal balance and current account balance is around 0.47. This implies that decrease (increase) in the fiscal balance by 1 percentage point of GDP may cause the current account balance to reduce (rise) by 0.47 percentage point of GDP. Intuitively, Keynesian behavior can be observed among the households where positive interaction between public and private consumption in the countries with low level of household debt at 73.96% of GDP threshold. This threshold level is close to the 73% of GDP threshold used by Kueh (2015), which is based on the exogenous threshold approach. This is due to the fact that changes in fiscal policy may affect the households' debt deleveraging efforts as in Eggertsson and Krugman (2012). In the case of lower taxation by the government with the aim to stimulate aggregate demand, this indirectly means households have higher level of disposable income and thus there is tendency for them to deleverage their debts. Similarly to the public debt threshold effect, there is no evidence of Twin Deficits in the above regime or countries with household debt above the 74% of GDP threshold level. This signifies that Ricardian Equivalence behavior can be perceived in the private sector. When the governments intend generate the aggregate demand via the fiscal stimulus by increasing the level of the public expenditure, private sector may react in the opposite direction instead. They may not increase their consumption level but instead pay off debt. Meanwhile, there is significant inverse

relationship between investment and current account deficit in the countries above and below the threshold level. Nevertheless, the inverse effect of the gross household debt on the current account deficit only can be observed in the countries above the household debt threshold with coefficient of -0.09.

The empirical results for the fiscal deficit threshold indicate that there is a significant positive association between fiscal balance and current account balance for both regimes, with coefficients of 0.18 and 0.47. This implies that the evidence of the Twin Deficits can be observed for the countries with fiscal deficit below -1.84% of GDP and above the threshold where the mean of the fiscal deficit is -3.01% of GDP. However, the effect of the fiscal balance on the current account balance is more responsive in the countries above the threshold level. This result is partly corresponding to Forte and Magazzino (2013) as they discover evidence of Twin Deficits only in high fiscal deficit countries. The investment variable has significant negative impact on the current account deficit in both regimes while gross household debt only has positive impact on the current account deficit in countries below the fiscal deficit threshold with coefficient of 0.05.

Table 2.5 presents the empirical threshold regression results for trade openness and financial development thresholds. In terms of the trade openness threshold, the results indicate that positive interaction between fiscal balance and current account balance in both regimes, but those countries with higher level of trade openness exhibit greater response on the interaction between fiscal balance and current account balance. The coefficient of the significant positive relationship between fiscal balance and current account balance in the countries below the trade openness of 78.01% of GDP threshold

is around 0.41 where changes in the fiscal balance by 1 percentage point of GDP leads to changes of current account balance by 0.41 percentage point of GDP. Similarly, the positive relationship between fiscal balance and current account balance can be seen in the countries above the trade openness threshold with relatively lower coefficient of around 0.28. Thus, this study indicates that there is stronger evidence of Twin Deficits in the countries below the trade openness threshold. Thus fiscal policy has more effect on current account in less open economies compared to in more open economies where imported goods tends to absorb the effects of the fiscal policy implementation in the more open economies. This outcome is similar to the study by Abbas et al. (2010) where linkage between fiscal deficit and current account deficit appears to be stronger in the countries that experience lower level of trade openness. Meanwhile there is an inverse relationship between the investment and the current account deficit in countries above and below the trade openness threshold. However, gross household debt only has impact on the current account deficit in the countries above the threshold level with coefficient of 0.07.

In view of the financial development threshold, there is evidence of a significant positive relationship between fiscal balance and current account balance in the countries with less developed financial market. The coefficient of the interaction between the two variables is around 0.47 where for instance, increase in the fiscal balance by 1 percentage point of GDP will lead to increase in the current account balance by 0.47 percentage point of GDP. This indicates that countries with less developed financial market (below the 126% of GDP threshold) have potential to liberalize their domestic financial market and thus generate more savings. Nevertheless, the results in the above regime provide contradictory view on the Twin Deficits behavior. There is an

insignificant negative relationship between fiscal balance and current account balance in the countries with financial development level above the 126% of GDP threshold. The main argument is that the precautionary motives for savings among the household is rather fragile in the countries with high level of financial development and thus dampen the savings level. These results are consistent with the studies by Chinn and Ito (2007) where deeper financial development may contribute to either stimulating the savings volume due to efficient capital allocation or discouraging savings due to fading need for precautionary savings. The investment variable has inverse relationship with the current account deficit in both regimes but there is no significant relationship between the gross household debt and current account deficit in either above or below the threshold level.

Overall, there is a significant positive interaction between current account deficit and fiscal deficit or more responsive of fiscal deficit on current account deficit in the countries below the public debt threshold, countries below the household debt threshold, countries above the fiscal deficit threshold, countries below the trade openness threshold and countries below the financial development threshold. This also means that the influence of fiscal policy on household saving behaviors is stronger in those countries, which eventually may affect the current account balance. Conversely, there is no evidence of Twin Deficits or less responsive of fiscal deficit on current account deficit in the countries above the high public debt threshold, countries above the household debt threshold, countries below the fiscal deficit threshold, countries above the trade openness threshold and countries below the financial development threshold. Thus, the households in those countries may exhibit more Ricardian Equivalence

behavior where households increase their saving in response to fiscal policy. This eventually leads to no significant impact on the current account balance.

#### **2.4.4. Classification of Countries Based on Threshold Levels**

Table 2.6 shows the classification of the eleven Euro area countries based on the threshold levels. The purpose of this classification is to provide better understanding regarding the individual country that exhibit the public debt, household debt, fiscal deficit, trade openness and financial development either above or below their respective threshold levels. Besides that, it is also important to identify existence of common trend in the countries, for instance country with public debt below the threshold level also exhibits fiscal deficit below the threshold level. Based on the thresholds classification, there is a common trend can be observed particularly in countries such as Austria, Belgium, France, Germany, Greece and Italy. Although these countries exhibit public debt above the threshold level, however, they also experience household debt and financial development below the threshold levels. Meanwhile, these group of countries excluding France, Greece and Italy experience fiscal deficit and trade openness above the threshold levels. There is also certain pattern can be observed when narrowing down to the periphery countries such as Greece, Ireland, Italy, Portugal and Spain. For instance, Greece and Italy exhibit public debt above the threshold level, but their household debt, fiscal deficit, trade openness and financial development are below the threshold levels. Meanwhile, Ireland and Spain show common trend with public debt below the threshold level, but household debt, fiscal deficit and financial development above the threshold levels. Portugal experience public debt, household debt and financial development above the threshold levels, nonetheless experience fiscal deficit and trade openness below the threshold levels.

With regards to the linkage between the fiscal deficit and current account deficit or evidence of Twin Deficits and the effect of the household debt towards the Twin Deficits phenomenon, the interpretation is also shown in Table 6. There is a strong evidence of Twin Deficits in the countries below the public debt threshold, household debt threshold and trade openness threshold as well as above the fiscal deficit threshold. Simultaneously, there is no significant association between gross household debt and current account deficit in those countries. This indicates that in the countries where existence of strong linkage between fiscal deficit and current account deficit, the gross household debt does not have any impact on the current account deficit. The evidence of Twin Deficit appears to be less strong in the countries above the public debt threshold and trade openness threshold as well as below the fiscal deficit threshold. However, there is significant relationship between the gross household debt and current account deficit in those countries. This shows that countries with relatively weak evidence of Twin Deficits may correspond with significant impact of the gross household debt on the current account deficit. This indirectly indicates that the influence of the household debt on the current account deficit may mitigate the relationship between the fiscal deficit and current account deficit.

Meanwhile, there is no significant linkage between the fiscal deficit and current account deficit in the countries above the household debt threshold level and financial development threshold level. Nevertheless, there is an inverse association between the gross household debt and current account deficit in the countries above the household debt threshold level but insignificant relationship in the countries above the financial development threshold level. This implies that although there is no evidence of Twin

Deficits in the countries above the household debt threshold level, the gross household debt may absorb the effect, such that increase (decrease) in the gross household debt may lead to increase (decrease) in the current account deficit, alike the behavior of the Twin Deficits. Although, there is support for Twin Deficits phenomenon in the countries below the financial development threshold level, however, there is no significant impact of gross household debt on the current account deficit.

Table 2.7 depicts the percentage of countries based on the thresholds classification as to show the general view on the common trait in the sample countries. One of the findings indicate that countries with public debt above the threshold level also exhibit fiscal deficit above the threshold level. The percentage of the countries in those regimes are 64%. This may prove to be valid since both variable are interrelated as fiscal deficit reflects net balance public sector yearly while public debt refers to the accumulation of the debt generated from the fiscal deficit. On the other hand, most of the countries in the sample also experience household debt and financial development below the threshold levels with percentage of countries in those regimes at 64%. Although those countries have level of financial development below the threshold level of 126% of GDP, however, they are considered as developed domestic financial market since over the 100% of GDP level. This may serve as channel to the households in easing the borrowing and lending purposes and may contribute the household debt, which is considered below the threshold level of around 74% of GDP. The percentage of countries in the above or below threshold for trade openness are almost equivalent.

The conclusion from the previous section indicate that strong evidence of Twin Deficits phenomenon can be observed in the countries with public debt, household debt, fiscal



deficit, trade openness and financial development below their respective threshold levels. However, the interpretation becomes interesting when considering the results from the respective individual countries as shown in Table 2.6 and Table 2.7. Therefore, the Twin Deficits behavior is dynamic depending on how the perception of the households towards the level of public debt, fiscal deficit, their household debt level, degree of trade openness and financial development. The important element in this threshold effects is the determination of the threshold level, which can serve as a guideline to the policy makers regarding the responsiveness of the households towards the fiscal policy and eventually affecting the current account deficit.

## **2.5. Conclusion**

This study has examined the relationship between the current account deficit and the fiscal deficit across endogenous thresholds for a number of indicators, namely public debt, household debt, fiscal deficit, trade openness and financial development. I use Hansen's (2000) threshold regression approach that is based on the sample splitting method to capture the behavior of the Twin Deficits phenomenon above or below the specific threshold variable.

In general, there is strong evidence of Twin Deficits phenomenon in the countries below the public debt threshold, household debt threshold, trade openness threshold and financial development threshold in addition to countries above the fiscal deficit threshold. This implies that non-Ricardian behavior can be observed in those countries where increase (decrease) of the fiscal deficit may lead to increase (decrease) of the current account deficit. On the other hand, there is no evidence of Twin Deficits in the countries above the public debt threshold, household debt threshold and trade openness

threshold or countries below the fiscal deficit threshold and financial development threshold. The findings at the individual countries indicate that there is a common trait in certain group of countries. Thus, evidence of the Twin Deficits is dynamic and rely on the perception of the households on the level of the threshold indicators. Nevertheless, endogenous threshold levels obtained in this study may provide essential guideline for the policy makers in managing their current account deficit via the fiscal policy.

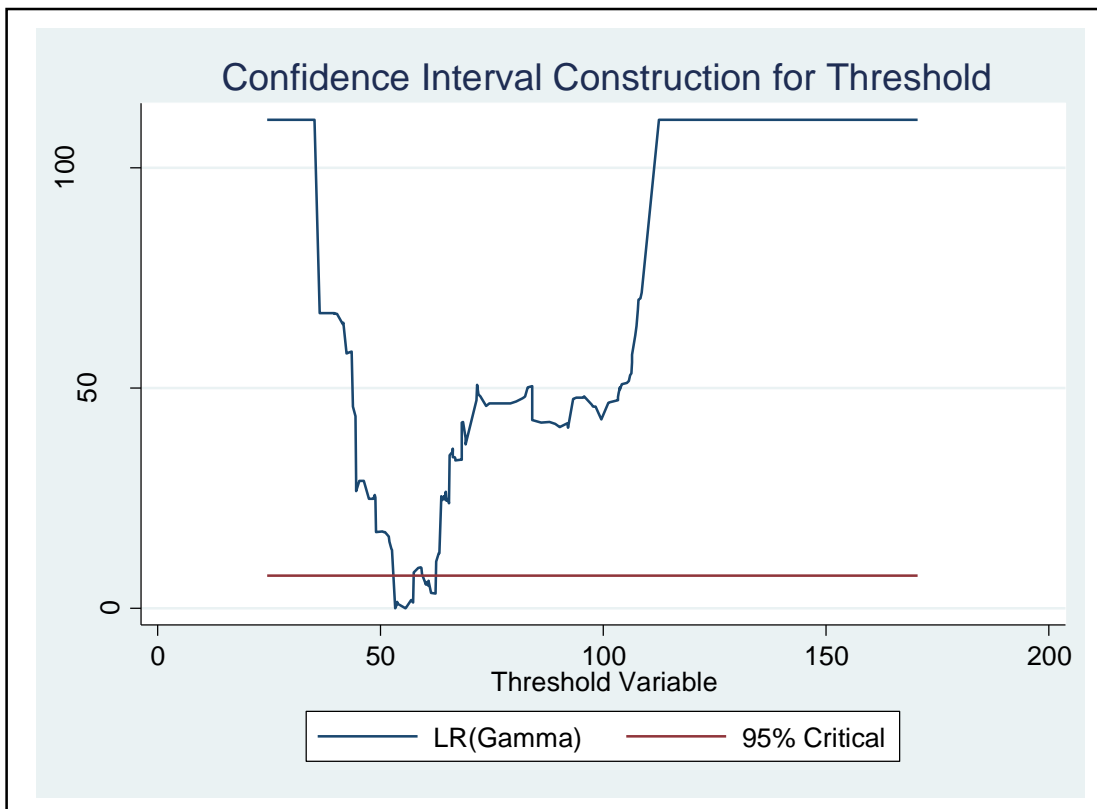
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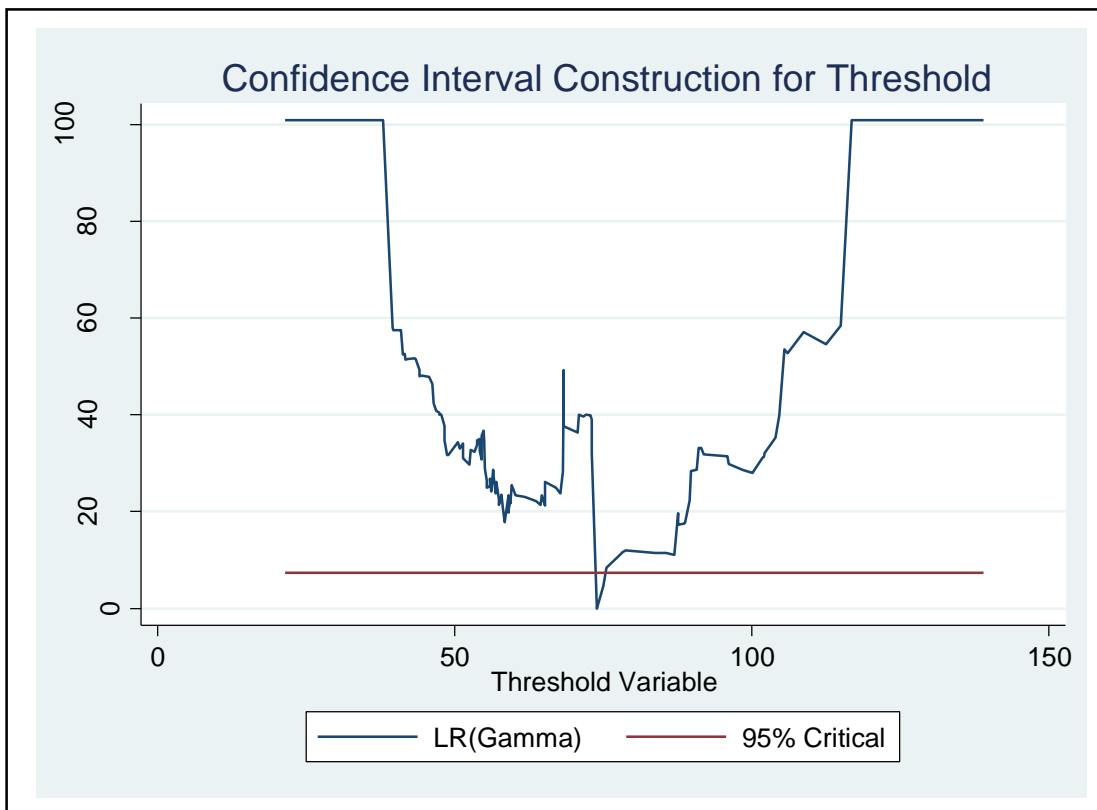
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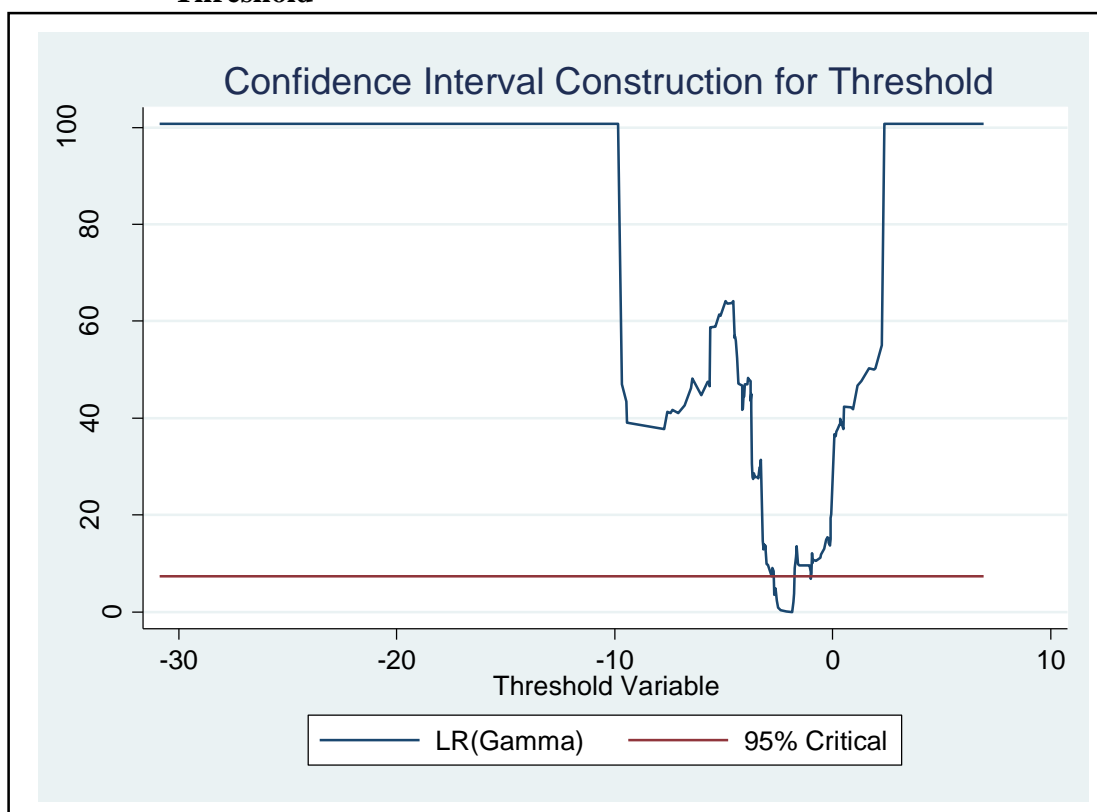
**Figure 2.1: Sample Split - Confidence Interval Construction for Public Debt Threshold**



