# The Impact of Government Expenditures on Imports within the Euro Area

An Analysis of Germany and the Peripheral Countries

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**Abstract**

Southern European countries emphasize the importance of increasing government expenditures of northern European countries as it will boost their internal demand for imported goods originating from southern European countries. This paper uses a vector error correction model to analyze this effect. Three internal demand components (government expenditures, private consumption and private investments) of Germany are regressed upon the volume of imports originating from the four peripheral countries, including Spain, Greece, Ireland and Portugal. The main conclusion of this paper is that only government expenditures and private consumption have a significant effect. However, the results should be interpreted carefully since there is evidence that the model is misspecified.

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# Introduction

Five years after the onset of the global financial crisis, Europe is still struggling to recover from its worst recession since the 1930s. Afflicted by its regional debt crisis, the recovery of the European economy is fragile, leading to unsustainable growth rates. European countries are dealing with severe economic and fiscal disorder and many do not fulfill the criteria of the Stability and Growth Pact[1]. In many countries, budget deficits exceed three percent of GDP while public debt to GDP ratios accumulate to excessive levels. The situation is even more problematic in the peripheral countries, including Greece, Spain, Portugal and Ireland. Unemployment rates have been rising steeply[2] and interest rates have been exceptionally high, indicating a low level of confidence of financial markets. Greece even feared a possible default on their debts and an exit from the Euro area.

The turmoil in southern European countries affects the whole Euro area. Member states are part of a common currency union implicating that monetary policy cannot be applied to country specific shocks. This makes the southern European fiscal difficulties also a northern European problem as a collapse of the Euro area is economically disastrous to all member states[3]. A close involvement, both politically and economically, of the northern countries is required for the European Monetary Union to overcome the current crisis.

However, a broad discussion exists about the right approach of northern European countries. Moreover, attention has returned to the long standing debate about to what extent countries have to comply with the criteria of the Stability and Growth Pact. Northern European countries underline the importance of this Pact. Southern European countries on the other hand, declare that core countries should increase government expenditures, as it induces positive spillover effects to southern European countries. Subsequently, this will stimulate economic activity within the peripheral countries, which is essential to boost the European economy. This statement was among others argued by the former French minister of Finance,

[1] The Stability and Growth Pact, enacted in 1997, facilitates and maintains stability of the Economic and Monetary Union. Currently, 27 member states take part in this agreement which has the objective to coordinate fiscal policy of national governments. Fiscal discipline is asserted as member states has to comply with the regulations of the Pact. The budget deficit to GDP ratio is not allowed to exceed 3%, while the public debt to GDP ratio must be below 60%.

[2] In 2012, Spain and Greece had the highest level of unemployment within the European Union. Spain and Greece had an unemployment rate of 25,0% and 24,2% respectively. Ireland had an unemployment rate of 14,9% and Portugal had a rate of 15,6% (OECD).

[3] A study conducted by UBS (2011) estimates the cost for a weak country leaving the Euro to be around EUR 9.500 to EUR 11.500 per capita during the first year. Cost in subsequent years would amount to EUR 3.000 to EUR 4.000. A stronger country, like Germany, leaving the Euro would incur a loss of EUR 6.000 to EUR 8.000 per capita in the first year and EUR 3.500 to EUR 4.500 in subsequent years. In comparison, a bailout of Greece, Ireland and Portugal would incur a direct cost of EUR 1.000 per capita of a strong country.

Christine Lagarde[4]. *'As it takes two to tango'*, she stated that Germany should increase its investments and consumption to boost domestic demand and stimulate its partners' export industries. Increasing exports of the peripheral countries would positively affect economic activity within these countries. Exports are, next to aggregate domestic demand, one of the main factors explaining economic growth. However, aggregate domestic demand is relatively low in these countries due to the severe austerity measures and the thorough reforms of their economies. This makes exports a considerable determinant stimulating economic activity in peripheral countries.

This paper makes a contribution to the recent discussion about fiscal policy of northern European countries and its effect upon the volume of imports originating from southern European countries. Southern European countries underline the importance of northern European countries to increase their government expenditures as it will stimulate economic activity within the Euro area. This paper examines the effect of government expenditures of core countries upon the volume of imports originating from peripheral countries. However, the model is a simplified version of reality as only Germany is included to represent a northern European country. This choice is motivated by the fact that Germany has a large economy which is currently characterized as the most powerful one in Europe. Other core countries, including Finland, Luxembourg and the Netherlands are not taken into account due to their relatively small economies. The peripheral countries include Spain, Greece, Ireland and Portugal; all receiving financial assistance of the Troika[5]. A Vector Error Correction Model (VECM) is used to examine the effects. This model is a restricted VAR model that incorporates cointegration restrictions. Added to the model are two other internal demand components; private consumption and private investments. These variables are included in the model to acquire the full effect of the three internal demand components. The results show that only government expenditures and private consumption have a positive effect upon the volume of imports originating from peripheral countries. Private investments on the other hand are found not to have a significant effect.

[4] Christine Lagarde was the French Minister of Finance from 2007 to 2011. Before, she fulfilled ministerial posts, including Minister of Agriculture and Fishing and Minister of Trade. Since July 2011, she is the managing director of the International Monetary Fund.

[5] The Troika is formed by three international organizations: the European Commission, the European Central Bank and the International Monetary Fund. The Troika determines if the peripheral countries have made sufficient progress in their austerity measures and economic reforms in order to be eligible for the next tranche of financial support.

This paper is structured as follows. First, a short overview is given about the European sovereign debt crisis. This is followed by a theoretical background, outlining two contradicting theories about fiscal policy, which are the underlying views for the statements of the northern and southern European countries. In addition, this section describes the dynamics of fiscal spillovers induced via the trade channel. Section four gives a overview of previous literature, while section five and six explain the theoretical model and the data. Subsequently, section seven describes the econometric part, outlining the techniques used and the final outcome. Eventually, a conclusion is given in section eight.

## Overview of the European Sovereign Debt Crisis

The European sovereign debt crisis, also referred to as the Euro crisis, commenced at the end of 2009. It is an ongoing debt crisis where almost all European countries face difficulties in refinancing their government debt. Causes of the crisis vary by country, but the collapse of the US subprime mortgage market in 2007 was the start of a global financial crisis which affected all countries. Due to this event, several European banks nearly collapsed and European governments were forced to implement banking bailout packages. In addition, many European countries also increased government spending in an attempt to stimulate domestic economic activity. In November 2008, the European Union passed a stimulus package of 200 billion euros in order to deal with the effects of the financial crisis. In June 2012, another stimulus package of 130 billion euros was announced to support growth and boost the European economy. As government debts rose, financial markets became more anxious whether some governments were capable of repaying their public debts. Concerns especially arose for southern European countries. Public debt and budget deficits increased substantially, far exceeding the criteria imposed by the Maastricht Treaty. Figure 1 and 2 in Appendix A show these economic indicators for the four peripheral countries, including Greece, Spain, Portugal and Ireland. Along with declining economic growth rates, investors were reluctant to invest in these countries, leading to a sharp rise in interest rates on their government debt. Bond yield spreads and risk insurance on Credit Default Swaps widened significantly in relation to Germany, which is considered to have the strongest economy of the Euro area. Brzeski (2011), senior economist at ING, estimated that Germany made more than a 9 billion euro profit from the crisis by the end of 2011, as investors sought out safe havens for their money. Also Austria, Finland and the Netherlands are considered to be safe havens as they benefited from low interest rates as well.

Despite the fact that only a few European countries experienced severe financial imbalances, it has become a persistent problem in the whole Euro area. The structure of the European Monetary Union is not considered as optimal to solve the European sovereign debt crisis. Monetary policy cannot be applied to country specific shocks, while diversity of fiscal policy (member states have, among others, different tax systems and public pension rules) increases divergence among member states (Masson and Taylor, 1993). This hinders European leaders to respond adequately. However, European leaders agreed upon financial support measures at the beginning of 2010. The European Financial Stability Facility (EFSF) and the successive European Stability Mechanism (ESM) were established to provide financial assistance to Euro area member states[6]. Currently, five out of the 17 EMU countries have been forced to seek assistance and received a bailout package of the Troika under the condition that they implement severe austerity measures and economic reforms. The bailout loans are issued in several periods and depend upon the progress made. So far, Greece, Ireland, Portugal and Cyprus received bailout packages of 240, 67.5, 78 and 10 billion euros respectively. Spain received a bailout package of 100 billion euros which was directly appointed to ailing banks.

## Theoretical Background

A long standing debate about the proper fiscal response to a downturn in the economy has existed for many years and erupts in times of recession. In addition, there is currently a discussion going on between northern and southern European countries about the necessary measures regarding fiscal policy to jointly overcome the Euro crisis. Southern European countries argue for increased government expenditures of the core countries as this will stimulate the export industry of peripheral countries. Northern European countries on the other hand, advocate fiscal prudence and fulfillment of the Maastricht criteria. Nevertheless, fiscal contractions[7] are required throughout Europe, since many countries (both northern as southern) do not fulfill the Maastricht criteria. Sound public finances, among others, increase convergence among member states.