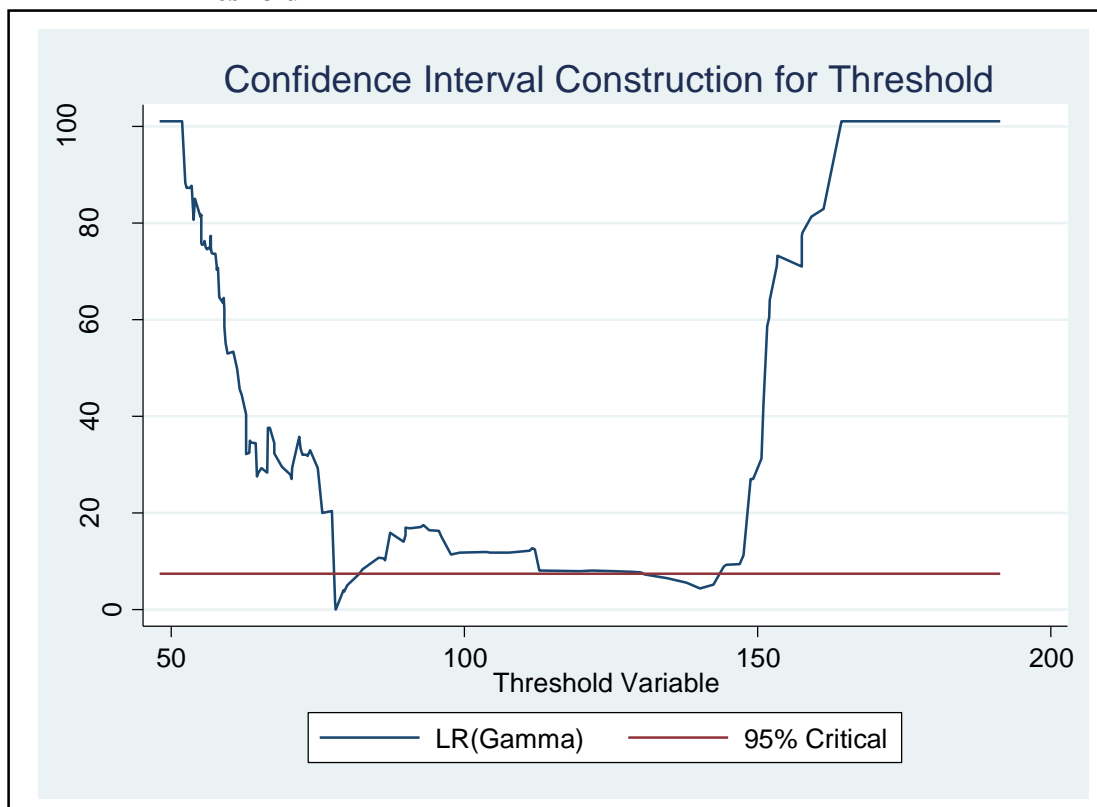
**Figure 2.2: Sample Split - Confidence Interval Construction for Household Debt Threshold**



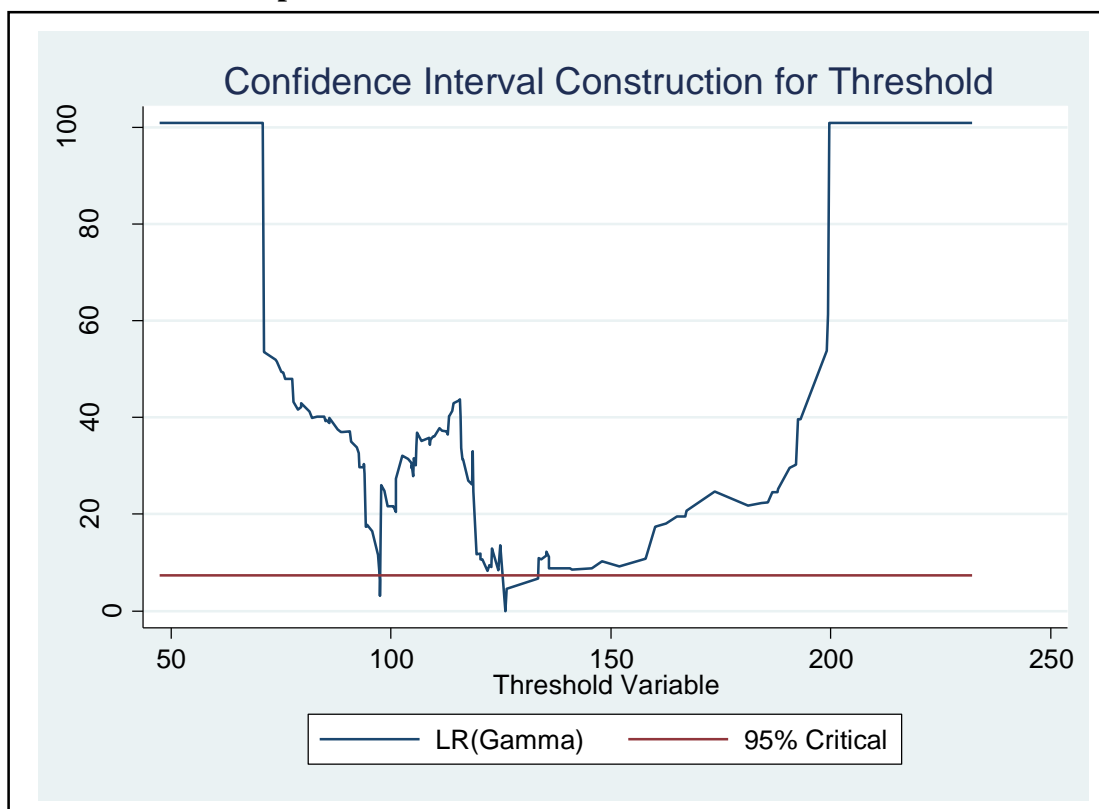
**Figure 2.3: Sample Split - Confidence Interval Construction for Fiscal Deficit Threshold**



**Figure 2.4: Sample Split - Confidence Interval Construction for Trade Openness Threshold**



**Figure 2.5: Sample Split - Confidence Interval Construction for Financial Development Threshold**





**Table 2.1: Descriptive Statistics**

Parameters of Interest	11 Euro Area Countries				5 Peripheral Euro Area Countries				6 Non-Peripheral Euro Area Countries			
	Mean	Median	Maximum	Minimum	Mean	Median	Maximum	Minimum	Mean	Median	Maximum	Minimum
Current Account Balance	-0.75	-0.49	9.741	-14.92	-5.18	-4.48	4.95	-14.92	2.94	2.64	9.74	-2.41
Fiscal Balance	-3.01	-3.07	6.94	-30.864	-4.76	-3.75	4.69	-30.86	-1.54	-1.75	6.94	-7.56
Net Foreign Assets	-24.80	-18.74	61.29	-165.53	-53.65	-51.31	47.38	-120.70	-0.76	-1.19	61.29	-1.66
Relative Income	73.65	75.00	122.98	31.492	62.55	58.43	122.98	31.49	82.91	84.31	109.89	60.62
GDP Growth	1.41	1.77	5.94	-8.54	1.28	1.72	5.94	-7.11	1.52	1.82	5.34	-8.54
Age Dependency - Young	24.60	23.67	32.49	20.02	23.77	21.96	32.49	21.05	25.29	25.80	29.12	20.03
Age Dependency - Old	25.02	25.33	32.10	16.18	24.86	25.55	31.97	16.18	25.15	25.28	32.10	19.98
Investment	21.28	21.15	30.98	10.02	22.34	22.71	30.98	10.02	20.39	20.38	24.53	16.46
Public Debt	73.25	66.19	170.62	24.63	81.07	84.08	170.62	24.63	66.73	64.88	107.78	33.94
Gross Household Debt	68.19	59.44	139.00	21.43	71.75	70.68	127.72	21.43	65.21	57.14	139.01	34.55
Trade Openness	92.25	73.65	191.37	48.02	81.14	61.23	191.37	48.02	101.51	92.79	171.15	48.56
Financial Development	120.53	110.97	232.09	47.40	133.37	122.89	232.09	47.40	109.82	105.16	214.15	53.15
Observations	143				65				78			

Notes: All the variables are expressed in term of % of GDP.

**Table 2.2: Threshold Test and Threshold Estimates**

<b>Threshold Indicators</b>	<b>Public Debt</b>	<b>Household Debt</b>	<b>Fiscal Deficit</b>	<b>Trade Openness</b>	<b>Financial Development</b>
Threshold estimate	55.59	73.96	-1.84	78.01	125.99
95% confidence interval	[53.34, 62.31]	[73.96, 87.65]	[-2.67, -0.99]	[77.99, 147.65]	[97.41, 133.41]
LM-test for no threshold	37.4300	43.5233	54.6017	47.4497	39.0255
Bootstrap <i>p</i> -value	0.0000	0.0000	0.0000	0.0000	0.0000
Number of bootstrap replications	5000	5000	5000	5000	5000
Trimming Percentage	15	15	15	15	15

Test of null of no threshold against alternative of threshold; Allowing heteroskedastic errors. LM-test denotes Lagrange Multiplier test.

**Table 2.3A: Percentage of Countries in Each Regime by Year (Based on Average Public Debt)**

Year	Below Regime			Above Regime		
	$\leq 55.59\%$ of GDP	Observation	Percentage	$> 55.59\%$ of GDP	Observation	Percentage
2000	45.27	4	36.36	80.42	7	63.64
2001	44.86	4	36.36	79.57	7	63.64
2002	46.05	5	45.45	82.74	6	54.55
2003	44.01	4	36.36	78.36	7	63.64
2004	43.13	4	36.36	78.57	7	63.64
2005	40.99	4	36.36	80.11	7	63.64
2006	37.83	4	36.36	79.97	7	63.64
2007	35.44	4	36.36	78.95	7	63.64
2008	39.53	3	27.27	79.58	8	72.73
2009	48.72	2	18.18	85.88	9	81.82
2010	48.64	1	9.09	90.94	10	90.91
2011	49.00	1	9.09	97.72	10	90.91
2012	53.34	1	9.09	102.70	10	90.91

Threshold variable: Public Debt as percentage of GDP. Below regime indicates low level of public debt; Above regime indicates high level of public debt.

**Table 2.3B: Percentage of Year in Each Regime by Countries (Based on Average Public Debt)**

Year	Below Regime			Above Regime		
	$\leq 55.59\%$ of GDP	Observation	Percentage	$> 55.59\%$ of GDP	Observation	Percentage
AUS	-	-	-	66.70	13	100.00
BEL	-	-	-	96.29	13	100.00
FIN	43.19	13	100.00	-	-	-
FRAN	-	-	-	69.43	13	100.00
GER	-	-	-	69.14	13	100.00
GREE	-	-	-	118.45	13	100.00
IRE	31.55	9	69.23	95.15	4	30.77
ITA	-	-	-	110.39	13	100.00
NET	50.48	8	61.54	63.92	5	38.46
PORT	51.04	3	23.08	78.65	10	76.92
SPN	45.11	8	61.54	65.90	5	38.46

Threshold variable: Public Debt as percentage of GDP. Below regime indicates low level of public debt; Above regime indicates high level of public debt.

**Table 2.3C: Percentage of Countries in Each Regime by Year (Based on Average Household Debt)**

Year	Below Regime			Above Regime		
	$\leq 73.96\%$ of GDP	Observation	Percentage	$> 73.96\%$ of GDP	Observation	Percentage
2000	44.88	9	81.82	80.98	2	18.18
2001	45.45	9	81.82	84.19	2	18.18
2002	47.66	9	81.82	87.46	2	18.18
2003	50.61	9	81.82	93.87	2	18.18
2004	51.39	8	72.73	90.65	3	27.27
2005	51.99	7	63.64	93.64	4	36.36
2006	54.23	7	63.64	99.65	4	36.36
2007	55.52	7	63.64	103.40	4	36.36
2008	56.77	7	63.64	107.38	4	36.36
2009	60.42	7	63.64	114.31	4	36.36
2010	62.38	7	63.64	113.31	4	36.36
2011	62.69	7	63.64	110.90	4	36.36
2012	62.57	7	63.64	110.29	4	36.36

Threshold variable: Household Debt as percentage of GDP. Below regime indicates low level of household debt; Above regime indicates high level of household debt.

**Table 2.3D: Percentage of Year in Each Regime by Countries (Based on Average Household Debt)**

Year	Below Regime			Above Regime		
	$\leq 73.96\%$ of GDP	Observation	Percentage	$> 73.96\%$ of GDP	Observation	Percentage
AUS	52.76	13	100.00	-	-	-
BEL	46.99	13	100.00	-	-	-
FIN	53.26	13	100.00	-	-	-
FRAN	55.71	13	100.00	-	-	-
GER	67.18	13	100.00	-	-	-
GREE	47.32	13	100.00	-	-	-
IRE	56.12	4	30.77	107.48	9	69.23
ITA	49.43	13	100.00	-	-	-
NET	-	-	-	115.42	13	100.00
PORT	-	-	-	92.86	13	100.00
SPN	61.14	5	38.46	87.69	8	61.54

Threshold variable: Household Debt as percentage of GDP. Below regime indicates low level of household debt; Above regime indicates high level of household debt.