[6] From July 2013, the EFSF no longer facilitates new loan agreements and the ESM is the sole institution providing financial loans to euro area member states. The EFSF will however continue to operate in the ongoing programs of Greece, Ireland and Portugal and will cease to exist when all issued funding instruments have been repaid (www.efsf.europa.eu).

[7] Fiscal contractions are defined as cumulative changes in the cyclically adjusted primary deficit as a percentage of potential GDP. It includes privatization, expenditure program reductions, tax increases and other initiatives with the aim of reducing the size of the public sector (Hjelm, 2002).

Southern European countries argue for expansionary fiscal policies of core European countries to stimulate the southern economies. The severe austerity measures and the thorough reforms of the southern European economies resulted in a deep recession, with high unemployment rates and falling levels of aggregate domestic demand. An increase in investment and consumption of the northern European countries would boost the southern European export industry and subsequently affect its economic activity. Increasing exports of southern European countries are especially important to stimulate their economy, since aggregate domestic demand has dropped significantly. Moreover, the Spanish Prime Minister Mariano Rajoy stated that countries able to implement growth policies should do so, in order to stimulate the European economy. Southern European countries are not capable of adopting expansionary fiscal policies in the years to come and a revival of their economies depends to a large extent upon their exports. He states that increasing imports of northern European countries, induced through adopted expansionary policies, will benefit their southern European trading partners, as trade flows are still particularly large within the European Union (Financial Times, 2013).

By contrast, northern European countries oppose this view and emphasize the importance of sound government finances and the fulfillment of the Stability and Growth Pact criteria. Besides, their fiscal capacity is limited since many northern European countries have an increasing public debt to GDP ratio as well and a budget deficit to GDP ratio well above the allowed three percent[8]. These countries are also affected by the European sovereign debt crisis as they are too in a recession, though less severe than southern European countries.

These contradicting views about fiscal policy in economic recessions are based upon two theories, the Keynesian theory and the expansionary fiscal contraction theory. The conventional Keynesian view asserts that government spending and deficit reducing policies are detrimental in times of economic slowdown. The induced decline in aggregate demand and output, caused by policy measures aimed to reduce the budget deficit, worsens the economy further in times of financial distress. Expansionary fiscal policy on the other hand, plays a key role in stimulating economic activity (Hemming et al, 2002).

This counter-cyclical fiscal policy faced criticism in the 1990s, when several countries embarked on substantial fiscal consolidations the decade before. As a result of the two oil

[8] In 2012, the Netherlands had a budget deficit to GDP of 4.1%, well above the allowed 3%. Germany, Finland and Austria had nevertheless a moderate rate. Their budget deficit to GDP in 2012 was respectively, -0.2%, 1.9% and 2.5%. Government debt to GDP for Austria, Germany and the Netherlands were in 2012 respectively 73.4%, 81.9% and 71.2%. Finland had a debt to GDP ratio of 53.0%, well below the maximum allowed ratio of 60% (Eurostat).

crises, countries were characterized with large government debts and deficits and high real interest rates. Contrary to widespread belief, austerity programs in many cases led to an increase in private consumption, surprising many economists and policymakers. The unexpected booms in their economies were the underlying principle for the expansionary fiscal contraction theory (EFC). This theory incorporates the role of future expectations and states that contractionary fiscal policy has an expansionary effect on economic activity. A credible, permanent fiscal policy aimed at reducing the budget deficit stimulates private consumption because of expected lower tax liabilities. Private spending increases sufficiently to countervail the direct effects of the fiscal contraction, aimed at decreasing the fiscal deficit. In addition, an unsustainable fiscal deficit encourages economic agents to save more and consume less in anticipation of an upcoming recession. Hence, a sufficient decrease in the budget deficit asserts agents that the government is taking the necessary steps to avoid a crisis. This leads to a higher confidence level and thus to an increase in private consumption (Hemming et al, 2002).

The validity of the expansionary fiscal contraction theory is confirmed by Giavazzi and Pagano (1990). They were among the first to empirically test this theory as they based their conclusions upon the two largest fiscal consolidations of the 1980s, namely Denmark from 1983 – 1986 and Ireland from 1987 – 1989. These examples showed that fiscal contractions are related to economic recovery, since government spending cuts increased aggregate consumption in both countries. Alesina and Perotti (1996) found complementary evidence for the EFC theory by taking the consolidation policies of five more countries into account[9]. They further refined the EFC theory by implying that government expenditure cuts are more successful in stabilizing debt levels than policy programs focused on raising taxes. Besides, government spending cuts have a larger positive effect upon output if the share of government expenditures to GDP is high (Barry and Devereux, 2003). This is also confirmed by Perotti (1999), who states that high or rapidly growing public debt increases the likelihood for contractions to be expansionary. Furthermore, he emphasizes that the initial conditions, such as the level of debt to GDP, budget deficit to GDP, interest rates and credit constraints, are important indicators determining whether fiscal shocks have Keynesian or non-Keynesian effects. He states that government expenditure shocks generate Keynesian effects at low levels of debt or deficit and non-Keynesian effects in the opposite circumstance.

[9] Next to Denmark and Ireland, they studied the consolidation policies of Belgium from 1984 – 1987, Italy from 1989 – 1992, Portugal from 1984 – 1986, Sweden from 1983 – 1989 and Canada from 1986 – 1988.

However, the statement of southern European countries is based upon the existence of fiscal spillovers. The following section describes these effects in further detail.

***Fiscal Spillovers***

Fiscal policy has spillover effects on other countries, irrespective of whether they are members of a currency union. Spillover effects are economically important as they increase the macroeconomic interdependence among countries. This clarifies the interest of governments in other countries' policy stances, and thus the dispute among northern and southern European countries about fiscal policy. However, the size of spillovers depends upon the degree of openness, the size of the country where the fiscal shock originates, and the distance between the two countries (Beetsma, Giuliodori and Klaassen, 2006).

Fiscal spillovers are especially important for countries joining a monetary union. Member states are financially well integrated and share a common currency, exchange rate and interest rate[10]. This implies that individual countries cannot use the exchange rate and interest rate as monetary instruments to country specific shocks. Stated differently, monetary authorities cannot respond to shocks in individual countries, since monetary measures apply to all member states (Masson and Taylor, 1993). On the contrary, member states of the EMU do have control over their own fiscal policy. Disciplined fiscal policy is therefore a matter of common concern, underlining the need of and compliance with fiscal regulations[11]. Moreover, large fiscal spillover effects contribute to the discussion for enhanced fiscal coordination among countries being part of a monetary union[12].

Fiscal spillovers occur via three channels; the trade channel, the interest rate channel and the exchange rate channel[13]. This paper focus on the first channel, because the trade effect

[10] The common interest rate is set by the unions' central bank and is referred to as the refinancing rate or the minimum bid rate. It is the interest rate at which central banks lend money to commercial financial institutions. It implies that individual governments cannot use this interest rate as an instrument to country specific shocks. Instead, monetary authorities use this tool to influence the interest rate on the money and capital markets, like the Euribor (Euro InterBank Offered Rate) and Eonia (Euro OverNight Index Average). This enables them to pursue their monetary goals and maintain financial stability within the currency area (www.ecb.europa.eu).

[11] An example is the Stability and Growth Pact which has the goal to ensure fiscal prudence of and minimize divergence among European member states. This is a necessary requirement to facilitate and maintain the stability of the European Monetary Union.

[12] See, e.g., Hebous and Zimmermann (2012) and Brunila (2002).

[13] A fiscal expansion may cause a rise in the common interest rate as monetary authorities intervene and uncertainties arise in the financial markets. This negatively affects all member states. Furthermore, if the fiscal shock originates in a large country, it may have a significant influence on the common external exchange rate. An appreciation decreases the competitiveness of the currency area, reducing net exports of all member states. Moreover, the various economic interdependences between the member states denote that there is no clear-cut conclusion about the overall effects of fiscal policy in a monetary union (Huart, 2002).

reflects the debate whether or not northern European countries should increase government expenditures in order to boost imports from peripheral countries, and thus stimulate economic activity within these countries. Besides, the trade channel is more important than the other two channels as intra-European trade is particularly large. Trade barriers do not exist since the establishment of the EMU in 1993, and countries do not face exchange rate risk as prices are denoted in the same currency unit. Literature describing spillover effects induced via the exchange rate and interest rate are given by e.g. Faini (2006), De Santis (2012) and Masson and Taylor (1993).

Fiscal spillovers induced via the trade effect occur via three channels; *i)* part of the fiscal stimulus falls directly on its imports, *ii)* fiscal expansion boosts domestic economic activity, increasing the demand for foreign products and *iii)* increased expenditures raise its domestic prices relative to prices of other countries. This increases the price competitiveness of foreign countries, whereupon domestic consumers might decide to substitute imported goods for locally produced products. The latter two are indirect effects. The aggregate effect leads to an increase in domestic imports, and thus to an increase in exports of its main trading partners. This subsequently stimulates foreign output, absorbing a part of the fiscal stimulus of the originating country (Giuliodori and Beetsma, 2005).

## Literature review

Not much literature has been published about fiscal policy and its spillover effects induced via the trade channel. Most academic literature focus on the overall spillover effects of fiscal policy, measured via changes in output in the affected countries. A common approach used to estimate these effects is the Vector Auto Regression (VAR) approach. This method was popularized by Blanchard and Perotti (2002), who studied the dynamic effects of shocks in government spending and taxes on the level of output of the United States in the postwar period. Benassy-Querer and Cimadomo (2006) adopted this approach and examined the cross-border fiscal spillovers from Germany upon the level of output of the seven largest economies in the European Union. They conclude that fiscal expansions in Germany have a positive effect upon neighboring countries, though the effect is declining in the long run. In a more recent paper, Hebous and Zimmermann (2012) uses a panel VAR approach to analyze the fiscal spillovers within the Euro area by estimating the effect of a fiscal shock in a member state upon the level of output of other members. Their findings indicate that, due to spillover

effects, area-wide fiscal shocks have a bigger effect upon domestic output than individual fiscal shocks.

One of the few studies exploring fiscal spillover effects induced via the trade channel is conducted by Giuliodori and Beetsma (2005). Using a panel VAR approach, they conclude that fiscal expansions of the three largest European economies (Germany, France and Italy) have a significant effect upon the level of imports of other European countries. The effects are nonetheless stronger for small neighboring countries than for countries lying geographically further away and not sharing a common border with the originating country. Furthermore, they conclude that the indirect effect dominates the direct effect. It turns out that fiscal expansion stimulates economic activity, which subsequently leads to more imports from other countries. Another study is performed by Funke and Nickel (2006). They analyze the relation between government expenditures and imports of the G7 countries. However, in contrast to previous literature, they take the long-run equilibrium relationship between the time series (c.q. cointegrating relationship) into account. In addition, they differentiate their model from the conventional form of the trade equation by making a distinction between private and public demand. The conventional trade equations only take total demand as an explanatory variable. Funke and Nickel on the other hand, allow for all demand components, including government expenditures, private consumption, private sector investments and exports.

The model in this paper is based upon the model of Funke and Nickel. The model allows for different demand components and a cointegrating relationship among the variables. However, the approach in this paper differs from the approach used by Funke and Nickel. Instead of their pooled mean group estimation, this paper uses a vector error correction model to account for the interdependent relations between the variables. The following section describes the model in further detail.

# Model

This paper examines the statements of southern European countries, implying that northern European countries should increase government expenditures in order to stimulate domestic demand. This will influence the demand for foreign products, leading to increasing imports of northern European countries which in turn stimulates the export industries of peripheral countries. Subsequently, this triggers domestic economic activity within these countries. Hence, the model in this paper explores whether increases in government expenditures of

northern European countries effect the volume of imports originating from peripheral countries.

The model in this paper is based upon the model of Funke and Nickel (2006). Their theoretical model and cointegrating features are used to explore the relationship between government expenditures of northern European countries and the volume of imports from peripheral countries. Adopting their model allows us to make a distinction between the different demand components, and thus isolating the effect of government expenditures. However, the approach differs from the approach used by Funke and Nickel. In this paper, the effects of the internal demand components are estimated by using a Vector Error Correction Model (VECM), rather than Funke and Nickels' pooled mean group estimation. A VECM incorporates the interdependent relationship between the variables, and thus takes account of the two contradicting theories described before (the Keynesian theory versus the Expansionary Fiscal Contraction theory). Besides, by taking account of the cointegrating relationship between the variables, this paper differs substantially from previous literature estimating the effect of fiscal shocks using a VAR model (e.g. Beetsma et al. 2006)

The model is, however, a simplified version as only Germany is included to represent a northern European country. This choice is motivated by the fact that Germany has a large economy which is currently characterized as the most powerful one in Europe. Other core countries, including Finland, Luxembourg and the Netherlands are not taken into account due to the relative small size of their economies[14]. Other countries, such as France and Italy, are excluded from the model, since they are regarded as intermediate cases. These countries have weaker economic fundamentals and a lower credit rating. Therefore, they cannot be considered as core countries. The peripheral countries include Spain, Greece, Ireland and Portugal; countries all receiving financial assistance from the Troika. Hence, the model analyzes the effect of government expenditures of Germany upon the volume of imports from the four peripheral countries Spain, Greece, Ireland and Portugal. Therefore, four different regressions are performed to analyze the individual effects. In addition, private consumption and private investments are included in the model as endogenous variables. These variables are, together with government expenditures, the three internal demand components influencing the volume of imports. In contrast to the model of Funke and Nickel, this paper

[14] Germany, Finland, Luxembourg and the Netherlands all have a triple A credit rating of the three credit rating agencies (Standard & Poor's, Moody's and Fitch) and can therefore be considered as core countries. However, Standard & Poor's downgraded the Netherlands to AA+ in November 2013.

excludes the variable for exports, since this is an external demand component and does not depend upon demand derived within Germany.

As stated, the effects in this paper are estimated by a Vector Error Correction Model (VECM). This is a restricted VAR model that incorporates cointegrating restrictions. The time series will first be tested to assess whether or not they are stationary and whether they are cointegrated. The baseline model explains the dynamics of the three internal demand components and the volume of imports and can be displayed as follow:

$$AX_t = \mathrm{C(L)}\, X'_{t-p} + u_t \qquad [\ 1\ ]$$

$X_t \equiv (G_t, C_t, I_t, M_{t,i})$ is the vector of endogenous variables, where the characters $G_t$, $C_t$, $I_t$ and $M_{t,i}$ represents the variables *government expenditures*, *private consumption*, *private investments* and the *volume of imports* from country *i*, respectively (*i* representing Spain, Greece, Ireland or Portugal). The subscript *t* represents time and *p* the number of lags. *A* is a matrix with the diagonal elements normalized to unity, illustrating the contemporaneous relations between the four variables. L is the lag operator, where C(L) captures the relation of the current values of the variables and their lagged values. Furthermore, $u_t \equiv (u_t^G, u_t^C, u_t^I, u_{t,i}^M)$ represents the reduced form residuals, which are mutually uncorrelated from each other.

The model assumes that the variables do not depend upon the contemporaneous values of the other endogenous variables. These restrictions imply that the internal demand components do not have a direct effect upon each other, as the variables do not react to contemporaneous changes in others variables. This assumption is also made by Beetsma et al. (2006), insinuating that spending components do not immediately react to any changes in real activity. This is justified by the presence of decision lags and the time required to collect information regarding the state of the economy. Furthermore, the equation shows that the variables depends upon their own lagged values, the lagged values of the other endogenous variables and upon a structural shock. These assumptions are reasonable given that the internal demand variables are only influenced by past developments of these others variables. For example, a government may decide to increase its expenditures to boost the economy after private demand components decreased in the previous time period. Vice versa, private investors and consumers may increase their spending after the government increased its expenditures with the purpose of stimulating the economy.

# Data

The models in this paper consists of three internal demand variables, including *government expenditures, private consumption* and *private investment* of Germany, and the *volume of imports* of Germany originating from the peripheral countries. The peripheral countries all needed financial assistance from the Troika and include Spain, Greece, Ireland and Portugal.

The statistics came from several sources. The import statistics are obtained from the IMF Direction of Trade Statistics (DOTS). Data for both *government expenditures* and *private consumption* comes from the OECD Economic Outlook database. *Government expenditures* are the sum of government final consumption expenditures and government fixed capital formation, which is consistent with previous literature on fiscal policy[15]. *Private consumption* is defined as private final consumption expenditures. Data for *private investments* comes from the IMF database of International Finance Statistics and consists of the variables private gross fixed capital formation and private changes in inventories. These variables are converted into dollars.

The *volume of imports* and *private consumption* are deflated by the consumer price index, while g*overnment expenditures* and *private investments* are deflated by the GDP deflator. Both indexes take the year 2005 as the base year. All variables are seasonally adjusted and expressed in natural logarithms. Quarterly data is used, ranging from 1993Q1 until 2007Q4. Data starts from 1993, the year that the European Single Market was established. This act removed trade barriers across member state of the European Union, allowing for free movement of the factors of production, goods and services. The existence of trade barriers is a fundamental element that influences the volume of trade between countries. By taking data starting from 1993, the model excludes the existence of trade barriers as, from that year on, it is not applicable in the European context. Furthermore, the time series ranges up to the end of 2007 to exclude outliners which might be due to the financial crises started in 2008.