**Table 2.3E: Percentage of Countries in Each Regime by Year (Based on Average Fiscal Deficit)**

Year	Below Regime			Above Regime		
	$\leq -1.84\%$ of GDP	Observation	Percentage	$> -1.84\%$ of GDP	Observation	Percentage
2000	-2.96	3	27.27	1.41	8	72.73
2001	-3.88	4	36.36	0.52	7	63.64
2002	-3.45	6	54.55	0.46	5	45.45
2003	-4.08	6	54.55	0.12	5	45.45
2004	-4.49	6	54.55	0.29	5	45.45
2005	-4.26	6	54.55	0.65	5	45.45
2006	-3.89	4	36.36	0.98	7	63.64
2007	-4.25	3	27.27	0.63	8	72.73
2008	-5.24	6	54.55	0.54	5	45.45
2009	-7.73	11	100.00	-	-	-
2010	-8.45	11	100.00	-	-	-
2011	-6.27	9	81.82	-0.85	2	18.18
2012	-5.30	9	81.82	-0.78	2	18.18

Threshold variable: Fiscal deficit as percentage of GDP. Below regime indicates low level/worsening of fiscal balance; Above regime indicates high level/improvement of fiscal balance.

**Table 2.3F: Percentage of Year in Each Regime by Countries (Based on Average Fiscal Deficit)**

Year	Below Regime			Above Regime		
	$\leq -1.84\%$ of GDP	Observation	Percentage	$> -1.84\%$ of GDP	Observation	Percentage
AUS	-3.34	6	46.15	-1.18	7	53.85
BEL	-4.01	5	38.46	-0.14	8	61.54
FIN	-2.76	2	15.38	3.15	11	84.62
FRAN	-4.26	11	84.62	-1.59	2	15.38
GER	-3.63	7	53.85	-0.16	6	46.15
GREE	-7.44	13	100.00	-	-	-
IRE	-14.65	5	38.46	1.42	8	61.54
ITA	-3.69	11	84.62	-1.25	2	15.38
NET	-4.11	6	46.15	0.12	7	53.85
PORT	-5.06	13	100.00	-	-	-
SPN	-9.02	5	38.46	0.38	8	61.54

Threshold variable: Fiscal deficit as percentage of GDP. Below regime indicates low level/worsening of fiscal balance; Above regime indicates high level/improvement of fiscal balance.

**Table 2.3G: Percentage of Countries in Each Regime by Year (Based on Average Trade Openness)**

Year	Below Regime			Above Regime		
	$\leq 78.01\%$ of GDP	Observation	Percentage	$> 78.01\%$ of GDP	Observation	Percentage
2000	61.85	6	54.55	127.68	5	45.45
2001	62.63	7	63.64	139.65	4	36.36
2002	60.00	7	63.64	133.12	4	36.36
2003	58.34	7	63.64	126.46	4	36.36
2004	60.53	7	63.64	130.89	4	36.36
2005	59.94	6	54.55	123.65	5	45.45
2006	59.67	5	45.45	120.64	6	54.55
2007	61.57	5	45.45	123.17	6	54.55
2008	62.05	5	45.45	127.09	6	54.55
2009	55.48	6	54.55	122.96	5	45.45
2010	57.88	5	45.45	126.88	6	54.55
2011	62.49	5	45.45	133.73	6	54.55
2012	63.59	5	45.45	136.84	6	54.55

Threshold variable: Trade Openness as percentage of GDP. Below regime indicates low level of trade openness/less open economies; Above regime indicates high level of trade openness/ more open economies.

**Table 2.3H: Percentage of Year in Each Regime by Countries (Based on Average Trade Openness)**

Year	Below Regime			Above Regime		
	$\leq 78.01\%$ of GDP	Observation	Percentage	$> 78.01\%$ of GDP	Observation	Percentage
AUS	-	-	-	102.19	13	100.00
BEL	-	-	-	155.79	13	100.00
FIN	72.46	5	38.46	83.02	8	61.54
FRAN	54.15	13	100.00	-	-	-
GER	69.65	6	46.15	89.45	7	53.85
GREE	58.13	13	100.00	-	-	-
IRE	-	-	-	166.79	13	100.00
ITA	53.69	13	100.00	-	-	-
NET	-	-	-	137.66	13	100.00
PORT	68.87	13	100.00	-	-	-
SPN	58.25	13	100.00	-	-	-

Threshold variable: Trade Openness as percentage of GDP. Below regime indicates low level of trade openness/less open economies; Above regime indicates high level of trade openness/ more open economies.

**Table 2.3I: Percentage of Countries in Each Regimes by Year (Based on Average Financial Development)**

Year	Below Regime			Above Regime		
	$\leq$ 125.99% of GDP	Observation	Percentage	$>$ 125.99% of GDP	Observation	Percentage
2000	84.85	9	81.82	130.24	2	18.18
2001	87.73	9	81.82	134.35	2	18.18
2002	88.41	9	81.82	138.53	2	18.18
2003	91.43	9	81.82	141.68	2	18.18
2004	91.09	8	72.73	142.43	3	27.27
2005	91.18	7	63.64	152.86	4	36.36
2006	94.99	7	63.64	166.82	4	36.36
2007	99.02	7	63.64	184.40	4	36.36
2008	102.82	7	63.64	197.41	4	36.36
2009	103.60	6	54.55	194.28	5	45.45
2010	110.82	7	63.64	204.49	4	36.36
2011	110.59	7	63.64	200.10	4	36.36
2012	110.29	7	63.64	190.74	4	36.36

Threshold variable: Financial Development as percentage of GDP. Below regime indicates low level of financial development; Above regime indicates high level of financial development.

**Table 2.3J: Percentage of Year in Each Regimes by Countries (Based on Average Financial Development)**

Year	Below Regime			Above Regime		
	$\leq$ 125.99% of GDP	Observation	Percentage	$>$ 125.99% of GDP	Observation	Percentage
AUS	112.69	12	92.31	125.99	1	7.69
BEL	83.88	13	100.00	-	-	-
FIN	77.42	13	100.00	-	-	-
FRAN	100.10	13	100.00	-	-	-
GER	111.26	13	100.00	-	-	-
GREE	85.62	13	100.00	-	-	-
IRE	109.36	4	30.77	191.52	9	69.23
ITA	97.70	13	100.00	-	-	-
NET	-	-	-	172.59	13	100.00
PORT	-	-	-	157.66	13	100.00
SPN	108.54	5	38.46	191.58	8	61.54

Threshold variable: Financial Development as percentage of GDP. Below regime indicates low level of financial development; Above regime indicates high level of financial development.

**Table 2.4: Threshold Regression Results - Public Debt, Household Debt and Fiscal Deficit as Threshold Indicators**

	Without Threshold	Public Debt Threshold		Household Debt Threshold		Fiscal Deficit Threshold	
		Below q < 55.59	Above q > 55.59	Below q < 73.96	Above q > 73.96	Below q < -1.84	Above q > -1.84
Constant	-0.0002 (0.0021)	-0.0032 (0.0054)	-0.0003 (0.0022)	-0.0072 (0.0048)	0.0856*** (0.0169)	-0.0052** (0.0022)	0.0142*** (0.0038)
Fiscal Balance	0.4261*** (0.0942)	0.7416*** (0.1854)	0.2307** (0.0895)	0.4725*** (0.0954)	-0.0472 (0.0635)	0.1779** (0.0854)	0.4725*** (0.1294)
Net Foreign Assets	0.0005 (0.0096)	-0.0150* (0.0059)	0.0311*** (0.0119)	-0.0050 (0.0061)	0.0343 (0.0270)	0.0268** (0.0112)	-0.0024 (0.0058)
Relative Income	0.2052*** (0.0271)	-0.0477 (0.0324)	0.1941*** (0.0255)	0.2241*** (0.0284)	0.3874*** (0.0873)	0.1944*** (0.0260)	-0.0062 (0.0393)
GDP Growth	0.3494** (0.1535)	0.5044** (0.2073)	0.2159 (0.1388)	0.4413*** (0.1281)	0.1192 (0.2833)	0.2392* (0.1441)	0.0279 (0.2536)
Age Dependency - Young	-0.4082*** (0.1079)	-0.7916*** (0.2789)	-0.4811*** (0.0951)	-0.4023*** (0.0983)	-1.5792*** (0.2568)	-0.4284*** (0.1001)	-0.4198** (0.2269)
Age Dependency - Old	0.2408*** (0.0895)	-0.7110*** (0.2671)	-0.0491* (0.1682)	0.1038 (0.1539)	0.8598 (0.6217)	0.1508 (0.1559)	-0.3747 (0.2819)
Investment	-0.9811*** (0.0895)	-1.8217*** (0.1207)	-0.8053*** (0.1039)	-1.0689*** (0.1229)	-1.5736*** (0.1571)	-0.6715*** (0.0832)	-1.5391*** (0.1462)
Gross Household Debt	0.0323*** (0.0118)	0.0385 (0.0246)	0.0246** (0.0118)	-0.0179 (0.0252)	-0.0904*** (0.0292)	0.0497*** (0.0106)	-0.0066 (0.0163)
Observations	143	42	101	100	43	84	59
R-Squared	0.8087	0.9480	0.8743	0.8218	0.9432	0.8648	0.8539

Dependent variable: Current account balance (% of GDP). \*\*\* denotes 1% of significance level, \*\* denotes 5% of significance level and \* denotes 10% of significance level. Values in parentheses denote standard errors.



**Table 2.5: Threshold Regression Results - Trade Openness and Financial Development as Threshold Indicators**

	Without Threshold	Trade Openness Threshold		Financial Development Threshold	
		Below q < 78.01	Above q > 78.01	Below q < 125.99	Above q > 125.99
Constant	-0.0002 (0.0021)	0.0068 (0.0042)	0.0465*** (0.0075)	-0.0072 (0.0048)	0.0197 (0.0144)
Fiscal Balance	0.4261*** (0.0942)	0.4111*** (0.1119)	0.2835*** (0.0786)	0.4725*** (0.0885)	-0.0389 (0.1108)
Net Foreign Assets	0.0005 (0.0096)	-0.0055 (0.0086)	-0.0026 (0.0109)	-0.0050 (0.0071)	0.0373 (0.0340)
Relative Income	0.2052*** (0.0271)	0.2427*** (0.0286)	-0.1490** (0.0733)	0.2241*** (0.0325)	0.2618*** (0.0909)
GDP Growth	0.3494** (0.1535)	0.3729** (0.1472)	0.3242 (0.2442)	0.4413*** (0.1403)	0.0961 (0.3080)
Age Dependency - Young	-0.4082*** (0.1079)	-0.5259*** (0.1373)	-0.3983 (0.2505)	-0.4023*** (0.1340)	-1.6519*** (0.4731)
Age Dependency - Old	0.2408*** (0.0895)	-0.4575** (0.2089)	0.0844 (0.3279)	0.1038 (0.1851)	0.0453 (0.7196)
Investment	-0.9811*** (0.0895)	-0.8648*** (0.1064)	-0.5479*** (0.1645)	-1.0689*** (0.1245)	-1.2464*** (0.1602)
Gross Household Debt	0.0323*** (0.0118)	0.0086 (0.0162)	0.0701*** (0.0163)	-0.0179 (0.0242)	0.0291 (0.0144)
Observations	143	77	66	99	44
R-Squared	0.8087	0.8870	0.7188	0.8212	0.9218

Dependent variable: Current account balance (% of GDP). \*\*\* denotes 1% of significance level, \*\* denotes 5% of significance level and \* denotes 10% of significance level. Values in parentheses denote standard errors.

**Table 2.6: Classification of Countries - Above or Below Threshold Levels**

<b>Countries Above Threshold Levels</b>										
	<b>Public Debt</b> [>55.59%]	<b>Average</b>	<b>Household Debt</b> [>73.96%]	<b>Average</b>	<b>Fiscal Deficit</b> [>-1.84%]	<b>Average</b>	<b>Trade Openness</b> [>78.01%]	<b>Average</b>	<b>Financial Development</b> [>125.99%]	<b>Average</b>
	Austria	66.70	Ireland	107.48	Austria	-1.18	Austria	102.19	Ireland	191.52
	Belgium	96.29	Netherlands	115.42	Belgium	-0.14	Belgium	155.79	Netherlands	172.59
	France	69.43	Portugal	92.86	Finland	3.15	Finland	83.02	Portugal	157.66
	Germany	69.14	Spain	87.69	Germany	-0.16	Germany	89.45	Spain	191.58
	Greece	118.45			Ireland	1.42	Ireland	166.79		
	Italy	110.39			Netherlands	0.12	Netherlands	137.66		
	Portugal	78.65			Spain	0.38				
Twin Deficit	Y		N		YY		Y		N	
Household Debt	Y		Y		N		Y		N	
<b>Countries Below Threshold Levels</b>										
	<b>Public Debt</b> [<55.59%]	<b>Average</b>	<b>Household Debt</b> [<73.96%]	<b>Average</b>	<b>Fiscal Deficit</b> [<-1.84%]	<b>Average</b>	<b>Trade Openness</b> [<78.01%]	<b>Average</b>	<b>Financial Development</b> [<125.99%]	<b>Average</b>
	Finland	43.19	Austria	52.76	France	-4.26	France	54.15	Austria	112.69
	Ireland	31.55	Belgium	46.99	Greece	-7.44	Greece	58.13	Belgium	83.88
	Netherland	50.48	Finland	53.26	Italy	-3.69	Italy	53.69	Finland	77.42
	Spain	45.11	France	55.71	Portugal	-5.06	Portugal	68.87	France	100.10
			Germany	67.18			Spain	58.25	Germany	111.26
			Greece	47.32					Greece	85.62
			Italy	49.43					Italy	97.70
Twin Deficit	YY		YY		Y		YY		Y	
Household Debt	N		N		Y		N		N	

Notes: Y = Significant relationship; YY = Significant strong relationship; N = No significant relationship.

**Table 2.7: Percentage of Countries - Above or Below Threshold Levels**

	Public Debt		Household Debt		Fiscal Deficit		Trade Openness		Financial Development	
	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below
AUS	X	-	-	X	X	-	X	-	-	X
BEL	X	-	-	X	X	-	X	-	-	X
FIN	-	X	-	X	X	-	X	-	-	X
FRA	X	-	-	X	-	X	-	X	-	X
GER	X	-	-	X	X	-	X	-	-	X
GREE	X	-	-	X	-	X	-	X	-	X
IRE	-	X	X	-	X	-	X	-	X	-
ITA	X	-	-	X	-	X	-	X	-	X
NET	-	X	X	-	X	-	X	-	X	-
PORT	X	-	X	-	-	X	-	X	X	-
SPN	-	X	X	-	X	-	-	X	X	-
	64%	36%	36%	64%	64%	36%	55%	45%	36%	64%

### Appendix 2.1

Test statistic for testing the significance of the threshold:

$$F_T = \sup_{q \in \mathcal{S}} F_T(q)$$

where

$$F_T(q) = T \left( \frac{\tilde{\sigma}_T^2 - \hat{\sigma}_T^2(q)}{\hat{\sigma}_T^2(q)} \right)$$

where

$\hat{\sigma}_T^2 = \frac{1}{T} \sum_{t=1}^T \hat{\epsilon}_t^2$  refers to the threshold predicted residual variance

$\tilde{\sigma}_T^2$  refers to the linear model residual variance

Source: Baum et al. (2013).

## **Chapter 3:**

### **Current Account Sustainability of Eleven European Countries**

#### **3.1. Introduction**

Current account imbalances have become the nexus of some debate among researchers recently. This is due to the importance for countries in choosing appropriate economic policies over the optimal size of current account imbalances. The persistence of current account deficits experienced by many European countries has triggered some alarm of financial crises. Based on the size of current deficits, future current account deficits may be unavoidable in the long-run. However, the ability of the countries to respond to external shocks causes concern. Therefore, sustainability of the current account is crucial in providing confidence to other countries of the ability to finance debt in the future without tendency to default on debt repayments.