# Econometric results

The appropriate econometric model should be determined in order to analyze the effect of *government expenditures*, *private consumption* and *private investments* upon the *volume of imports* originating from the four peripheral countries. This paper first tests whether the time series are stationary and whether there are cointegrating relationships between the variables. If

[15] See e.g. Auerbach and Gorodnichenko (2012)

the variables are cointegrated, a Vector Error Correction Model should be used as it incorporates cointegrating restrictions into its model. The next paragraphs test whether the time series possesses a unit root and thus whether or not they are stationary. Subsequently, the variables are tested upon the existence of a cointegrating relationships among them.

***Unit root test***

When studying time series processes, it is important to verify whether the series are stationary. Stationarity implies that the statistical properties of the time series, such as its distribution, mean, variance and autocorrelation, do not depend upon time. In other words, it implies that the historical relationship of the variable can be generalized for future forecasting. If not, time series are said to be non-stationary. Non-stationarity arises if the series possesses a persistent long term movement over time. That is, if a time series follows a random walk, it is not stationary because the variance of a random walk increases over time and so the distribution of the time series changes over time. A time series follows a random walk if the value at $t$ depends upon the value at $t - 1$ plus a random error term. This can be illustrated by:

$$Y_t = \beta_0 + Y_{t-1} + u_t$$

where $\beta_0$ is the drift in the random walk and $u_t$ is serially uncorrelated. A series that has a random walk is said to be integrated of order 1, or I(1). It implies that the time series has a stochastic trend and is non-stationary. A series that does not have a stochastic trend and is stationary is said to be integrated of order zero, or I(0) (Stock and Watson, 2007).

One can test whether a time series is non-stationary if it has a so-called unit root, that is, if it has a stochastic trend and thus is I(1). The presence of a unit root in time series can be tested by the so-called Augmented Dickey-Fuller test (ADF test). This test is reliable and commonly used in practice. It is a one sided test, where the null hypothesis states that the variable has a unit root. The null hypothesis is tested against the alternative that the variable has no unit root and thus is stationary. The more negative the statistic is, the stronger is the rejection of the null hypothesis for the presence of a unit root. One must be aware that failure to reject the null hypothesis of a unit root does not necessarily mean that the time series has a stochastic trend. Insufficient information in the data could also be a reason for rejecting the null hypothesis (Stock and Watson, 2007).

Table 1 in Appendix A shows the estimated coefficients from an OLS regression of the variables *government expenditures, private consumption, private investments* and the *volume of imports* originating from Spain, Greece, Ireland and Portugal. The variables are regressed upon a constant and their own lagged value to satisfy the above defined equation. In addition, the Augmented Dickey-Fuller statistic is included in the table. A trend is included in all equations, as a graphical inspection of the series clearly indicates the presence of a positive trend. Besides, the Schwarz Information Criterion (SIC) is used to compute the lag length structure. The critical values for the 1, 5 and 10 percent significance level are -4.12, -3.49 and -3.17 respectively. The slope has a positive value and is significant at a 1 percent level for all variables. The intercept is only significant for *private consumption* and *imports* originating from Portugal. Looking at the ADF statistic, one can see that in all time series, the null hypothesis of a unit root cannot be rejected. This indicates that all the time series have a stochastic trend (c.q. a unit root) and thus depend upon time; that is all time series are I(1). This implies that the estimator of its coefficient can have a nonstandard distribution, even in large samples. Therefore, the use of a standard regression does not give valid estimators. A problem caused by the presence of a stochastic trend is when one or more time series imply that these variables are related, when they are not. This phenomenon is a so-called spurious regression. However, a situation to acquire reliable estimators arises when the time series are said to be cointegrated. This means that the time series have a common stochastic trend, indicating the existence a long-run relationship between the variables (Verbeek, 2008). A test for cointegration between the non-stationary variables will be performed in the next section.

***Cointegration test***

The unit root test described above indicates that the variables are non-stationary and thus depend upon time. The use of non-stationary variables does not necessarily result in invalid estimators if two or more I(1) variables are cointegrated. Cointegration implies that there exists a particular linear combination of these non-stationary variables that is stationary. In other words, the variables have a common stochastic trend that reveals a long-run relationship among the time series. However, the existence of a long-run relationship has an effect upon the short-run behaviour of the variables. The mechanism that drives these short-run movements towards their long-run equilibrium is the so-called error correction mechanism (Verbeek, 2008).

There are three ways to determine whether time series are cointegrated: *i)* common knowledge and economic theory are applied to find an intuitive explanation, *ii)* a graphical view of the time series shows whether the time series have a common stochastic trend, and *iii)* statistical tests for cointegration are performed (Stock and Watson, 2007). These three approaches are used to determine whether a cointegrating relationship exists between *government expenditures*, *private consumption* and *private investments* and the *volume of imports* originated from the four peripheral countries. The following sections describes these three approaches in more detail.

*Intuitive explanation*

First, an intuitive explanation is given, based upon the conventional theory. This theory states that internal demand of a country influences the demand for imported goods. An increase in government expenditures, private consumption and/or private investments will increase the demand for foreign goods[16]. On the other hand, a decrease in one of these internal demand components negatively influences the demand for imports. In addition, a cointegrating relationship may exist among *government expenditures*, *private consumption* and *private investments.* This relationship can be explained by both theories described earlier in this paper. The Keynesian theory states that government expenditures stimulate domestic output and positively affect private consumption and private investments. The Expansionary Fiscal Contraction theory on the other hand, implies that fiscal contraction boost private demand as economic agents take lower future tax liabilities into account. In either case, government expenditures affect private demand.

*Graphical inspection*

The second approach includes a visual inspection of the time series to analyze whether cointegration is plausible. The time series of the three internal demand components are, together with the imports from the four peripheral countries, plotted in the figure 3 in Appendix A. In general, a gradual upward trend is visible in all time series for the whole period. The variables *government expenditures* and *private consumption* show a strong similarity. The time series of the *volume of imports* shows the most resembling with *private investments*. Only Ireland follows a particular course from 1998 until 2006, which cannot be explained intuitively.

[16] The theory holds under the assumption that no trade barriers exist.

*Statistical tests*

The third method includes a statistical test for cointegration. Two procedures are common to test for a long-run relationship in the variables; the two-step Engle-Granger procedure and the Johansen test. Both test are performed in this paper.

The Engle-Granger procedure is the most well know test for cointegration and it is similar to the unit root test described in the previous section. It requires running an OLS regression upon the assumed cointegrated variables and test for the presence of a unit root in the regressions residuals. The long-run cointegrated regression can be estimated according to the following formula:

$$Y_t = \alpha + \beta X'_t + \varepsilon_t \qquad [2]$$

where α is a constant, $X'_t$ is the vector of endogenous variables and ε the residuals. The variables are cointegrated if the error term is stationary and does not have a stochastic trend, i.e. the error term is integrated of order zero (I(0)). The variables are not cointegrated if the error term is integrated of order 1. Hence, the presence of a cointegrating relationship between the variables can be tested by the presence of a unit root in the regressions' residuals. Again, this can be performed by the Augmented Dickey-Fuller test (Verbeek, 2008).

If the variables are cointegrated, the first part of the right hand side of the equation ($\alpha + \beta X'_t$) is considered as the long-run value of the dependent variable, $Y_t$. In that case, the residual, $\varepsilon_t$, reveals the deviation of the dependent variable from its long-run equilibrium. A positive (negative) value of $\varepsilon_t$ indicates that the dependent variable is above (below) its long-run value. Thus, the presence of cointegration suggests that any deviation of the dependent variable from its long-run value must be corrected in order to restore long-run equilibrium. Therefore, an error correction mechanism is included in the formula, modeling the dynamics of the dependent variable upon the dynamics of the independent variables. This error correction model is formulated as:

$$\Delta Y_t = \alpha + \Delta X'_{t-p} + (Y_{t-1} - \theta X'_{t-1}) + \varepsilon t$$

where $Y_t - \theta X'_t$ is the error correction term and θ the error correction coefficient. This equation implies that a change in the dependent variable depends upon a change of the independent variable plus an error correction term. This latter term measures the speed of adjustment towards its long-run equilibrium. Stated differently, it estimates the speed to which the dependent variable returns to its long-run equilibrium after a change in the

independent variable. The error correction coefficient should lie between 0 and 1, where 0 indicates no adjustment and 1 indicates full adjustment. Furthermore, the error correction term must be negatively signed, indicating a move back towards its equilibrium. A positive sign indicates a move away from its equilibrium (Verbeek, 2008). This is quite intuitive, since the relation between the dependent variable and its deviation from the long run is negatively related; if the deviation is positive (i.e. the dependent variable is above its long-run value), the dependent variable adjusts downwards in the next period and if the deviation is negative (i.e. the dependent variable is below its long-run value) the dependent variable adjusts upwards.

Table 2 in Appendix A shows the estimated coefficients of the error correction model for the four individual countries. The three internal demand components are regressed upon the volume of imports from the peripheral country. Two lags are included to take the previous two quarters into account. All error correction terms are significant and have the appropriate, negative, sign. It implies that in case of both Spain and Greece, about 39% of disequilibrium in the long run is corrected each quarter. For Ireland and Portugal this correction is 24% and 37%, respectively. However, many other coefficients are not significant. This puzzling result is an indication for the presence of so-called red flags and it should increase awareness. In addition, the ADF test statistic is included in the table. The ADF test tests the presence of a unit root in the residuals and the test statistic reveals the value for whether or not the null hypothesis is rejected. The null hypothesis states the presence of a unit root which corresponds to no cointegration of the time series. A rejection of the null hypothesis implies a cointegrating relationship between the time series. Accordingly, the Phillips-Ouliaris critical values are adopted. These values are relevant and depend upon *i)* the number of regressors and *ii)* whether a constant and / or a time trend is included[17]. The cointegrated regression in this paper includes a constant and three regressors and no deterministic trend. Hence, for this regression, the critical values for the 1, 5 and 10 percent significance level are 4.73, 4.11 and 3.83, respectively. The outcome of the ADF statistic implies that the null hypothesis of the presence of a unit root can be rejected in all equations[18]. This means that the time series possess a cointegration relationship. However, it must be stressed that these results should be interpreted carefully, since many coefficients are not significant, indicating the presence of possible misspecifications.

The Engle-Granger approach has however a few drawbacks when applied in a Vector Auto Regression model. It tends to lack power as it does not incorporate all the available

[17] The critical values of the different cointegrating regressions are shown in Appendix B
[18] Including a deterministic trend leads to the same rejecting outcome of the null hypothesis.

information about the mutual interactions of the variables. Besides, more than one cointegrating relationship may exist between the variables. This is not incorporated by the Engle-Granger approach as it typically estimates a linear combination between the cointegrated relationships. Nevertheless, the Engle-Granger approach is still appropriate to test for cointegration as the null hypothesis states a non-cointegrating relationship between the variables (Verbeek, 2008).

An alternative cointegration test is the Johansen approach. This approach tests the number of cointegrating relationships and is therefore better applicable than the Engle-Granger approach if there are more than two variables. There are two types of the Johansen tests; the trace test and the maximum eigenvalue test. The null hypothesis of the trace test is formulated as $H_0$: $r \leq r_0$, versus the alternative $H_1$: $r_0 > r$, where $r$ is the number of cointegrated vectors. The null hypothesis of this test successively refers to the number of cointegrating relationships. If the null hypothesis of no cointegration is rejected, the trace approach tests the null hypothesis of at least one cointegrating relationship. This continues until a null hypothesis is not rejected. The maximum eigenvalue test conducts a separate test on each eigenvalue. The null hypothesis states the presence of $r$ cointegrated vectors against the alternative of $r + 1$ ($H_o$: $r = r_0$ vs $H_1$: $r = r_0 + 1$). Despite the fact that these two tests differ slightly from each other, they do not always provide the same number of cointegrating vectors (Verbeek, 2008).

Consequently, the Johansen test is performed upon the variables *government expenditures, private consumption, private investments,* and the *volume of imports* from Spain, Greece, Ireland and Portugal, respectively. The results are shown in table 3 in Appendix A. When examining the results, a clear contradicting outcome is provided by the two tests. According to the trace test, only Greece and Portugal have cointegrating vectors. For Greece the null hypothesis of no cointegrating vectors is rejected, implying that one cointegrated relationship exist. For Portugal on the other hand, the null hypothesis of two cointegrating variables is rejected, indicating the presence of three cointegrated variables. Both Spain and Ireland do not have a cointegrated relationship in the trace test. Looking at the outcome of the maximum eigenvalue test, opposite results are given. Spain and Ireland both have one cointegrated vector, while Greece and Portugal have no cointegration relationship among the variables. These results are striking and together with the detected red flags in the Engle-Granger approach, it should increase awareness concerning the cointegrating relationship among the variables. Nevertheless, both the Engle-Granger approach and at least

one test in the Johansen approach identifies a cointegrating vector. Therefore, this paper continues under the assumption that a cointegrating relationship exits among the variables.

As explained above, a cointegrating relationship implies that a long-run relationship exists between the variables. However, a long-run relationship has implications for the short-run movement of the variables. It indicates the presence of a particular short-run behavior that moves towards their long-run equilibrium relationship. This mechanism, computed by the vector error correction mechanism, reveals a long-run relationships in the short term dynamics (Stock and Watson, 2007). However, a vector autoregressive model, which is used in previous literature to analyze the effect of fiscal shocks upon the level of output, does not take the dynamics of cointegrated vectors into account. Instead, this paper uses a vector error correction model to determine the effect of the internal demand component of Germany upon the volume of imports from the four individual peripheral countries.

***Vector Error Correction Model***

A vector error correction model (VECM) is a restricted VAR model that incorporates cointegration restrictions to get a reliable outcome. Therefore, the VECM is suitable for non-stationary time series that are known to be cointegrated. The model incorporates cointegrating relations to restrict the long-run behaviour of the endogenous variables to converge towards their cointegrating relationship. At the same time, the model allows for short-run adjustment dynamics. These partial short-run adjustments gradually correct the deviation from the long-run equilibrium, which is know as the so-called error correction term (Mishra P.K., 2011).

The baseline model, defined by equation [1], gives four equations, equal to the number of endogenous variables. These equations are formulated as:

$$\Delta M_t = \alpha_{1t} + \beta_{1p}\Delta M_{t-p} + \beta_{1p}\Delta G_{t-p} + \beta_{1p}\Delta C_{t-p} + \beta_{1p}\Delta I_{t-p} + \gamma_1 ECT + u_{1t}$$
$$\Delta G_t = \alpha_{2t} + \beta_{2p}\Delta M_{t-p} + \beta_{2p}\Delta G_{t-p} + \beta_{2p}\Delta C_{t-p} + \beta_{2p}\Delta I_{t-p} + \gamma_2 ECT + u_{2t}$$
$$\Delta C_t = \alpha_{3t} + \beta_{3p}\Delta M_{t-p} + \beta_{3p}\Delta G_{t-p} + \beta_{3p}\Delta C_{t-p} + \beta_{3p}\Delta I_{t-p} + \gamma_3 ECT + u_{3t}$$
$$\Delta I_t = \alpha_{4t} + \beta_{4p}\Delta M_{t-p} + \beta_{4p}\Delta G_{t-p} + \beta_{4p}\Delta C_{t-p} + \beta_{4p}\Delta I_{t-p} + \gamma_4 ECT + u_{4t}$$

where ECT is the error correction term. The combined model in these equations is called the vector error correction model. Tables 4 and 5 in Appendix A show the outcomes of the VECM for the four peripheral countries. Two lags are included to incorporate the effects of the previous two quarters. Table 4 shows the outcome when a trend is included, while table 5

omits this effect. The first parts of the tables (4a and 5a) show the estimated coefficients of the long-run cointegrating equations, defined by equation [2], where the three internal demand components (*government expenditures, private consumption* and *private investments*) are regressed upon the volume of imports originating from the four peripheral countries. As can be seen, most coefficients are significant. The second parts of the tables (4b and 5b) show the coefficients of the error correction terms (ECT) of the four equations formulated above. These coefficients indicate how deviations from its long-run relationship affects the changes in the variable in the next period. In other words, it measures the speed of adjustment in which the variable moves towards its long-run equilibrium. As explained above, these coefficients should be negative, since the relation between the dependent variable and its deviation from the long run is negative. However, the results are striking, since not all coefficients are negative if significant. Looking for example to *government expenditures,* the variables are significant in all countries. In addition, it has the expected negative sign in all countries, except for *imports from Greece*. The coefficients of Greece mean that the variable moves 2,5 percent (with the inclusion of a trend) and 0.7 percent (without the inclusion of a trend) away from its equilibrium. In all other countries, the variables have the appropriate negative sign and move instead towards their long-run equilibrium. Also the variable *private investments* does not have the proper negative sign in any country, raising awareness about the validity of this variable. *Private consumption* on the other hand has, when significant, a negative sign in all countries but Greece.

This remarkable outcome is confirmed when looking at the impulse response functions, displayed in figure 4 in Appendix A. The figures show the response functions of the *volume of imports* after an impulse from the variables *government expenditures, private consumption* and *private investments*. It is peculiar that all functions do not return to zero in the long run. This strengthens the presumption made before that the model might be misspecified. Therefore, this paper extends the model by excluding one of the three internal demand components. This means that the volume of imports will be regressed by three combinations, namely *government and consumption, government and investment* and *consumption and investment*. Hence, a total set of 12 regressions are performed. For consistency reasons, the regressions are checked for the presence of cointegration. Again, this is performed by the Engle-Granger test and Johansen test.