This paper examines the sustainability of current account imbalances for eleven European countries from 1980-2013 while taking into consideration different sub-periods. These different sub-periods reflect the development in the EU region such as establishment of EU in 1992, introduction of Euro currency in 1999 and consequences of the global financial crisis in 2008. This study focuses on the long-run and short-run perspectives to provide a comprehensive understanding of the dynamic behavior of current account persistence. As a benchmark measure, countries meeting their long-run budget constraint are seen as having a sustainable current account. However, satisfying the condition of the long-run budget constraint does not guarantee current account is sustainable over time as conditions change. Large short-run imbalances may lead to the

tendency of the unsustainability of the current account and contribute to barriers in the future debt repayment efforts.

Table 3.1 shows global data on current account balances for 2003 to 2012. On average, the advanced economies demonstrate persistent current account deficits of 0.7% of GDP in 2003, reaching a peak of 1.2% of GDP in 2008 and declining to 0.1% of GDP in 2012. In contrast, the Developing Asia and Middle East and North Africa regions exhibit sustainable current account surpluses during the same period. There are mixed current account balances in Latin America and Caribbean and Sub-Saharan Africa with consistent current account deficits from 2009 to 2012. The European Union region exhibits sustainable current account deficits from 2005 to 2010 which escalated to a peak of 1.0% of GDP in 2008. The EU recorded surpluses of 1.3% of GDP in 2012. In view of the Euro zone, the current account balances were mostly surpluses with a peak of 1.1% of GDP in the year 2004, down to 0.2% of GDP in 2007, just prior to the global financial crisis. The Euro area recorded a current account deficit of 0.7% of GDP in the year 2008, but moved towards surplus figures from the year 2009 onwards and ended at 1.3% of GDP in 2012.

At the country level, Table 3.2 shows the current account balances from 2003 to 2012 of individual Euro Area economies. The countries are classified into two main groups: those with persistent current account surpluses and those with persistent current account deficits. Of the 17 EU countries depicted, 11 countries experienced persistent current account deficits while six economies recorded surpluses in their current account from 2003 to 2012. The top panel shows that of those running higher surpluses prior to the global financial crisis in 2008 and lower surpluses following 2008. The current account

surplus of Netherlands and Germany are considerably larger than the others with 10.1% of GDP for Netherlands and 7.0% of GDP for Germany in 2012. Of those countries with current account deficits, the deficits tend to be largest in 2007 and 2008. Greece, Portugal and Spain had large deficits in 2008 with 14.7% of GDP for Greece, 12.6% of GDP for Portugal and 9.6% of GDP for Spain. This can be seen in the smaller deficits following 2008. Some economies such as Ireland, Malta, Slovak Republic and Slovenia recorded current account surpluses in 2012.

The persistence of current account deficits emerges as a prominent and debatable issue as it may be an indication of a country's ability to manage external debt. A sustainable current account deficit indicates that a country has the ability to finance its external debts. An unsustainable current account deficit signifies that a country may experience impediments in repaying its debt and the possibility of bankruptcy. Indications of unsustainability may lead to severe economic turbulence. Measuring the persistence of current account deficits is important to capture the real effect of the current account behavior. This paper examines the sustainability of current account behavior in the EU region with a particular focus on the countries with persistent current account deficits. There are two approaches to measure sustainability. One is to measure the stationarity of the current account. The other is to measure the long-run relationship between exports and imports. Empirically, the stationarity of the current account, which is based on mean reverting concept, serves two purposes. The main purpose is to measure the persistence of the current account deficit where stationarity reflects a sustainable current account. The other purpose is to confirm the inter-temporal model where the current account may act as a tool to absorb any external shocks, thus providing a mean for consumption smoothing. Alternatively, measuring the current account sustainability

can be done by examining the association between exports and imports. Based on the model in Husted (1992), the coefficient of the interaction between exports and imports determines evidence of current account sustainability. There are two criteria that are critical in identifying sustainability in Husted (1992). First, the existence of a linkage between export and import implies the current account is sustainable. Second, the coefficient of the parameter of interest lies between 0 and 1. Any values exceeding this range indicate violation of the intertemporal budget constraint, and thus the current account is considered unsustainable. Intuitively, the intertemporal budget constraint implies that the current level of international borrowing (lending) of a country must be equivalent to the present values of the future trade surpluses (deficits). A violation of this condition means that the ability of the country to repay its debts will be doubtful. If this condition holds, then the interaction between exports and imports over time must also be equivalent to one.

Suppose that the current account satisfies the long-run budget constraint as in the exercise above and thus is sustainable in the long-run. Debt problems may emerge due to the volatility of the current account in the short-run. Raybaudi et al. (2004) argue that short-run imbalances of the current account with large accumulated deficits (debt) may lead to the long-run inter-temporal budget constraint no longer being satisfied. Their argument provides useful insight on the nature of current account sustainability. Countries may view their current accounts as sustainable in the long-run with a low tendency to default or end up in bankruptcy. This leads to the propensity of the countries to step into an over borrowing situation. The impediment arises from short-run imbalances in the current account, which began to signify long-run unsustainability, eventually leading to inability to meet the long-run intertemporal budget constraint.



Therefore, sustainable current account in the long-run perspective does not guarantee that a country can avoid being trapped in a debt crisis that leads to an unsustainable current account in the short-run.

I investigate the sustainability of the current account in the European countries, particularly those countries that adopted the Euro currency. There are several aspects that I consider in this study. First, this study examines the interaction between exports and imports approach as used in the model by Husted (1992). Second, a series of time frames are taken into consideration to capture the current account sustainability effect in those periods, namely: establishment of Maastricht Treaty in 1992, European Monetary Union (EMU) in 1999 and the global financial crisis in 2008. Third, long-run and short-run effects will be captured using the Pooled Mean Group (PMG) estimation for the countries as a group. I also examine the short-run effect at the country level. I follow closely the studies by Schoder et al. (2013) and Raybaudi et al. (2004). Schoder et al. (2013) investigated the sustainability of the current account in terms of the association between net exports and external debt in the EU region from 1975 to 2011 by using quarterly data. Panel unit root and Pooled Mean Group (PMG) estimator were used to determine the sustainability of the current account. Furthermore, their study also considered classification of countries (European Monetary Union countries and non-European Monetary Union countries) and two sub-periods (1975-1996 and 1997-2011). They discovered that the sustainable external debt may shift towards unsustainable external debt when taking into account the introduction of euro. Raybaudi et al. (2004) determine the sustainability of the current account by using Markov switching ADF technique for United States, United Kingdom and Japan from 1970 to 2002. Their

empirical results show that short-run effects may lead to the violation of the long-run budget constraint.

This paper differs in the following aspects. First, this paper adopts the model introduced by Husted (1992) in examining the relationship between real exports and real imports. This provides comparative findings with the results from Schoder et al. (2013) where they used measures of the linkage between net exports and external debt. Second, this paper concentrates on the EU countries that adopted the Euro currency and takes into consideration a series of structural breaks. The inclusion of these series of developments in the EU region, particularly the effect of the global financial crisis in 2008, is essential to reflect the contemporary view. This distinguishes from Schoder et al. (2013) by inclusion of more sub-periods to provide detailed information regarding the dynamic behavior of the current account by considering the development in the EU region as listed above. Third, both the long-run and short-run perspectives are discussed in this paper, particularly the behavior of the individual EU countries in the short-run. Schoder et al. (2013) only provide discussion on the long-run perspective as a group of countries (European Monetary Union countries and non-European Monetary Union countries). I follow the motivation of Raybaudi et al. (2004) where sufficient large short-run current account imbalances may lead to potential current account unsustainability even when there is no evidence of violation of the long-run budget constraint. Thus, this paper incorporates the investigation on the short-run perspective and also analysis at individual country level.

The remainder of the paper progresses as follows. Section 3.2 provides discussion on the related literature regarding sustainability of the current account from the perspective

of time-series analysis and panel analysis. Section 3.3 presents the model specification and econometric techniques adopted to measure the persistence of the current account. Section 3.4 highlights the empirical results and discussion of the results. Lastly, section 3.5 provides conclusions and policy implications.

### **3.2. Literature Review on Current Account Sustainability**

In general, research on current account sustainability can be decomposed into two perspectives: time-series analysis and panel analysis. The time-series analysis has adopted the conservative unit root test where the fundamental principle is the mean-reverting concept. Evidence of mean-reverting series provides indication of sustainability of the current account. Cointegration tests and the Bounds test, which is also known as the Autoregressive Distributive Lag (ARDL) model, are among approaches adopted to examine the sustainability issue. Existence of a cointegrating relationship between the parameters of interest is the necessary condition for the economy to satisfy the intertemporal budget constraint and thus implies sustainability of the parameters of interest (Hakkio and Rush, 1991). Although their main interest was to determine the fiscal deficit sustainability, the fundamental intertemporal budget constraint concept used by Hakkio and Rush, (1991) is applicable in determining the current account sustainability. The intertemporal budget constraint entails that the international borrowing (lending) of a country must be correspond to the present values of the future trade surpluses (deficits). Violation of this condition implies that a country may experience difficulty in repaying its debt. The Bounds test is used to further estimate the relationship between the parameters of interest in the long-run and short-run, after detection of cointegration between the variables. Panel analysis embraces a more powerful panel unit root tests and panel cointegration tests. The purpose of these

tests are consistent with time-series unit root test and cointegration test. The difference between the panel analysis and time-series analysis is the dimensions where panel analysis takes into consideration time and country dimensions, whereas time-series analysis only considers the time dimension. Most of the studies on the sustainability of the current account are based on the intertemporal view where consumption smoothing is a fundamental element. The following section reviews the related previous studies on current account sustainability and classifies these studies according to time-series versus panel analysis.

In terms of time-series approach, cointegration method is used to investigate the sustainability of the current account deficit. Husted (1992) studies the long-run external imbalances of the United States from 1960 to 1983. He adopted the cointegration approach to estimate the long-run relationship between exports and imports of goods and services. The empirical results indicate that current account of the United States was sustainable until 1983 and he predicted that current account may become unsustainable from 1983 onwards. Fountas and Wu (1999) employed the Engel-Granger cointegration test to examine the association between export and import quarterly data from 1967 to 1994 for the United States. They discovered evidence of cointegration, indicating a long-run association between exports and imports, thus indicating the current account deficit of the United States was considered sustainable. Their results are inconsistent with findings from Husted (1992) who predicted that current account of the United States was unsustainable following 1983. Apergis et al. (2000) also used a cointegration test in addition taking into account structural breaks to investigate the sustainability of the current account of Greece from the year 1960 to 1994 from the perspective of exports and imports. Their results confirm persistence of

the current account deficit of Greece. Meanwhile, Kalyoncu and Ozturk (2010) applied a similar econometric approach to test on Latin America and Caribbean countries using quarterly data ranging from 1980 to 2006. There is a mixed empirical result where current account deficit in Peru is viewed as sustainable. On the other hand, Colombia, Venezuela, Mexico, Brazil and Argentina experienced unsustainable current account deficits.

Besides the cointegration method, the Bounds testing or ARDL approach has been used to examine the current account deficit sustainability. Yol (2009) performed Bounds testing on exports and imports for Egypt, Morocco and Tunisia from 1972 to 2005. The empirical result is in favor of evidence of persistent current account deficits for those three countries. Subsequently, Pattichis (2010) adopted the same approach on Cyprus from the year 1976 to 2004 and showed no violation of the intertemporal budget constraint. Thus, this reflects proof of a sustainable current account deficit for Cyprus.

Unit root tests or stationarity tests have also been used to examine the sustainability issue. Intuitively, the current account deficit is considered as sustainable if there is evidence of stationarity in the unit root test indicating mean reversion. Raybaudi et al. (2004) examined the sustainability of the current account deficits using 132 quarterly observations of trade balance and real current account of United States, United Kingdom and Japan for the period 1970 to 2002. They adopted the Markov switching Augmented Dickey-Fuller (ADF) technique to determine the periods where current account and trade deficits are non-stationary. This approach is an alternative to pre-determined or fixed structural breaks since the number of regime changes in time series is estimated using the likelihood approach. Their empirical findings indicate that short-

run effects may lead to the violation of the long-run budget constraint. Holmes (2006) employs ADF within a seemingly unrelated regression (SURADF) on 16 Latin American countries from 1979 to 2001. The empirical result depicts at least 75% or 12 countries in the sample exhibit current account mean-reversion. This means that the current account deficit in those countries is sustainable and constrained within the intertemporal budget constraint. Chen (2011) adopted unit root approach with regime switching from 1970 to 2009 using quarterly data on OECD countries. Their empirical results showed that violation of the long-run intertemporal budget constraint for Australia, the Czech Republic, Finland, Hungary, New Zealand, Portugal and Spain. This implies that the current account deficits of those countries were unsustainable. Holmes et al. (2011) adopted both parametric tests via cointegration method as well as nonparametric approach proposed by Breitung (2002) and Breitung and Taylor (2003) to test current account deficit persistence in India from 1950 to 2003. Their results imply that evidence supporting current account deficit sustainability is sensitive to structural breaks. Although the current account deficit in India is considered as unsustainable in the period prior to the 1990s, it became sustainable in the subsequent years. Clower and Ito (2012) conducted a study with a larger sample of 70 countries and they employed the Markov switching process to determine whether the current account is persistent. Their results provide interesting insight where emerging economies with fixed exchange rate regimes or countries with high degree of financial openness exhibit unsustainable current accounts. Furthermore, countries with a high degree of trade openness and with greater real exchange rate misalignments have lower levels of current account sustainability while those countries with persistent fiscal deficits tend to have similar trends in their current account.

With regards to panel analysis, panel unit root test and panel cointegration tests are commonly used to detect evidence of sustainability in the current account deficit. Baharumshah et al. (2005) performed panel unit root and panel cointegration tests on 8 East Asia countries with data from 1970 to 2000. They also take into account the structural break of the 1997 Asian Financial crisis in their analysis. They discovered that current account deficits of those countries are unsustainable in the period prior to the crisis, but become sustainable in the post crisis period. Holmes et al. (2010) conducted a study on European Union (EU) countries using specific panel unit root test proposed by Hadri (2000) to examine current account stationarity and sustainability for EU members compared to non-EU members. Their results imply evidence of sustainable current account deficits in the core EU countries. However, the evidence becomes less supporting for those countries added later as EU members. Durdu et al. (2013) investigated the relationship between net exports and net foreign assets based on the stochastic intertemporal budget constraint perspective using dynamic panel framework. They adopted Pooled Mean Group (PMG) error correction estimation to examine the annual data from 1970 to 2006 for 21 industrial and 29 emerging economies. They discovered that the solvency condition is satisfied if net foreign assets are integrated of any finite order. Besides that, the empirical results from the PMG estimation implied the solvency condition holds if net exports and net foreign assets are connected by error-correction term. Moreover, the convergence effect is higher for emerging economies relative to industrial countries. Schoder et al. (2013) analyzes EU countries using quarterly data from 1975 to 2011. They implemented panel unit root test proposed by Breitung and Das (2005) to determine stationarity of the external debt. Moreover, they also adopted Pooled Mean Group estimator to determine sustainable of current account based on the linkage between net export and external debt. Their

empirical results depict that there is a shift from sustainable external debt towards unsustainable external debt when taking into account the introduction of euro.

Therefore, I use these previous literatures to motivate the use of the Pooled Mean Group (PMG) estimator approach to examine the current account sustainability based on the association between exports and imports. The PMG method allows estimation of respective individual dynamic short-run coefficients or error-correction term while constrained homogeneity in the long-run coefficient. This means that both the long-run and short-run perspectives can be captured using this method, particularly the short-run behavior of the current account at the individual country level. This serves as the main contribution to the literature since there has been less emphasis on investigating the short-run imbalances of the current account at individual country level while considering the sub-periods effect.

### **3.3. Methodology and Econometric Approach**

This section provides the motivation and model specification used in this study. Next, the econometric techniques as well as estimation strategy in investigating the parameters of interest are discussed.