The results of the Engle-Granger test are shown in tables 6 in Appendix A. Again, not many coefficients are significant. The error correction term is nevertheless negative in all regressions, which means that disequilibrium is corrected towards its long-run equilibrium

each quarter. Besides, the error correction term is significant in all cases, except when *Government and Consumption* are regressed upon imports from Spain and Greece. Furthermore, the Augmented Dickey-Fuller statistic is significant in all regressions at a 1 percent level, indicating the presence of a cointegration relationship among the variables. However, as before, the outcome is not straightforward and should be interpreted carefully, since many coefficients are not significant. Again, the Johansen test is performed as a robustness check. The result of both the trace test and the maximum eigenvalue test are given in tables 7 to 10 in Appendix A. As can be seen, both the trace test and the maximum eigenvalue test indicate the presence of at least one cointegrating relationship for the combination *government and consumption* for all countries. Portugal has at least two cointegrating relationships. The other combinations, *government and investment* and *consumption and investment* do not have a cointegrating relationship. This, together with the fact that the error correction term of *private investments* does not move towards its long-run equilibrium, suggests that the inclusion of this variable does not contribute to the model. This result differs from the outcome of the Engle-Granger test, where all regressions have a cointegrating relationship. However, the Johansen test is more powerful than the Engle-Granger test. Therefore, this paper relies more on the outcome of the first test, assuming that only *government and consumption* is relevant. Hence, only the variables *government expenditures* and *private consumption* are regressed upon the volume of imports from the four peripheral countries in the vector error correction model.

The outcome is shown in tables 11 and 12 in Appendix A. Table 1 shows the outcome with the inclusion of a trend, while table 12 does not include a trend. Comparing these results, it is clear that the inclusion of a trend does not contribute to the model. Table 11 shows that the trend is not significant, except for Greece. Furthermore, the variables *government expenditures* and *private consumption* are all significant, except for *private consumption* in case of Portugal in table 11. Notice that the two variables have opposing signs; if *government expenditures* is positive (negative), *private consumption* is negative (positive). This gives supporting evidence that an increase in *government expenditures* crowds out *private consumption* and vice versa. It illustrates a possible confirmation of the expansionary fiscal expansion theory (EFC) explained earlier. An increase in government expenditures decreases private consumption since economic agents take future higher tax liabilities into account. As a result, they save more and consume less. If, on the other hand, governments decide to decrease their expenditures, private consumption will increase since economic agents expect lower tax liabilities, raising their disposable income. Furthermore, it should be noted that the

two variables have contradicting signs for Spain and Greece on one side and Ireland and Portugal on the other; *government expenditures* is negative for Spain and Greece, but positive for Ireland and Portugal. The opposite occurs for *private investments.*

The second part of tables 11 and 12 shows the outcome of the error correction term. As explained before, the coefficient measures the speed of adjustment and a negative sign means that correction of the deviation moves towards its long-run equilibrium. In the case of Ireland and Portugal, all variables have the appropriate negative sign in both tables, though they are not all significant. For Spain and Greece, the outcome is inconclusive since all significant coefficients have a positive sign. This outcome is remarkable and should therefore be interpreted carefully.

The contradicting signs of *government expenditures* and *private consumption* in the cointegrating equation are also visible when looking at the impulse response functions. Figure 5 and 6 in the Appendix A show the response function of the imports for the four peripheral countries after an impulse from respectively *government expenditures* and *private consumption*. Figure 5 represents the impulse response functions when a trend is included, while figure 6 shows the functions without the inclusion of a trend. As one can see, the functions of *government expenditures* and *private consumption* have a contradicting course. If *government expenditures* has a positive course, then *private consumption* follows a negative course, and vice versa[19]. Again, it is remarkable that the response functions do not return to zero in the long run. Therefore, it should be stressed that the outcome must be interpreted carefully and that this model is probably misspecified as well. Nevertheless, the model with the inclusion of only two variables, performs better than the model with all three internal demand components.

After all, it can be concluded that peripheral countries do benefit from increases in government expenditures and private consumption of northern European countries. Increases in private investments on the other hand do not lead to significant increases in the volume of imports from the peripheral countries. Hence, the results strengthen the statement of southern European countries, implying that northern European countries should increase their government expenditures with the aim to stimulate the export of the peripheral countries. Along with, northern European countries can implement policies stimulating private consumption, which subsequently increase the volume of imports from peripheral countries. However, it should be stressed that these conclusions should be interpreted carefully for two

[19] This does, however, not hold for Spain when a trend is included.

reasons. First, the model is a simplified version of reality as only data of the three internal demand components is based on Germany. Other northern European countries might cause other effects, depending on their trade habits. Second, the curves of the impulse response functions indicate that the model might be misspecified since the response functions do not return to zero in the long run. It is not credible that an impulse of government expenditures or private consumption has a long lasting effect on the volume of imports. Nevertheless, this paper contributes to the current discussion as it reveals that only government expenditures and private consumption stimulate the volume of imports, while private investments are not significant.

# Conclusion

Disagreement exists about the proper approach to solve the European sovereign debt crisis. Southern European countries state that core countries should increase their government expenditures with the aim to stimulate the export industry of the peripheral countries. Subsequently, this will stimulate economic activity within the southern European countries. Northern European countries on the other hand, emphasize the importance of the fulfillment of the Maastricht criteria. The core countries are also affected by the financial crisis and are dealing with high ratios of public debt to GDP and budget deficit to GDP as well. Accordingly, they assert that fiscal prudence is important to restore the European economy.

The statements of the southern European countries are based upon the conventional Keynesian theory. This theory states that government expenditures stimulate domestic demand, which will accordingly increase the demand for imported goods. This in turn will increase economic activity in southern European countries, and boost the European economy. By contrast, the view of northern Europe can be based upon the efficiency contraction theory. This theory argues that contractionary fiscal policy has a expansionary effect upon the economy. A credible, permanent fiscal policy stimulates private consumption, because economic agents expect lower tax liabilities in the future. Eventually, private spending increases sufficiently, countervailing the direct effects of fiscal contractions.

This paper examines the validity of the southern European statement. It explores the effect of government expenditures of northern European countries upon the volume of imports from southern European countries. However, the model is simplified version of reality, as only Germany is included to represent northern Europe. Hence, this paper analyzes the effect of German government expenditures upon the volume of imports originating from

Spain, Greece, Ireland and Portugal. In addition, private consumption and private investment are also included in the model in order to measure the effects of the three internal, aggregate demand components. Quarterly data is used, ranging from 1993 to 2007. The regressions are performed by a Vector Error Correction Model, taking the cointegration relationship between the variables into account.

The results show that government expenditures and private consumption of northern European countries have the most beneficial effect upon the volume of imports from southern European countries. Private investment does not has a significant effect. In addition, the results show that government expenditures and private consumption have opposing signs in the long-run, cointegrating equation; if government expenditures increase, private consumption decrease and vice versa. Nevertheless, this paper gives evidence supporting the statement of southern European countries, affirming that government expenditures of northern European countries affect the volume of imports from peripheral countries. Along with, northern European countries can implement policies stimulating private consumption, which subsequently increases the volume of imports from peripheral countries.

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# Appendix A

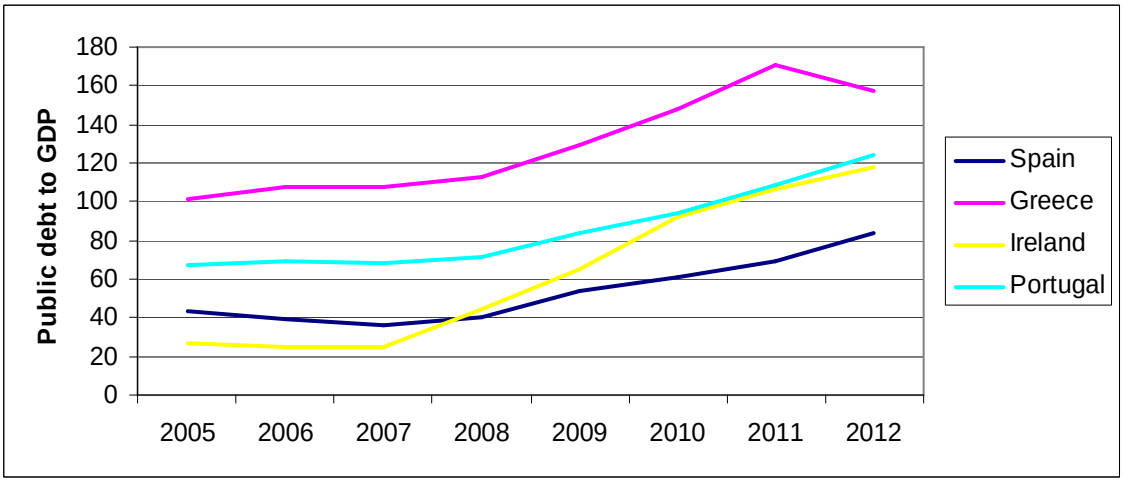



*Figure 1: Public debt to GDP ratio of the four peripheral countries. The Maastricht criteria imposes a restriction of 60%.*