#### **3.3.1 Current Account Framework**

I adopt the framework by Hakkio and Rush (1991) and Husted (1992) in the derivation of the current account model, which is based on a small open economy structure. The intuition behind the model is that the current account is considered sustainable if there exists long-run association between exports and imports. In this model, the main assumption is perfect capital mobility where the representative agents have access to



the financial market in order to lend or borrow at the given world interest rate. Thus, they will try to optimize their consumption constrained by the two-period budget constraint as shown in the following equations. I replicate the model below from Husted (1992).

$$C_t = Y_t + B_t - I_t - (1 + r_t)B_{t-1} \quad (3.1)$$

where  $C_t$  is current consumption,  $Y_t$  is output,  $I_t$  is investment,  $r_t$  is one period world interest rate,  $B_t$  is international borrowing which could be positive or negative,  $(1 + r_t)B_{t-1}$  is the initial debt of the representative agent, equivalent to the external debt of the country.

Since the budget constraint must hold for every period, the intertemporal budget constraint can be formed from this period budget constraint. By forward iterating Equation (3.1), the intertemporal budget constraint can be expressed as:

$$B_t = - \sum_{i=1}^{\infty} \frac{1}{1+r} (Y_{t+i} - C_{t+i} - I_{t+i}) + \lim_{i \rightarrow \infty} \frac{1}{1+r} B_{t+i} \quad (3.2)$$

where  $\frac{1}{1+r}$  is the discount factor. Note that  $Y_t - C_t - I_t = X_t - M_t = TB_t$  where  $TB_t$  refers to trade balance.

Therefore, the budget constraint of the economy can be expressed as:

$$B_t = - \sum_{i=1}^{\infty} \frac{1}{1+r} (X_{t+i} - M_{t+i}) + \lim_{i \rightarrow \infty} \frac{1}{1+r} B_{t+i} \quad (3.3)$$

Equation (3.3) implies the inter-temporal budget constraint (IBC) and serves as essential platform in explaining the sustainability of the current account. One of the important conditions to be met is the last term in the equation where it must be zero in order to reflect the Transversality condition. This indicates that the international borrowing or foreign debt of a country has to be equivalent to the sum of the present discounted values of future trade surpluses. If the current foreign debt exceeds the present value of future trade balances, then the country is “bubble-financing” its foreign debt, and thus the current account is unsustainable.

Following Hakkio and Rush (1991), Husted (1992) assumed a stationary world interest rate with mean  $r$ , which is exogenous. Equation (3) can be written as:

$$M_t + r_t B_{t-1} = X_t + \sum_{i=0}^{\infty} \left( \frac{1}{1+r} \right) [\Delta X_{t+i} - \Delta Z_{t+i}] + \lim_{i \rightarrow \infty} \left( \frac{1}{1+r} \right) B_{t+i} \quad (3.4)$$

where  $Z_t = M_t + (r_t - r)B_{t-1}$ . The left-hand side in Equation (3.4) denotes the expenditure on the imports and interest payments (receipt) on the net foreign debt (assets). Subsequently, subtracting  $X_t$  from both sides and multiplying by (-1), the left-hand side of the equation implies the current account.

$$\begin{aligned} CA_t &= X_t - M_t - r_t B_{t-1} \\ &= \sum_{i=0}^{\infty} \left( \frac{1}{1+r} \right) [\Delta X_{t+i} - \Delta Z_{t+i}] + \lim_{i \rightarrow \infty} \left( \frac{1}{1+r} \right) B_{t+i} \end{aligned} \quad (3.5)$$

Based on Hakkio and Rush (1991), Husted (1992) assumed that  $X$  and  $Z$  are  $I(1)$  processes and thus Equation (3.5) becomes:

$$X_t = \alpha + \beta MM_t - \lim_{i \rightarrow \infty} \left( \frac{1}{1+r} \right)^i B_{i+1} + \epsilon_t \quad (3.6)$$

where  $MM_t = M_t + r_t B_{t-1}$ .

Assuming the limit term equals zero, Equation (3.6) can be transformed into a standard regression equation:

$$X_t = \alpha + \beta MM_t + \epsilon_t \quad (3.7)$$

If the economy satisfies the intertemporal budget constraint,  $\beta$  must be one and  $\epsilon_t$  must be stationary. Several conclusions regarding the sustainability of the current account can be derived as followed:

- a) If there is no cointegrating relationship between exports and imports, then the current account is unsustainable.
- b) If there is a cointegrating relationship between exports and imports with  $\beta = 1$ , then the current account is sustainable.
- c) If there is a cointegrating relationship between exports and imports with  $\beta < 1$ , then the current account may not be sustainable.

Again, based on Hakkio and Rush (1991), if  $X$  and  $MM$  are non-stationary in level, then the condition  $0 < \beta < 1$  is a sufficient condition for the budget constraint to hold. Although the main study of Hakkio and Rush (1991) is on government budget sustainability, the interpretation of the long-run budget constraint concept is applicable in the current account context.

### 3.3.2. Econometric Approach and Estimation Strategy

The current account sustainability of the eleven EU countries is considered by two main tests. First, I examine whether there is a cointegrating relationship between exports and imports (where imports include net interest payments and net transfer payments). Prior to testing the cointegrating relationship, I test whether the variables are stationary in first difference,  $I(1)$ . Unit root tests are used to determine the stationarity of the variables with the null hypothesis that the variables contain a unit root. If exports and imports are  $I(1)$ , then the cointegration test can be performed. Subsequently, if exports and imports are cointegrated, then the intertemporal budget constraint condition holds. The Im, Pesaran and Shin (2003) panel unit root test is used to determine the stationarity of both the variables while the Pedroni (1999) panel cointegration test is used to identify the existence of a cointegrating relationship between exports and imports. The current account is considered sustainable if there is evidence of a cointegrating relationship between exports and imports.

Second, I test the convergence and short-run imbalances of the relationship between exports and imports (where imports include net interest payments and net transfer payments). The convergence parameter, known as the error-correction term (ECT), measures the speed of the short-run in converging to the long-run equilibrium. Existence of negative and significant convergence coefficients signify the existence of a long-run relationship between exports and imports and thus the current account can be considered sustainable. Meanwhile, a large magnitude of short-run imbalances may indicate the current account is unsustainable with the range  $0 < \beta < 1$ . These ECT and short-run imbalances can be captured using the Pooled Mean Group (PMG) estimator approach.

### 3.3.2.1. Panel Unit Root Tests

The verification of the integration of the order for the variables used in the model is a common practice prior to the cointegration test. The purpose is to identify whether the variables are stationary or non-stationary. This study adopts the panel unit root test proposed by Im, Pesaran and Shin (2003) (henceforth denoted IPS). This panel unit root test is preferred to Levin and Chu (1993) unit root test as it is less restrictive in terms of allowing cross-sectional dependencies.

The fundamental equation for the IPS test based on ADF regression is shown in Equation (3.8).

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p_i} \varphi_{ij} \Delta y_{i,t-j} + \varepsilon_{i,t} \quad (3.8)$$

$$t = 1, 2, \dots, N; \quad t = 1, 2, \dots, T$$

where  $y_{i,t}$  refers to the respective variables ( $X, MM$ ) in the model setup and  $\alpha_i$  denotes the country-specific effect. The null hypothesis is defined as

$H_0: \rho_i = 0$  for all  $i = 1, \dots, N$  against the alternative hypothesis,

$H_A: \rho_i < 0$  for some  $i = 1, \dots, N$  and  $\rho_i = 0$  for  $i = N + 1, \dots, N$ .

The alternative hypothesis allows for  $\rho_i$  differing across groups, which implies a less restrictive condition. This means that some of the variables contain unit roots instead of all of the variables.

Im et al. (2003) propose a standardized  $t$ -bar statistic as follows:

$$Z_{tbar} = \frac{\sqrt{N} \left\{ tbar_{NT} - \frac{1}{N} \sum_{i=1}^N E[t_{i,T}(p_i, 0) | \rho_i = 0] \right\}}{\sqrt{\frac{1}{N} \sum_{i=1}^N Var[t_{i,T}(p_i, 0) | \rho_i = 0]}} \xrightarrow{T, N} N(0, 1) \quad (3.9)$$

where

$$tbar_{NT} = \frac{1}{N} \sum_{i=1}^N t_{iT}(p_i, \varphi_i)$$

$$E(t_{iT}) = \mu \text{ and } V(t_{iT}) = \sigma$$

$tbar$  represents the ADF  $t$ -statistic for examining unit root in country  $i$ . This statistic is shown to be normally distributed as  $N$  and  $T$  tend to infinity under the assumption of cross-sectional independence.

### 3.3.2.2. Panel Cointegration Tests

In this study, the Pedroni (1999) cointegration test is adopted after the order of integration of the variables is identified. The purpose is to determine the existence of cointegration, indicating a long-run relationship between the parameters of interest. One of the benefits of this test is it allows heterogeneity of the parameters of interest across countries and vectors of cointegration may vary among countries instead of homogeneity. Initially, the long-run interaction can be tested by the following equation:

$$X_{it} = \alpha_i + \theta_i t + \beta_{1i} MM_{it} + \varepsilon_{it} \quad (3.10)$$

Equation (3.10) indicates the respective coefficients with variation of cointegrating vector across countries. This implies heterogeneity is captured in  $\beta_i$ , fixed effects  $\alpha_i$  and individual specific deterministic trends  $\theta_i t$  across countries. The deterministic trends  $\theta_i t$  are often omitted (Pedroni, 1999). Thus, the panel cointegration test in this study consider model without the deterministic trend since all the variables are non-stationary in levels and stationary in first difference (so variables are  $I(1)$ ).

In order to examine the estimated cointegrating residuals, Pedroni proposed seven different statistics. These statistics can be classified into two groups with unique features distinguishing them. The first group consists of four statistics that are based on pooling or known as within-dimension. The within-dimension statistics are constructed via summation of both the numerator and denominator terms over the  $N$  dimension distinctly. Thus, the estimators can group the autoregressive coefficient ( $\delta_i$ ) across different members for unit root test on the estimated residuals. The null hypothesis of no cointegration is based on a residual test of the  $H_0: \delta_i$  for all  $i$  against  $H_0: \delta_i = \delta < 1$  for all  $i$  as it assume a common value of  $\delta_i = \delta$ . On the other hand, the second group consists of three statistics and is referred as between-dimension. These three statistics are constructed via division of the numerator against the denominator before summation over the  $N$  dimension. Thus, the estimators are based on average of individually estimated coefficients of each members  $i$ . The null hypothesis of no cointegration is based on a residual test of the  $H_0: \delta_i$  for all  $i$  against  $H_0: \delta_i < 1$  for all  $i$  as it does not assume a common value of  $\delta_i = \delta$ . This means potential heterogeneity across individual members is permitted in between-dimension model. The specific models of the within-dimension statistics and between-dimension are shown in the Appendix.

The identification of the existence of the cointegrating relationship between exports and imports is based on the number of the statistics results that indicate significant cointegrating relationship. If a majority of the statistics provides evidence of cointegration between the parameter of interests, then there is a strong indication for a cointegrating relationship.

### **3.3.2.3. Mean-Group (MG) Estimator and Pooled Mean-Group (PMG) Estimator**

After testing for the existence of the cointegrating relationship between exports and imports, I turn to MG and PMG methods to estimate the long-run and short-run linkages between exports and imports. These two estimation techniques are proposed by Pesaran and Smith (1995) and Pesaran et al. (1999). The purpose is to estimate the long-run and short-run linkage between the dependent variable and the independent variables. They are useful in examining the variation of the dependent variable due to the change in the independent variable at average level. Nevertheless, there are some features that distinguish between the two techniques.

The MG estimator allows distinct estimations for each cluster in the panel and thus provides consistent average estimates. This means that the MG estimator is able to predict the respective independent error-correction parameters for each country and country specific mean coefficients. The only shortcoming of the MG estimator is that it omits long-run homogeneity between clusters although it allows heterogeneity across countries (Pesaran and Smith, 1995). This implies that the MG estimator is inefficient when the error-correction coefficients are homogenous across countries. Subsequently, Pesaran et al. (1999) introduced the PMG estimator which constrains the homogenous long-run coefficient while allowing heterogeneity in the short-run coefficients and error-correction coefficients across countries. This indicates that the PMG estimator is able to provide estimation for dynamic short-run coefficients as well as the independent error-correction coefficients across countries while treating the long-run coefficients to be the same across countries. I use a Hausman test to verify which estimator (MG or PMG) is preferable. Failure to reject the null hypothesis of homogenous long-run



coefficients implies that the PMG estimator is appropriate compared to the MG estimator.

Following Pesaran et al. (1999), the association between the exports and imports can be shown in the autoregressive distributed lag (ARDL) model with lags of  $m$  and  $n$ , as followed:

$$X_{i,t} = \alpha_i + \sum_{j=1}^m \gamma_{i,j} X_{i,t-j} + \sum_{k=0}^n \theta_{i,k} MM_{i,t-k} + \varepsilon_{i,t} \quad (3.11)$$

where  $X_{i,t}$  and  $MM_{i,t}$  represent the exports and imports in country  $i$  at time  $t$ , respectively, while  $\alpha_i$  refers to country-specific fixed effects and  $\varepsilon$  denotes the error term, which is normally distributed with country-specific variance,  $\text{var}(\varepsilon_{i,t}) = \sigma_i^2$ .

Subsequently, the equation can be expressed in terms of levels and first differences:

$$\begin{aligned} \Delta X_{i,t} = & \alpha_i + \phi_i X_{i,t-1} + \tau_i MM_{i,t} + \sum_{j=1}^{p-1} \gamma_{i,j}^* \Delta X_{i,t-j} + \sum_{k=0}^{q-1} \theta_{i,k}^* \Delta MM_{i,t-k} \\ & + \varepsilon_{i,t} \end{aligned} \quad (3.12)$$

where  $\phi_i = -(1 - \sum_{j=1}^p \gamma_{i,j})$ ,  $\tau_i = \sum_{j=0}^p \theta_{i,j}$ ,  $\gamma_{i,j}^* = -\sum_{l=j+1}^p \gamma_{i,l}$ ,  $\theta_{i,k}^* = \sum_{l=k+1}^q \gamma_{i,l}$ ,  $j = 1, 2, \dots, p-1$  and  $k = 1, 2, \dots, q-1$ .

Following Pesaran et al. (1999), Equation (3.12) can be rearranged in order to indicate the long-run relationship:

$$\Delta X_{i,t} = \alpha_i + \phi_i [X_{i,t-1} - \omega_i MM_{i,t}] + \sum_{j=1}^{p-1} \gamma_{i,j}^* \Delta X_{i,t-j} + \sum_{k=0}^{q-1} \theta_{i,k}^* \Delta MM_{i,t-k} + \varepsilon_{i,t} \quad (3.13)$$

where  $\omega_i = -\phi_i^{-1}\tau_i$  represents the long-run association between  $X_{i,t}$  and  $MM_{i,t}$ , while  $\phi_i$  measures the speed of adjustment by which  $X$  converge to the long-run association upon a change in  $MM$ . The error-correction convergence parameter  $\phi_i$  and the long-run coefficient of  $\omega_i$  are of primary concern. The  $\phi_i$  is expected to be negative and statistically significant if existence of convergence to the long-run equilibrium is depicted by the variables. The sufficient condition for the intertemporal budget constraint in equation (3.4) to hold is a negative and statistically significant value of  $\omega$ .

### 3.3.3. Data

I use annual data on exports and imports from eleven European countries in the Euro area from 1980 to 2013. Cyprus, Estonia, Latvia, Luxembourg, Malta, Slovak Republic and Slovenia are omitted due to incomplete data. The EU countries considered in this analysis are Austria (AUT), Belgium (BEL), Finland (FIN), France (FRA), Germany (GER), Greece (GRE), Ireland (IRE), Italy (ITA), Netherlands (NET), Portugal (PORT) and Spain (SPN). All the data are obtained from Eurostat. Following Husted's (1992) model, the exports ( $X$ ) consist of exports of goods and services while imports ( $MM$ ) consist of imports of goods and services in addition to net interest payments and net transfer payments. Both variables are expressed in terms of percentage of Gross Domestic Product (GDP). The consumer price index (CPI) is used to derive the real exports and real imports.