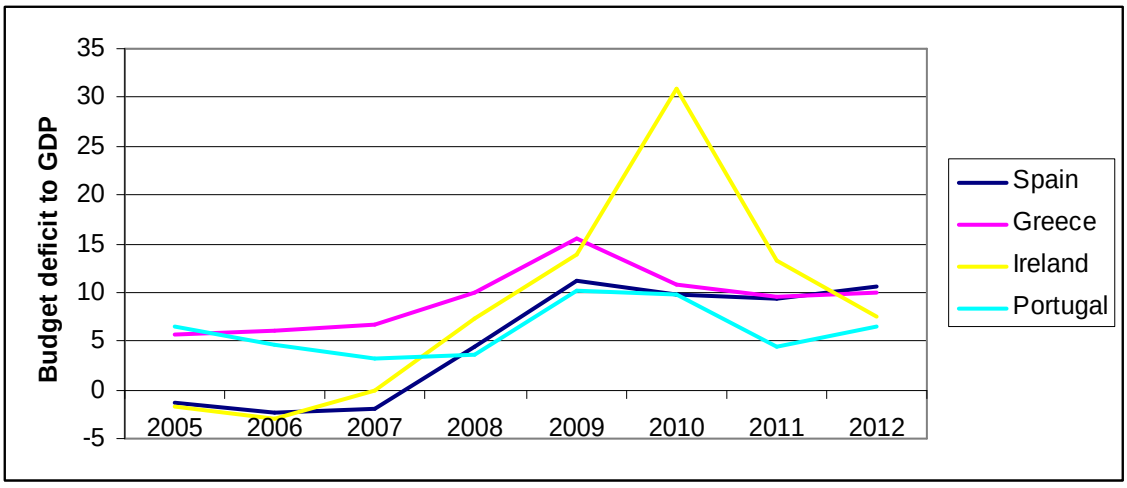



*Figure 2: Budget deficit to GDP ratio of the four peripheral countries. The Maastricht criteria imposes a restriction of 3%.*

| | Govern-ment spending | Private consump-tion | Private invest-ment | Imports from Spain | Imports from Greece | Imports from Ireland | Imports from Portugal |
|---|---|---|---|---|---|---|---|
| **Intercept** | 0.759 | 0.434** | 0.648 | 0.631 | 0.254 | 1.245 | 1.805** |
| **Slope** | 0.972*** | 0.984*** | 0.975*** | 0.973*** | 0.988*** | 0.943*** | 0.914*** |
| ***ADF*** | -3.189 | -3.231 | -0.624 | -1.882 | -0.411 | -2.314 | -2.208 |

*Table 1: Unit root test. The variables are regressed upon an intercept and their own lagged value. The ADF test statistic is included, testing the presence of a unit root in the time series.*

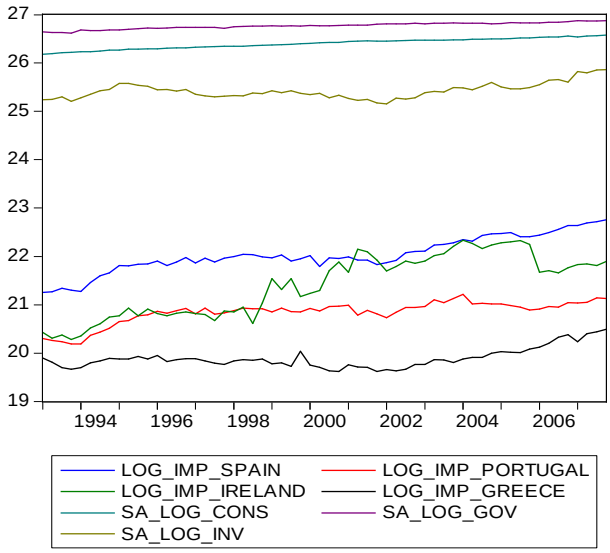



*Figure 3: Graphical illustration of the time series (in logarithms).*

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Intercept** | 0.006 | 0.035* | -0.043 | -0.011 |
| **Government** | 1.238 | 0.412 | 1.244 | 1.333 |
| **Government (*t* - 1)** | 0.559 | -0.961 | 1.853 | 0.985 |
| **Consumption** | 1.755 | -1.938 | 7.380* | 3.053* |
| **Consumption (*t* - 1)** | -0.849 | -1.994 | 0.646 | -0.956 |
| **Investment** | 0.430*** | 0.674*** | 0.158 | 0.353** |
| **Investment (*t* - 1)** | 0.146 | 0.025 | 0.243 | 0.002 |
| **Error Correction Term** | -0.394*** | -0.397*** | -0.225** | -0.375*** |
| ***ADF*** | -8.597*** | -8.011*** | -7.980*** | -9.133*** |

*Table 2: Engle-Granger test. The change in the volume of imports originating from the four peripheral countries are regressed upon an intercept, the change of the three internal demand variables when two lags are included and an error correction term. The ADF test statistic is included, testing the presence of a unit root in the residuals.*

| | Spain | | | Greece | | | Ireland | | | Portugal | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 47.658 | 47.856 | 0.0522 | 74.262 | 63.876 | **0.0052*** | 47.727 | 47.856 | 0.0514 | 81.942 | 63.876 | **0.0007*** |
| **At most 1** | 17.729 | 29.797 | 0.5861 | 42.397 | 42.915 | 0.0563 | 16.471 | 29.797 | 0.6788 | 50.594 | 42.915 | **0.0072*** |
| **At most 2** | 4.548 | 15.495 | 0.8548 | 19.238 | 25.872 | 0.2670 | 7.780 | 15.495 | 0.4873 | 26.339 | 25.872 | **0.0437*** |
| **At most 3** | 0.007 | 3.841 | 0.9308 | 7.480 | 12.518 | 0.2953 | 0.034 | 3.841 | 0.8526 | 9.380 | 12.518 | 0.1582 |

*Table 3a: Johansen cointegration test - Trace test.*

| | Spain | | | Greece | | | Ireland | | | Portugal | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 29.929 | 27.584 | **0.0245*** | 31.865 | 32.118 | 0.0536 | 31.257 | 27.584 | **0.0161*** | 31.348 | 32.118 | 0.0619 |
| **At most 1** | 13.181 | 21.132 | 0.4358 | 23.159 | 25.823 | 0.1081 | 8.673 | 21.132 | 0.8579 | 24.255 | 25.823 | 0.0794 |
| **At most 2** | 4.541 | 14.265 | 0.7983 | 11.738 | 19.387 | 0.4400 | 7.763 | 14.265 | 0.4033 | 16.959 | 19.387 | 0.1088 |
| **At most 3** | 0.007 | 3.841 | 0.9308 | 7.480 | 12.518 | 0.2953 | 0.034 | 3.841 | 0.8526 | 9.380 | 12.518 | 0.1582 |

*Table 3b: Johansen cointegration test - Maximum eigenvalue test*

Table 3: Johansen cointegration test. The test is performed upon the three internal demand components and the volume of imports originating from the four peripheral countries. Table 3a shows the outcome of the trace test, whereas table 3b shows the outcome of the maximum eigenvalue test. A star (*) rejects the null hypothesis, indicating the presence of a cointegrating relationship.

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Intercept** | 146.624 | -70.108 | -124.998 | 451.213 |
| **Government** | 114.137*** | -17.623*** | 52.856*** | 26.213*** |
| **Consumption** | -113.144*** | 19.548*** | -47.257*** | -41.281*** |
| **Investment** | -9.780*** | 0.322 | -2.618** | -3.523*** |
| **Trend** | 0.379** | -0.074*** | 0.010 | 0.187*** |

*Table 4a: Long-run cointegrating equation with the inclusion of a trend.*

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Imports** | -0.004 | -0.011 | 0.006 | -0.046** |
| **Government** | -0.003*** | 0.025*** | -0.009*** | -0.009*** |
| **Consumption** | -0.001 | 0.006 | -0.003* | -0.002 |
| **Investment** | 0.015*** | -0.060 | 0.020 | 0.042** |

*Table 4b: Error correction coefficients with the inclusion of a trend.*

Table 4: Outcome of the VECM where the three internal demand components are regressed upon the volume of imports originating from the four peripheral countries. A trend is included.