The data analysis consists of a series of sub-periods in order to capture the effects of the relationship between exports and imports in the specific time periods. These sub-periods can be classified into four development stages. The first sub-period refers to the period prior to the introduction of the Maastricht Treaty, which is prior to formation of European Union from 1980 to 1992. The second sub-period from 1993 to 1999 captures the subsequent effect of the establishment of the EU prior to introduction of the Euro currency area. The third sub-period denotes the period from 2000 to 2007 as to observe the effect of the introduction of the Euro currency until prior to the global financial crisis. The last sub-period aims to examine the effect of the global financial crisis starting in 2008.

The analysis of the current account sustainability in this study is based on exogenous or pre-determined structural breaks. The main reason for selecting these structural breaks of 1980-1992, 1993-1999, 2000-2007 and 2008-2013 is to provide better understanding on the behavior of the parameters of interest considering the important developments in the region. Determining the structural break endogenously is not suitable due to the limitation of the observations since this study uses annual data from 1980-2013.

In order to ensure reliability of the pre-determined structural breaks used in this study, I adopt the Chow test to examine the significance of those exogenous breaks. The general model specification of the Chow test is as shown in Equation 3.14 and 3.15.

$$X_t = \alpha + \beta MM_t + e_t \quad (3.14)$$

$$X_t = \alpha + \beta MM_t + \theta D_t + \delta D_t MM_t + e_t \quad (3.15)$$

where  $X_t$  = dependent variable,  $MM_t$  = independent variable,  $D_t$  = dummy for the pre-determined structural breaks: namely 1992, 1999 and 2007,  $\alpha$  = constant,  $e_t$  = error terms,  $\beta$  = coefficient of the independent variable,  $\theta$  = coefficient of the dummy (either 1 after the break and 0 before the break) and  $\delta$  = coefficient of the interaction between dummy and independent variable. The model has constant parameters if  $\theta$  and  $\delta$  are equal to zero where  $H_0: \theta = \delta = 0$  and  $H_1$ : at least one coefficient is not equal to zero. If the null hypothesis of constant coefficients of no breaks is rejected, then this provides evidence of structural breaks at the chosen break points.

### **3.4. Empirical Results and Discussions**

#### **3.4.1. Significance of the Structural Breaks**

Table 3.3 indicates the results of the Chow test in order to test of the significance of the pre-determined structural breaks, namely 1992, 1999 and 2007. The null hypothesis states that there is no structural break. If the  $p$ -value is less than the 5 percent significance level, then we can reject the null hypothesis in favor of the alternative hypothesis that there is evidence of a structural break. For all the chosen time periods, Table 3.3 shows that the Chow test rejects the null hypothesis and thus implies significance of those exogenous breaks.

#### **3.4.2. Panel Unit Root Test Results**

Common practice requires identification of the order of the macroeconomics variables prior to performing the cointegration test. The IPS test is employed at levels and first differences with the objective to detect the possible unit roots or non-stationarity. The IPS panel unit root test results are reported in Table 3.4. The second column depicts the statistic values while the third column denotes the  $p$ -values. The results indicate that

the null hypothesis of the unit roots cannot be rejected in levels. While the null hypothesis can be rejected in first differences. Thus indicating the variables are  $I(1)$ . This means that the variables are non-stationary in levels and stationary in first differences for the case of the eleven EU countries. Thus, panel cointegration can be performed to investigate possible evidence of a cointegrating relationship between exports and imports.

### **3.4.3. Pedroni Cointegration Tests Results**

Table 3.5 reports the outcome for the Pedroni (1999) cointegration test for exports and import of the eleven EU countries. Column (A) refers to the full sample period from 1980 to 2013; Column (B) denotes sub-period from 1980 to 1992, Column (C) denotes sub-period from 1993 to 1999, Column (D) refers to sub-period from 2000 to 2007 and lastly Column (E) denotes sub-period from 2008 to 2013. The results are based on four within-dimension or panel tests and three between-dimension or group tests, which serve as tools to detect existence of cointegration linkage. The computed values of the statistics in the within-dimension are obtained from pooling the autoregressive coefficient across countries on the estimated residuals. On the other hand, the computed values of the statistics in the between-dimension are obtained from average respective individual countries.

The results in Table 3.5 indicate rejection of the null hypothesis of no cointegration at 1%, 5% and 10% significance level for the full sample period 1980-2013 as shown in Column (A). Four out of seven statistic results favor rejection of the null hypothesis. This implies evidence of a long-run cointegrating relationship between exports and imports in the eleven EU countries. In terms of the sub-periods, evidence of

cointegration between exports and imports is discovered in sub-period 1980-1992 (prior to the establishment of EU) but this is rather weak. This can be seen from the results where four out of seven statistic results reject the null hypothesis of no cointegration as shown in Column (B). However out of this four statistic results, only two statistic results are significant at the 5% significance levels. The results for the sub-period 1993-1999 (prior to the introduction of Euro currency) indicates strong evidence of a cointegrating relationship between the parameters of interests where six out of seven statistic results reject the null hypothesis of no cointegration as shown in Column (C). There is no evidence of a long-run association between exports and imports in the sub-period 2000-2007 as depicted in Column (D). The sub-period 2008-2013 indicates rejection of null hypothesis of no cointegration with four out of seven statistic results in favor for rejection of null hypothesis of no cointegration as shown in Column (E). This indirectly shows evidence that current account can be considered as persistent even prior to EU enlargement (sub-period 1980-1992), before the introduction of Euro currency (sub-period 1993-1999) and after the global financial crisis (sub-period 2008-2013). The null hypothesis of no cointegration cannot be rejected for sub-period 2000-2007 and this implies that the current account is unsustainable during those periods.

The existence of the long-run association between exports and imports in the eleven EU countries in the full sample period shows there is no violation of the inter-temporal budget constraint. Therefore, further verification and estimation of the relationship between exports and imports and eventually determination of the sustainability of the current account can be performed via Pooled Mean Group estimator (PMG).

#### **3.4.4. Pooled Mean Group (PMG) Results - Group Level**

The presentation of the PMG outcomes is shown in Table 3.6 for eleven EU countries. The tables report the adjustment coefficients (known as the convergence parameter), long-run coefficients as well as short-run coefficients and the Hausman test. All the Hausman tests indicate failure to reject the null hypothesis, which means the PMG estimator is preferable relative to the MG estimator due to validity of the homogenous long-run assumption.

##### **3.4.4.1. Pooled Mean Group (PMG) Results - Group Level: Comparing Long-run and Short-run at Different Sub-Periods**

In Table 3.6, the adjustment coefficients in all the periods show the expected negative sign with statistically significant coefficients. The convergence coefficient in the full sample period in Column (A) is -0.108 and significant at 1% level. This result is consistent with findings of Durdu et al. (2013), where the adjustment coefficient for overall sample countries is -0.265, with coefficient of -0.201 and -0.316 for industrial countries and emerging nations, respectively. Note that they used net exports and net foreign assets as their parameters of interest. However, this result is inconsistent with findings from Schoder et al. (2013), where their coefficients are rather low -0.040 in their full sample period for the European Monetary Union countries. This may be due to the data used in their study, which are quarterly data, with some data obtained via interpolation. Based on the convergence coefficient result, there is evidence that the current account is persistent over the full period of 1980-2013. However, the long-run coefficient is 1.245, with deviation of 0.245 from an equilibrium value of 1. This implies violation of the long-run budget constraint and this indicates the current account is considered as unsustainable over the full period.

In terms of the sub-periods, the adjustment coefficient remains significant, but with higher values in the period 1993-1999 and the period 2008-2013. This indicates there is evidence of convergence of the imports from short-run to long-run perspective. In terms of the long-run perspective, the long-run coefficients exceeding value of one can be observed in the sub-periods 2000-2007 and 2008-2013, with coefficients of 1.245 and 1.302, respectively, with 0.245 and 0.302 deviations from equilibrium one. Those sub-periods are the period after the introduction of the Euro currency and after the global financial crisis. This signifies that current account is considered as unsustainable. In contrast, the long-run coefficient of sub-periods 1980-1992 and 1993-1999 take values 0.649 and 0.846, respectively, with 0.351 and 0.154 deviations from an equilibrium value of unity. These values lie within the budget constraint and with small deviation from the equilibrium of one. This implies no evidence of long-run budget constraint violation and thus the current account is considered sustainable.

The short-run coefficient for the full sample period 1980-2013 is 0.569, implying considerable average deviation from unity. The small magnitude of the short-run imbalances may indicate lower tendency of inability to repay foreign debt in the future. Thus, current account can be regarded as sustainable. In terms of the sub-periods, the short-run coefficient in sub-period 1980-1992 stood at 0.306 with 0.694 deviation from unity. The subsequent sub-period 1993-1999 shows a lower short-run coefficient of 0.195 with larger deviation of 0.805 from equilibrium of one. Nevertheless, the short-run coefficients recorded increasing trend of 0.236 and 0.358 in sub-period 2000-2007 and 2008-2013, respectively. Although the short-run coefficients for all the sub-periods are within the budget constraint, the short-run imbalances depict low coefficients and



with large deviation from equilibrium of unity, particularly in sub-period 1993-1999 (prior to the introduction of Euro currency). Thus, larger short-run imbalances may lead to the indication that the current account is unsustainable.

#### **3.4.4.2. Pooled Mean Group (PMG) Results - Group Level: Identification of the Current Account Sustainability Status**

With regards to the interpretation of the current account sustainability, Table 3.7 depicts the identification of the current account sustainability status based on full sample period and the series of sub-periods for the eleven EU countries. Based on the results from the convergence coefficients along with the long-run and short-run coefficients, the status of the current account can be identified. For the full sample period 1980-2013, the ECT coefficients and short-run results show that current account is considered sustainable. However, the long-run results show violation of the long-run budget constraint and thus the current account is considered unsustainable.

In terms of sub-periods the ECT coefficients results show that the current account is considered sustainable in all sub-periods. However, there are mixed conclusions regarding the status of the current account sustainability in the sub-periods from the long-run perspective. The long-run outcomes indicate that the current account is sustainable in the sub-period 1980-1992 (prior to formation of EU) and sub-period 1993-1999 (prior to introduction of Euro currency). The current account is regarded as unsustainable due to the violation of long-run budget constraint in sub-period 2000-2007 (after the introduction of Euro currency) and sub-period 2008-2013 (after global financial crisis). Meanwhile, the short-run results depict that current account is regarded

as unsustainable in all the sub-periods due to the large imbalances or deviation from the equilibrium value of unity.

Therefore, sustainability of the current account may shift to unsustainable when taking into account the different time periods. Furthermore, large imbalances in the short-run will lead to the tendency of unsustainable current account. This is in line with conclusion from Schoder et al. (2013) where the sustainable of the external debt becomes unsustainable corresponding to the introduction of the Euro. Their study only focus on one structural break that may not reflect the whole situation. There are a series of major development in the European region such as the formation of the European Union in 1992 and global financial crisis in 2008 in addition to the introduction of the Euro currency in 1999, which are incorporated in this study. By looking at the different sub-periods, the trajectory of the current account sustainability can be observed prior and post particular sub-periods and this may provide indication on the ability of the government in financing their debts in the future. The results from this study shows that sustainability of the current account may shift to unsustainable when considering a series of structural breaks, rather than on one particular structural break. The arguments are based on the fact of the economic convergence or economic catching-up which is built on stages of development hypothesis. The establishment of EU in 1992, EU enlargement and further economic integration via the Single Euro currency in 1999 lead countries at lower stage of development has the tendency to import capital and eventually experiencing current account deficit. The new evidence from this study is the consequences of the debt crisis also contribute to the unsustainable current account in the region.

### **3.4.5. Pooled Mean Group (PMG) Results - Individual Level**

Analyzing the sustainability of the current account at country level provides further understanding and identify which country may encounter financing debts problems in the future if the country exhibit unsustainable current account. The error-correction coefficients and short-run coefficients are reported in Table 3.8 and Table 3.9 for each country. The evidence of significant error-correction term coefficients and short-run coefficients are identified as either Y (significant ECT) or N (insignificant ECT). In terms of the ECT coefficients, existence of negative and significant ECT coefficients denotes the existence of convergence to the long-run equilibrium and signifies the sustainability of the current account. On the other hand, insignificant ECT coefficients indicate non-convergence evidence between the parameters of interests and means that the current account is unsustainable. The measurement of the deviations from the equilibrium of unity for the significant short-run coefficients provide insight on the gap between those coefficients. The deviation of 0.5 is used as a benchmark to determine whether the gap is large or small. The larger the gap, the more it signifies the tendency of violation of the IBC condition, provides evidence of an unsustainable of the current account.

#### **3.4.5.1. Pooled Mean Group (PMG) Results - Individual Level: ECT Results**

In terms of the full sample period 1980-2013 as shown in Column (A), eight out of eleven EU countries portray insignificant error-correction terms and this signifies no evidence favoring convergence towards equilibrium. This indicates that the other three countries, namely Belgium, Ireland and the Netherlands, demonstrate evidence of convergence and thus current account of those countries are considered sustainable.

Loosely speaking, most of the eleven EU countries experienced unsustainable current account for the period 1980 to 2013.

The results from the sub-periods provide more insight on the behavior of the current account of the eleven EU countries. In the sub-period 1980-1992, the majority of the EU countries in the sample experienced persistent current account. This can be verified via the convergence parameters, where most are negative and statistically significant, with exceptional case for Germany, Greece and Spain. The subsequent sub-period 1993-1999, that seven out of eleven EU countries demonstrate evidence of persistent current account. The seven EU countries are Belgium, Finland, France, Germany, Italy, the Netherlands and Spain. This indirectly implies that the other four EU countries in the Euro Area experienced unsustainable current accounts in this period. This may be due to the catching-up or economic convergence of those countries that are at relatively lower stages of development and rely heavily on importation of capital of development purpose. The evidence for sustainable current accounts becomes stronger in the sub-period 2000-2007, which represent the effect of the introduction of Euro currency. Almost three quarters of the sample countries exhibit evidence of convergence and thus persistence in the current account. The results indicate eight out of the eleven EU countries have significant ECT coefficients. This signifies that the adoption of the Euro currency contributes to the stability in the currency and economic development in the region. The sub-period 2009-2013 demonstrates marginal evidence of persistent current accounts. The results portray six out of eleven EU countries have significant ECT coefficients. This means that the severe implication of the global financial crisis contributed to the unsustainable current account in half of the sample countries.

The error-correction term coefficients indicate evidence of unsustainable current account for all countries in the full sample 1980-2013. However, the current account is considered as sustainable in each sub-period with weaker evidence in the sub-period 2008-2013.

#### **3.4.5.2. Pooled Mean Group (PMG) Results - Individual Level: Short-run Results**

In terms of the short-run coefficients, all the values in the full sample period 1980-2013 as depicted in Column (A) of Table 3.9 are within the range of 0 and 1. This shows that the current account trend of the eleven EU countries are consistent with the long-run budget constraint although there are two countries that have comparatively larger deviation from value one, namely Belgium and Portugal with coefficients of 0.470 and 0.495, respectively. The short-run results demonstrate that the persistence of the current account is sensitive to the different time periods. In the sub-period 1980-1992, five countries, Austria, Belgium, Greece, Ireland and the Netherlands, depict significant short-run coefficients with Greece and the Netherlands having relatively lower coefficients of 0.433 and 0.432, respectively. This denotes ambiguity of the current account persistency indicator as almost half of the eleven EU countries show insignificant short-run coefficients. The sub-period 1993-1999 shows less countries with significant short-run coefficients, namely Austria, Finland, Germany and Ireland. This signifies the tendency of violation of the IBC and leads to unsustainable current accounts during this sub-period since the majority of the countries depict insignificant short-run relationship evidence. Similarly, this may be due to the catching-up effect among the EU countries since the establishment of EU in 1992. Meanwhile, the sub-period 2000-2007 shows eight out of eleven EU countries exhibit significant short-run coefficients with insignificant short-run coefficients for Austria, Germany and Ireland.

Within the eight countries, Belgium, Greece, Italy and Spain show larger imbalances with more than 0.500 deviation from equilibrium of one, indicating potential of unsustainable current accounts. The sub-period 2008-2013 also shows that six out of eleven EU countries, namely, Belgium, France, Germany, Ireland, Italy and the Netherlands, have insignificant short-run coefficients. This indicates evidence of unsustainable current accounts in the 2008-2013 period.

Overall, the country level results show that the non-existence of short-run evidence in sub-periods 1980-1992, 1993-1999 and 2008-2013 indicating that the short-run imbalances may lead to unsustainable current accounts.

#### **3.4.6. Summary of the Results on the Current Account Sustainability**

Table 3.10 depicts the summary of the current account sustainability results for the eleven Euro countries based on the panel cointegration and pooled mean group estimator methods. The main purpose is to compare evidence from the long-run and short-run-perspectives that may lead to ambiguous conclusions regarding the status of the current account of the sample countries as either sustainable or unsustainable. The determination of the current account status is ambiguous in the case where there is contradiction between the results from the long-run and short-run-perspectives. The results from the panel cointegration that capture the long-run association between the parameters of interest show that there is evidence of a long-run relationship between exports and imports in the full sample period 1980-2013 and thus current account is considered as sustainable. The results from the pooled mean group estimators method show that in the full sample period 1980-2013, 27 percent of sample countries indicate significant error-correction terms while 73 percent show insignificant convergence

terms. This implies that the majority of the countries in the sample exhibit unsustainable current accounts due to the large portion of the countries do not show evidence of convergence. In terms of the short-run perspective, the majority of the countries show significant short-run coefficients with 82 percent against 18 percent. Within this 82 percent, 78 percent of the countries exhibit deviation of the short-run coefficient from the equilibrium value of 1 with a gap of more than 0.5. The short-run results indicate only a small number of countries have deviation of gap more than 0.5 magnitude and thus this signifies that the probability of the countries experiencing unsustainable current account is low.

When considering the pre-determined structural breaks, there are evidences of long-run interaction between exports and imports for sub-periods 1980-1992, 1993-1999 and 2008-2013. This means that current account is viewed as sustainable from the long-run perspective in all sub-periods except for sub-period 2000-2007, which is prior to the global financial crisis. In terms of the convergence perspective, the results show significant error-correction terms for most of the countries with 73 percent versus 27 percent in sub-period 1980-1992 and 2000-2007, 64 percent versus 36 percent in sub-period 1993-1999 and 55 percent versus 45 percent in sub-period 2000-2013. This indicates that the current account can be considered sustainable in most of the countries in those sub-periods. However, the number of countries that can be viewed as exhibiting sustainable current accounts in the long-run had fallen to around 50 percent in the last sub-period 2008-2013, which is aftermath the global financial crisis. In terms of the short-run perspective, there are a small number of countries that indicate significant short-run coefficients for all sub-periods, except for sub-period 2000-2007 where 73 percent of the sample countries show evidence of short-run interaction. Within the

significant short-run results, 3 out of 5 countries in the sub-period 1980-1992 while 4 out of 5 countries in the sub-period 2008-2013 depict short-run deviation less than 0.5 magnitude from the equilibrium of 1. This indicates that the likelihood of those countries experiencing unsustainable current account is low. In contrast, 3 out of 5 countries in the sub-period 1993-1999 depict large short-run deviation from equilibrium of 1 and thus casts some doubt on sustainability of the current account. Meanwhile, the sustainability of the current account status is ambiguous in the sub-period 2000-2007 where 50 percent of the sample countries exhibit large or small short-run deviation from equilibrium of 1.

Table 3.11 shows the summary of the current account sustainability results at the individual country level. The main objective is to show that the determination of the current account status as either sustainable or unsustainable may be unknown for respective individual countries due to inconsistency in outcome between the long-run error-correction terms and the short-run perspective, particularly the gap of the short-run deviation. In the full sample period 1980-2013, the current account sustainability status is ambiguous due to mixed evidence from the error-correction terms and short-run perspective. For instance, convergence results indicate that the current account is considered unsustainable in Austria, Finland, France, Germany, Italy and Spain while the short-run results indicate the current account is unsustainable in Belgium and the Netherlands. Both the convergence and short-run results show evidence that current account is unsustainable in Greece and Ireland in the full sample period. In the sub-period 1980-1992, both the error-correction term and short-run results depict that Belgium exhibited sustainable current account whereas Greece and Portugal experienced unsustainable current account. In other words, there are mixed results on



the status of the current account for the other eight countries. In the sub-period 1993-1999, the current account is considered as sustainable in Germany while France, Greece and Portugal experienced unsustainable current account. These conclusions are based on the similar evidence from convergence and short-run results. The evidence of sustainable current account can be observed in Finland and the Netherlands but unsustainable current account experienced by Greece in the sub-period 2000-2007. Meanwhile, there is evidence that the current account is sustainable in Finland and unsustainable in Ireland and Italy in the sub-period 2008-2013.

In a nutshell, the importance of the short-run indicator in determining the likelihood of a country in experiencing unsustainable current account in the future cannot be denied. The large (small) gap of the short-run deviation from the equilibrium value of 1 provides an early signal regarding the unsustainability of the current account in the long-run. Although the long-run results signify that the current account is sustainable, the short-run results may provide contradictory conclusions on the status of the current account. Thus, taking into consideration the short-run perspective is crucial in detecting the likelihood of a country experiencing impediments in financing its future debt.

### **3.5. Conclusion**

This paper has examined both the long-run and short-run indicators of the current account sustainability. Despite the long-run view of the current account behavior, short-run view also play important role as large deviation of the current account imbalance in the short-run may reflect impediments in the future debt repayment efforts. This paper investigated the sustainability of the current account in the eleven EU countries using data on exports and imports as well as taking into account different time frames.

This is crucial as to reflect the development in the EU region such as formation of EU in 1992, introduction of Euro currency in 1999 and effect of the global financial crisis in 2008.

The empirical findings from the panel cointegration and pooled mean group estimator indicate evidence in favor of a long-run association between exports and imports. This means that there is no violation of the long-run budget constraint and the current account is considered sustainable. Nevertheless, the results from the various sub-periods show sustainability of the current account may shift upon different time frames. The results from the error-correction terms indicate that the current account is sustainable in all the sub-periods while there is a mixed conclusions from the long-run results. On the other hand, the short-run results indicate that current account is unsustainable in all the sub-periods. Furthermore, the results of the pooled mean group estimator at individual level provide more insight on the behavior of the current account of each country. This is due to the fact that some countries may experience changes in the current account sustainability from sustainable to unsustainable or vice versa in certain sub-periods.

Therefore, the current account in the eleven EU countries is considered sustainable in the long-run. However, short-run imbalances and consideration on different timeframes provides an indicator that the current accounts may not be sustainable over time.

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**Table 3.1: Global Current Account Imbalances (% of GDP)**

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Advanced Economies	-0.7	-0.7	-1.2	-1.2	-0.9	-1.2	-0.2	-0.2	-0.2	-0.1
European Union	0.1	0.4	-0.1	-0.4	-0.6	-1.0	-0.1	-0.1	0.4	1.3
Developing Asia	2.8	2.6	3.4	5.6	6.6	5.6	3.7	3.3	1.6	0.9
Latin America & Caribbean	0.5	1.0	1.4	1.6	0.4	-0.7	-0.6	-1.2	-1.3	-1.9
Middle East & North Africa	6.5	9.5	16.0	18.0	14.2	15.0	2.4	7.7	14.2	13.2
Sub-Saharan Africa	-2.8	-1.4	-0.6	4.3	1.6	0.1	-2.3	-1.2	-1.7	-3.0
Euro Area	0.4	1.1	0.4	0.3	0.2	-0.7	0.1	0.3	1.1	1.3

Source: World Economic Outlook, International Monetary Fund.

**Table 3.2: Current Account Imbalances in Euro Area (% of GDP)**

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<i>Persistent Current Account Surplus</i>										
Austria	1.7	2.2	2.2	2.8	3.5	4.9	3.1	2.7	1.9	1.8
Belgium	3.4	3.2	2.0	1.9	1.6	-1.8	0.0	1.0	-1.0	-1.6
Finland	4.8	6.2	3.4	4.2	4.3	2.8	2.3	3.1	-1.2	-1.8
Germany	1.9	4.7	5.1	6.3	7.5	6.3	5.6	5.7	5.7	7.0
Luxembourg	8.1	11.9	11.5	10.4	10.1	5.3	6.9	7.8	7.1	5.7
Netherlands	5.6	7.8	7.6	9.7	6.7	4.4	4.9	7.1	8.5	10.1
<i>Persistent Current Account Deficit</i>										
Cyprus	-2.3	-5.0	-5.9	-7.0	-11.7	-17.2	-7.5	-7.7	-10.4	-6.5
Estonia	-11.3	-11.3	-10.0	-15.3	-17.2	-9.7	4.5	3.6	2.1	-1.8
France	0.7	0.5	-0.5	-0.6	-1.0	-1.7	-1.5	-1.7	-1.9	-2.2
Ireland	0.0	-0.6	3.5	-3.5	-5.3	-5.6	-2.9	0.5	1.1	4.4
Greece	-6.6	-5.9	-7.4	-11.2	-14.4	-14.7	-11.0	-10.5	-9.8	-3.4
Italy	-1.3	-0.9	-1.7	-2.6	-2.4	-2.9	-2.1	-3.3	-3.3	-0.7
Malta	-3.1	-5.9	-8.7	-9.8	-8.1	-7.4	-7.5	-4.8	-1.3	1.1
Portugal	-6.5	-8.4	-10.4	-10.7	-10.1	-12.6	-10.9	-9.9	-6.4	-1.5
Slovak Rep	-5.9	-7.8	-8.5	-7.8	-5.3	.6.6	-3.2	-3.5	0.1	2.3
Slovenia	-0.8	-2.6	-1.7	-2.5	-4.8	-6.7	-1.3	-0.8	0.0	3.3
Spain	-3.5	-5.3	-7.4	-9.0	-10.0	-9.6	-5.2	-4.6	-3.5	-1.1

Source: World Economic Outlook, International Monetary Fund.

**Table 3.3: Chow Test - Structural Breaks**

	1992	1999	2007
<i>F</i> -statistic	36.98	11.69	4.34
Probability	0.000	0.000	0.01

Notes: Null hypothesis is no structural break. If *p*-value is less than 0.05 significance level, reject the null hypothesis and there is evidence of break.

**Table 3.4: Panel Unit Root results 1980-2013**

	Statistic	<i>p</i> -value
<i>With Trend:</i>		
EX	-0.546	0.293
IM	-1.279	0.101
<i>Without Trend:</i>		
$\Delta$ EX	-9.891***	0.000
$\Delta$ IM	-11.222***	0.000

Notes:  $\Delta$  refers to first difference operator. Automatic lag length selection based on Schwarz Information Criterion (SIC). IPS indicates Im et al. (2003) test.

\*\*\* denotes significance at 1%.

\*\* denotes significance at 5%.

\* denotes significance at 10%.

**Table 3.5: Pedroni Panel Cointegration Results for Eleven EU countries**

	(A) 1980-2013	(B) 1980-1992	(C) 1993-1999	(D) 2000-2007	(E) 2008-2013
Within-dimension (Panel):					
<i>v</i> -stat	-0.923	0.309	4.315***	-0.650	-0.222
$\rho$ -stat	-1.216	-0.337	-2.126**	0.933	-0.176
PP-stat	-4.111***	-1.480*	-5.115***	0.461	-5.870***
ADF-stat	-4.164***	-3.063***	-5.1345***	0.893	-6.046***
Between-dimension (Group):					
$\rho$ -stat	-0.356	1.131	0.904	2.216	2.016
PP-stat	-1.926**	-1.505*	-2.759***	-0.255	-2.333***
ADF-stat	-1.719**	-2.248**	-2.987***	0.143	-2.975***

Notes: The test statistics are normalized so that asymptotic distribution is standard normal.

\*\*\* denotes significance at 1%.

\*\* denotes significance at 5%.

\* denotes significance at 10%.

**Table 3.6: Pooled Mean Group Estimator for Eleven EU Countries**

	(A) 1980-2013	(B) 1980-1992	(C) 1993-1999	(D) 2000-2007	(E) 2008-2013
Adjustment Coefficient	-0.108** (0.049)	-0.382*** (0.064)	-0.543*** (0.131)	-0.358*** (0.101)	-0.469*** (0.055)
Long-run Coefficient	1.245*** (0.053)	0.649*** (0.043)	0.846*** (0.033)	1.245*** (0.044)	1.302*** (0.036)
<i>Deviation from 1</i>	<i>0.245</i>	<i>-0.351</i>	<i>-0.154</i>	<i>0.245</i>	<i>0.302</i>
Short-run Coefficient	0.569*** (0.061)	0.306*** (0.100)	0.195** (0.089)	0.236** (0.117)	0.358*** (0.057)
<i>Deviation from 1</i>	<i>-0.431</i>	<i>-0.694</i>	<i>-0.805</i>	<i>-0.764</i>	<i>-0.642</i>
Hausman test	2.390 [0.122]	0.390 [0.531]	0.000 [0.948]	0.420 [0.515]	0.000 [0.968]
Observations	363	132	77	88	55
Countries	11	11	11	11	11

Notes: The value in parenthesis indicates the standard error. The  $p$ -values are reported in brackets for Hausman tests.

\*\*\* denotes significance at 1%.

\*\* denotes significance at 5%.

\* denotes significance at 10%.



**Table 3.7: Identification of Current Account Sustainability for Eleven EU Countries**

	<b>(A)</b> <b>1980-2013</b>	<b>(B)</b> <b>1980-1992</b>	<b>(C)</b> <b>1993-1999</b>	<b>(D)</b> <b>2000-2007</b>	<b>(E)</b> <b>2008-2013</b>
Convergence Coefficient (Sustainable/Unsustainable)	Significant (Sustainable)	Significant (Sustainable)	Significant (Sustainable)	Significant (Sustainable)	Significant (Sustainable)
Long-run Coefficient (Sustainable/Unsustainable)	Violation (Unsustainable)	No Violation (Sustainable)	No Violation (Sustainable)	Violation (Unsustainable)	Violation (Unsustainable)
Short-run Coefficient (Sustainable/Unsustainable)	Small Deviation (Sustainable)	Large Deviation (Unsustainable)	Large Deviation (Unsustainable)	Large Deviation (Unsustainable)	Large Deviation (Unsustainable)
Observations	363	132	77	88	55
Countries	11	11	11	11	11

Notes: The value in parenthesis indicates the standard error. The  $p$ -values are reported in brackets for Hausman tests.

**Table 3.8: Pooled Mean Group - Individual Level**

	(A)		(B)		(C)		(D)		(E)	
	1980-2013		1980-1992		1993-1999		2000-2007		2008-2013	
	ECT	SR	ECT	SR	ECT	SR	ECT	SR	ECT	SR
AUS	-0.132 (0.099)	0.752*** (0.124)	-0.453* (0.252)	0.625** (0.277)	0.023 (0.280)	0.494** (0.250)	-0.896*** (0.194)	-0.376 (0.263)	-0.568** (0.174)	0.329* (0.189)
BEL	-0.307*** (0.084)	0.470*** (0.099)	-0.298*** (0.092)	0.674*** (0.103)	-0.968** (0.388)	0.183 (0.402)	-0.354*** (0.063)	0.371*** (0.091)	-0.0809*** (0.129)	-0.044 (0.110)
FIN	0.003 (0.066)	0.854*** (0.119)	-0.460* (0.276)	0.389 (0.339)	-0.844*** (0.112)	-0.309* (0.159)	-0.171*** (0.062)	0.580*** (0.096)	-0.349*** (0.125)	0.814*** (0.178)
FRA	-0.026 (0.059)	0.607*** (0.103)	-0.548** (0.257)	0.213 (0.239)	-1.175*** (0.436)	0.045 (0.237)	-0.039 (0.139)	0.628*** (0.204)	-0.741*** (0.234)	-0.017 (0.246)
GER	-0.035 (0.043)	0.717*** (0.089)	-0.208 (0.136)	0.201 (0.192)	-0.302** (0.126)	0.726*** (0.076)	-0.383*** (0.099)	0.105 (0.120)	-0.572** (0.281)	0.477 (0.359)
GRE	-0.001 (0.069)	0.218 (0.136)	-0.119 (0.133)	-0.433** (0.217)	-0.109 (0.528)	0.108 (0.255)	0.035 (0.123)	0.378** (0.193)	0.099 (0.219)	0.784*** (0.180)
IRE	-0.069* (0.038)	0.677*** (0.118)	-0.193** (0.088)	0.724*** (0.192)	-0.023 (0.127)	0.496** (0.206)	-0.547*** (0.181)	0.014 (0.293)	-0.182 (0.142)	0.172 (0.279)
ITA	-0.079 (0.059)	0.659*** (0.096)	-0.859*** (0.188)	-0.002 (0.144)	-0.759*** (0.267)	0.074 (0.307)	-0.229** (0.112)	0.492*** (0.167)	-0.262 (0.487)	0.533 (0.592)
NET	-0.517*** (0.115)	0.234 (0.150)	-0.509** (0.241)	0.432* (0.249)	-1.002*** (0.285)	-0.128 (0.226)	-0.999*** (0.149)	-0.505*** (0.189)	-0.609* (0.338)	0.256 (0.422)
PORT	0.003 (0.059)	0.495*** (0.114)	-0.318** (0.161)	0.222 (0.195)	-0.217 (0.194)	0.179 (0.184)	-0.093 (0.140)	0.596*** (0.207)	0.218 (0.239)	0.806*** (0.225)
SPN	-0.027 (0.079)	0.576*** (0.120)	-0.233 (0.166)	0.318 (0.309)	-0.599** (0.262)	0.283 (0.306)	-0.263** (0.111)	0.312** (0.138)	0.089 (0.125)	0.719*** (0.103)

Notes: The value in parenthesis indicates the standard error. \*\*\* denotes significance at 1%, \*\* denotes significance at 5% and \* denotes significance at 10%.

**Table 3.9: Pooled Mean Group - Individual Level (Significant and Deviation from Equilibrium)**

	(A) 1980-2013		(B) 1980-1992		(C) 1993-1999		(D) 2000-2007		(E) 2008-2013	
	ECT	SR	ECT	SR	ECT	SR	ECT	SR	ECT	SR
AUS	N	Y (-0.248)	Y	Y (-0.375)	N	Y (-0.506)	Y	N	Y	Y (-0.671)
BEL	Y	Y (-0.530)	Y	Y (-0.326)	Y	N	Y	Y (-0.629)	Y	N
FIN	N	Y (-0.146)	Y	N	Y	Y (-0.691)	Y	Y (-0.420)	Y	Y (-0.186)
FRA	N	Y (-0.393)	Y	N	Y	N	N	Y (-0.372)	Y	N
GER	N	Y (-0.283)	N	N	Y	Y (-0.274)	Y	N	Y	N
GRE	N	N	N	Y (-0.567)	N	N	N	Y (-0.622)	N	Y (-0.216)
IRE	Y	Y (-0.323)	Y	Y (-0.276)	N	Y (-0.504)	Y	N	N	N
ITA	N	Y (-0.341)	Y	N	Y	N	Y	Y (-0.508)	N	N
NET	Y	N	Y	Y (-0.568)	Y	N	Y	Y (-0.495)	Y	N
PORT	N	Y (-0.505)	Y	N	N	N	N	Y (-0.404)	N	Y (-0.194)
SPN	N	Y (-0.424)	N	N	Y	N	Y	Y (-0.688)	N	Y (-0.281)
# of Y	3	9	8	5	7	4	8	8	6	5
# of N	8	2	3	6	4	7	3	3	5	6
# of SR coefficients deviation < 0.500	-	7	-	3	-	1	-	4	-	4
# of SR coefficients deviation > 0.500	-	2	-	2	-	3	-	4	-	1

Notes: Y denotes significant coefficients and N denotes insignificant coefficients; SR refers to short-run and values in the parenthesis denote deviation from the equilibrium of 1.

**Table 3.10: Summary of the Results on the Current Account Sustainability**

<b>Panel Cointegration</b>	<b>Full Sample: 1980-2013</b>		<b>Sub-period: 1980-1992</b>		<b>Sub-period: 1993-1999</b>		<b>Sub-period: 2000-2007</b>		<b>Sub-period: 2008-2013</b>	
LR	Y		Y		Y		N		Y	
<b>Pooled Mean Group</b>	<b>Full Sample: 1980-2013</b>		<b>Sub-period: 1980-1992</b>		<b>Sub-period: 1993-1999</b>		<b>Sub-period: 2000-2007</b>		<b>Sub-period: 2008-2013</b>	
	<b>Sig</b>	<b>Insig</b>	<b>Sig</b>	<b>Insig</b>	<b>Sig</b>	<b>Insig</b>	<b>Sig</b>	<b>Insig</b>	<b>Sig</b>	<b>Insig</b>
ECT [11]	27% [3]	73% [8]	73% [8]	27% [3]	64% [7]	36% [4]	73% [8]	27% [3]	55% [6]	45% [5]
SR [11]	82% [9]	18% [2]	45% [5]	55% [6]	36% [4]	64% [7]	73% [8]	27% [3]	45% [5]	55% [6]
<i>Deviation:</i>										
<0.5	78% [7]	-	60% [3]	-	25% [1]	-	50% [4]	-	80% [4]	-
>0.5	22% [2]	-	40% [2]	-	75% [3]	-	50% [4]	-	20% [1]	-

Notes: LR denotes long-run; ECT denotes error correction terms; SR denotes short-run; Sig refers to significant; Insig refers to insignificant; Y denotes Yes and N denotes No; Deviation of <0.5 implies smaller gap of the SR coefficients from equilibrium of 1 while deviation of >0.5 implies larger gap of the SR coefficients from equilibrium of 1; values in the bracket indicate number of countries.

**Table 3.11: Summary of Current Account Sustainability at Individual Country Level**

Countries	Full Sample: 1980-2013		Sub-period: 1980-1992		Sub-period: 1993-1999		Sub-period: 2000-2007		Sub-period: 2008-2013	
	ECT	SR	ECT	SR	ECT	SR	ECT	SR	ECT	SR
<i>Non-Periphery</i>										
AUS	N	Y	N	Y	Y	N	Y	N	Y	N
BEL	Y	N	<b>Y</b>	<b>Y</b>	Y	N	Y	N	Y	N
FIN	N	Y	Y	N	Y	N	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>
FRA	N	Y	Y	N	<b>N</b>	<b>N</b>	N	Y	Y	N
GER	N	Y	Y	N	<b>Y</b>	<b>Y</b>	Y	N	Y	N
NET	Y	N	Y	N	Y	N	<b>Y</b>	<b>Y</b>	Y	N
<i>Periphery</i>										
GRE	N	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	N	Y
IRE	<b>Y</b>	<b>Y</b>	N	Y	Y	N	Y	N	<b>N</b>	<b>N</b>
ITA	N	Y	Y	N	Y	N	Y	N	<b>N</b>	<b>N</b>
PORT	N	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	N	Y	N	Y
SPN	N	Y	Y	N	Y	N	Y	N	N	Y

Notes: ECT denotes error correction terms; SR denotes short-run; Y denotes Yes or evidence that current account is sustainable and N denotes No or current account is unsustainable; Bold Y or N indicate evidences of the current account is sustainable/unsustainable based on the similar results from error-correction terms and short-run perspective.

### Appendix 3.1

All statistics are from Pedroni (1997a).

Panel  $\nu$ -statistic:

$$T^2 N^{3/2} Z_{\hat{\nu}_{N,T}} \equiv T^2 N^{3/2} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1}$$

Panel  $\rho$ -statistic:

$$T\sqrt{N} Z_{\hat{\rho}_{N,T-1}} \equiv T\sqrt{N} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1}^2 \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \right)$$

Panel  $t$ -statistic (non-parametric):

$$Z_{t_{N,T}} \equiv \left( \hat{\sigma}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1}^2 \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \right)$$

Panel  $t$ -statistic (parametric):

$$Z_{t_{N,T}}^* \equiv \left( \tilde{s}_{N,T}^{*2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1}^{*2} \Delta \hat{e}_{i,t}^*) \right)$$

Group  $\rho$ -statistic:

$$TN^{-1/2} \tilde{Z}_{\hat{\rho}_{N,T-1}} \equiv TN^{-1/2} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{t=1}^T (\hat{e}_{i,t-1}^2 \Delta \hat{e}_{i,t} - \hat{\lambda}_i)$$

Group  $t$ -statistic (non-parametric):

$$N^{-1/2}\tilde{Z}_{tN,T-1} \equiv N^{-1/2} \sum_{i=1}^N \left( \hat{\sigma}_i^2 \sum_{t=1}^T \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i)$$

Group  $t$ -statistic (parametric):

$$N^{-1/2}\tilde{Z}_{tN,T}^* \equiv N^{-1/2} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{t=1}^T (\hat{e}_{i,t-1}^* \Delta \hat{e}_{i,t}^*)$$

where

$$\begin{aligned} \hat{\lambda}_i &= \frac{1}{T} \sum_{s=1}^{k_i} \left( 1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\mu}_{i,t} \hat{\mu}_{i,t-s} \\ \hat{s}_i^2 &\equiv \frac{1}{T} \sum_{t=1}^T \hat{\mu}_{i,t}^2 \\ \hat{\sigma}_i^2 &= \hat{s}_i^2 + 2\hat{\lambda}_i \\ \hat{\sigma}_{N,T}^2 &\equiv \frac{1}{N} \sum_{i=1}^N \hat{L}_{11i}^{-2} \hat{\sigma}_i^2 \\ \hat{s}_i^{*2} &\equiv \frac{1}{t} \sum_{t=1}^T \hat{\mu}_{i,t}^{*2} \\ \hat{s}_{N,T}^{*2} &\equiv \frac{1}{N} \sum_{i=1}^N \hat{s}_i^{*2} \\ \hat{L}_{11i}^{-2} &= \frac{1}{T} \sum_{t=1}^T \hat{\eta}_{i,t}^2 + \frac{2}{T} \sum_{s=1}^{k_i} \left( 1 - \frac{s}{k_i + 1} \right) \sum_{t=s+1}^T \hat{\eta}_{i,t} \hat{\eta}_{i,t-s} \end{aligned}$$

where the residuals  $\hat{\mu}_{i,t}$ ,  $\hat{\mu}_{i,t}^*$  and  $\hat{\eta}_{i,t}$  are obtained from the following regressions:

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \hat{\mu}_{i,t}$$

$$\hat{e}_{i,t} = \hat{\gamma}_i \hat{e}_{i,t-1} + \sum_{k=1}^{K_i} \hat{\gamma}_{i,k} \Delta \hat{e}_{i,t-k}^* + \hat{\mu}_{i,t}^*$$

$$\Delta y_{i,t} = \sum_{m=1}^M \hat{b}_{mi} \Delta x_{mi,t} + \hat{\eta}_{i,t}$$

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### Appendix 3.2: Selected Literature Reviews on Current Account Sustainability: Time-series Analysis

Authors	Methods/Variables	Sample	Findings
Kalyoncu and Ozturk (2010)	<ul style="list-style-type: none"> <li>• Cointegration</li> <li>• Real X &amp; M</li> </ul>	<ul style="list-style-type: none"> <li>• Latin America and Caribbean</li> <li>• 1980:Q1 - 2006:Q2</li> </ul>	<ul style="list-style-type: none"> <li>• CA Sustainable - Peru</li> <li>• CA unsustainable - Colombia, Venezuela, Mexico, Brazil and Argentina</li> </ul>
Pattichis (2010)	<ul style="list-style-type: none"> <li>• Bounds testing approach</li> </ul>	<ul style="list-style-type: none"> <li>• Cyprus</li> <li>• 1976 to 2004</li> </ul>	<ul style="list-style-type: none"> <li>• No violation of its intertemporal budget constraint and its current account balance is ‘strongly’ sustainable in the long-run</li> </ul>
Holmes et al. (2011)	<ul style="list-style-type: none"> <li>• Cointegration</li> <li>• Breitung nonparametric procedure</li> </ul>	<ul style="list-style-type: none"> <li>• India</li> <li>• 1950 to 2003</li> </ul>	<ul style="list-style-type: none"> <li>• Regime of noncointegration runs until the late 1990s and the second regime of cointegration is present after that</li> </ul>
Apergis, et al. (2000)	<ul style="list-style-type: none"> <li>• Unit root &amp; Cointegration</li> </ul>	<ul style="list-style-type: none"> <li>• Greece</li> <li>• 1960-1994</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence of CAD sustainability</li> </ul>
Yol (2009)	<ul style="list-style-type: none"> <li>• Bounds testing approach &amp; Cointegration</li> <li>• X &amp; M</li> </ul>	<ul style="list-style-type: none"> <li>• Egypt, Morocco and Tunisia</li> <li>• 1972-2005</li> </ul>	<ul style="list-style-type: none"> <li>• Cointegration between exports and imports in three countries; Egypt and Morocco CAD unsustainable</li> </ul>
Fountas and Wu (1999)	<ul style="list-style-type: none"> <li>• Engle-Granger cointegration</li> <li>• X &amp; M</li> </ul>	<ul style="list-style-type: none"> <li>• USA</li> <li>• 1967q-1994q</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence of cointegration.</li> </ul>
Holmes (2006)	<ul style="list-style-type: none"> <li>• ADF regressions within a seemingly unrelated regression (SURADF)</li> </ul>	<ul style="list-style-type: none"> <li>• 16 Latin American countries</li> <li>• 1979–2001</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence in favor of current account mean-reversion for at least 12 Latin American countries</li> </ul>
Chen (2011)	<ul style="list-style-type: none"> <li>• Unit root process with regime switching</li> <li>• Current account</li> </ul>	<ul style="list-style-type: none"> <li>• OECD countries</li> <li>• 1970q-2009q</li> </ul>	<ul style="list-style-type: none"> <li>• LRBC does not hold for the Australia, the Czech Republic, Finland, Hungary, New Zealand, Portugal or Spain – CA unsustainable</li> </ul>

### Appendix 3.3: Selected Literature Reviews on Current Account Sustainability: Panel Analysis

Authors	Methods/Variables	Sample	Findings
Baharumshah et al. (2005)	<ul style="list-style-type: none"> <li>Exports &amp; Imports</li> </ul>	8 East Asia	<ul style="list-style-type: none"> <li>Current account imbalances were not on the long-run steady state in the pre-crisis era, but sustainable during the post-crisis period.</li> </ul>
Holmes et al. (2010)	<ul style="list-style-type: none"> <li>Current account</li> <li>Panel unit root test: Hadri (2000)</li> </ul>	European countries	<ul style="list-style-type: none"> <li>Mixed evidence that current account stationarity applies when examining individual countries.</li> </ul>
Clower and Ito (2012)	<ul style="list-style-type: none"> <li>Current account</li> <li>Markov switching (MS) process</li> </ul>	70 countries	<ul style="list-style-type: none"> <li>Countries with budget deficits and current account deficits tend to stay in stationary regimes.</li> <li>Trade or financial openness - smaller degree of current account persistence.</li> <li>International reserves holding - larger degree of persistence.</li> </ul>
Durdu, et al. (2013)	<ul style="list-style-type: none"> <li>Net exports &amp; Net foreign assets</li> <li>PMG</li> </ul>	21 industrial and 29 emerging economies	<ul style="list-style-type: none"> <li>Solvency condition holds if net exports and net foreign assets are connected by error-correction term.</li> </ul>
Schoder et al. (2013)	<ul style="list-style-type: none"> <li>Net exports &amp; Net foreign assets</li> <li>PMG</li> <li>Panel unit root test: Breitung and Das (2005)</li> </ul>	European countries	<ul style="list-style-type: none"> <li>Introduction of the euro is associated with a regime shift from sustainability to unsustainability of external debt accumulation for the euro area</li> </ul>

# CURRICULUM VITAE

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Economic Integration between ASEAN+5 Countries: Comparison of GDP, *Global Review of Business and Economics Research*, 6, 2, (2010) 191-198. (with Chin-Hong Puah and Mattias Murphy Lai)

Bound Estimation for Trade Openness and Government Expenditure Nexus of ASEAN-4 Countries, *Economics, Management, and Financial Markets*, 4, 1, (2009) 103-112. (with Chin-Hong Puah and Chiew-Meu Wong)

Outward FDI of Malaysia: An Empirical Examination from Macroeconomic Perspective, *Economics Bulletin*, 6, 28, (2008) 1-11. (with Chin-Hong Puah, and Albert Apoi)

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