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Intercept** | -170.406 | 727.708 | -447.200 | -3161.235 |
| **Government** | 16.038*** | -53.549*** | 44.166*** | 234.212*** |
| **Consumption** | -8.684** | 24.304*** | -27.163*** | -105.626** |
| **Investment** | -2.036*** | 1.747 | -1.554* | -13.432** |

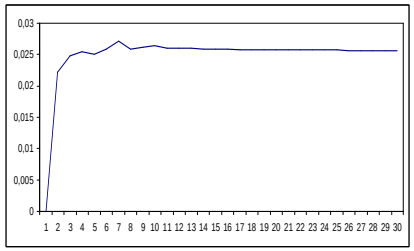
*Table 5a: Cointegrating equation without the inclusion of a trend.*

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Imports** | -0.037 | 0.011 | 0.016 | -0.004 |
| **Government** | -0.014** | 0.007*** | -0.011*** | -0.001*** |
| **Consumption** | -0.007** | 0.003** | -0.004** | -0.001** |
| **Investment** | 0.057* | -0.008 | 0.012 | 0.003 |

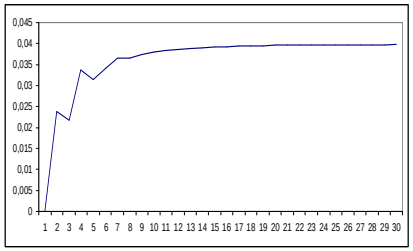
*Table 5b: Error correction coefficient without the inclusion of a trend.*

Table 5: Outcome of the VECM where the three internal demand components are regressed upon the volume of imports originating from the four peripheral countries. A trend is not included.

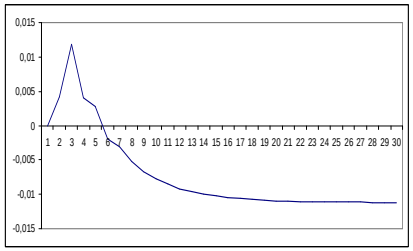
Spain



Greece



Ireland



Portugal

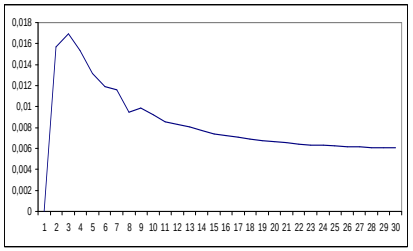
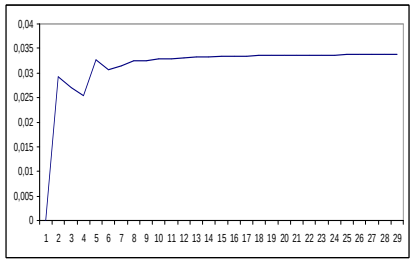
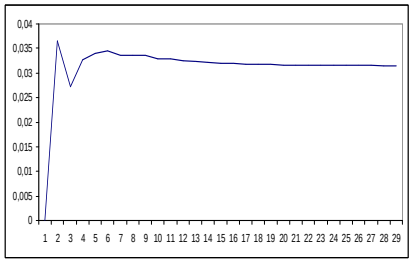


*Figure 4a: Government expenditures*

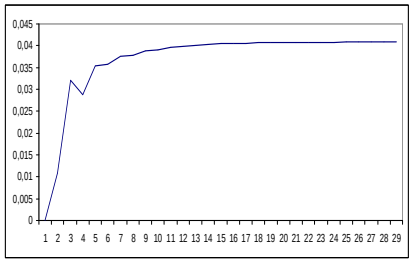
Spain



Greece



Ireland



Portugal

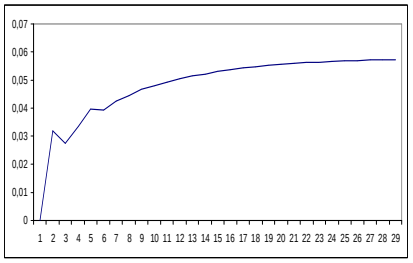
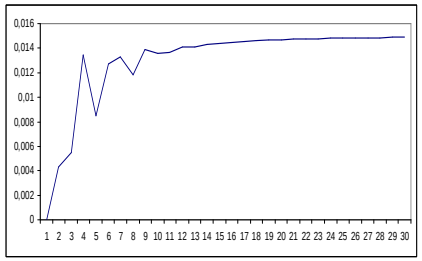
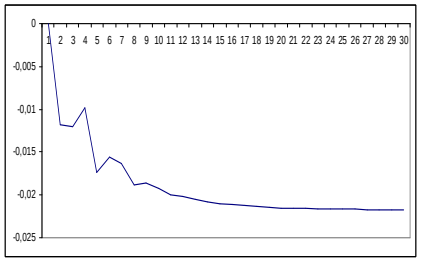


*Figure 4b: Private consumption*

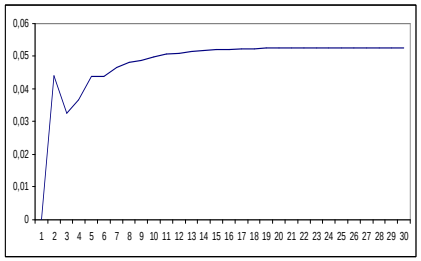
Spain



Greece



Ireland



Portugal

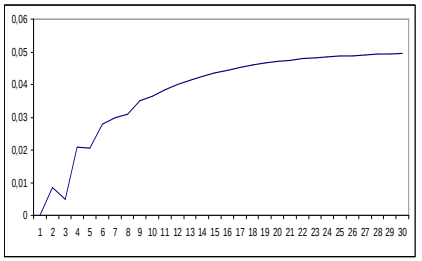


*Figure 4c: Private investments*

Figure 4: Response functions of the volume of imports originating from the four peripheral countries after an impulse of government expenditure (figure 4a), private consumption (figure 4b) and private investment (figure 4c).

| | Volume of Imports | Volume of Imports | Volume of Imports |
|---|---|---|---|
| **Intercept** | 0.013474 | 0.012561 | 0.015657 |
| **Government** | 1.294169 | 1.154343 | |
| **Government (*t* - 1)** | 0.744416 | 0.373833 | |
| **Consumption** | 1.101361 | | 1.452227 |
| **Consumption (*t* - 1)** | -0.633814 | | -0.922403 |
| **Investment** | | 0.381326** | 0.451248*** |
| **Investment (*t* - 1)** | | 0.197671 | 0.100506 |
| **Error Correction Term** | -0.111997 | -0.377608*** | -0.359426*** |
| ***ADF*** | -8.564622*** | -8.391577*** | -8.828300*** |

*Table 6a: Spain*

| | Volume of Imports | Volume of Imports | Volume of Imports |
|---|---|---|---|
| **Intercept** | 0.043742* | 0.006587 | 0.028442 |
| **Government** | 0.734486 | 0.495631 | |
| **Government (*t* - 1)** | -0.737643 | -0.614457 | |
| **Consumption** | -3.252054* | | -1.493048 |
| **Consumption (*t* - 1)** | -1.273243 | | -1.738439 |
| **Investment** | | 0.686110*** | 0.670903*** |
| **Investment (*t* - 1)** | | 0.038995 | -0.020802 |
| **Error Correction Term** | -0.058505 | -0.385475*** | -0.376880*** |
| ***ADF*** | -9.125236*** | -8.118728*** | -8.189826*** |

*Table 6b: Greece*

| | Volume of Imports | Volume of Imports | Volume of Imports |
|---|---|---|---|
| **Intercept** | -0.036927 | 0.015818 | -0.021968 |
| **Government** | 1.047074 | 0.905997 | |
| **Government (*t* - 1)** | 1.984223 | 0.871246 | |
| **Consumption** | 7.411899* | | 6.461328* |
| **Consumption (*t* - 1)** | 0.367642 | | 0.257456 |
| **Investment** | | 0.011310 | 0.189613 |
| **Investment (*t* - 1)** | | 0.358189 | 0.232055 |
| **Error Correction Term** | -0.200488* | -0.230806** | -0.246477** |
| ***ADF*** | -8.012146*** | -7.676760*** | -7.708416*** |

*Table 6c: Ireland*

| | Volume of Imports | Volume of Imports | Volume of Imports |
|---|---|---|---|
| **Intercept** | -0.006754 | 0.004510 | 0.002788 |
| **Government** | 1.515244* | 1.189500 | |
| **Government (*t* - 1)** | 1.098082 | 0.638130 | |
| **Consumption** | 2.348646 | | 2.545151 |
| **Consumption (*t* - 1)** | -0.557055 | | -1.128850 |
| **Investment** | | 0.274623* | 0.378327** |
| **Investment (*t* - 1)** | | 0.078674 | -0.037192 |
| **Error Correction Term** | -0.429289*** | -0.211461** | -0.213386** |
| ***ADF*** | -8.542640*** | -9.808132*** | -9.618989*** |

*Table 6d: Portugal*

Table 6: Engle-Granger test. The change in the volume of imports are regressed upon the change in government and consumption, government and investment, and consumption and investment, respectively. In addition, an intercept and the error correction term are included. The variables are regressed upon two lags. The ADF test statistic tests the presence of a unit root in the residuals. The regressions are performed upon the volume of imports originating from Spain (table 6a), Greece (table 6b), Ireland (table 6c) and Portugal (table 6d).

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 32.128 | 29.797 | **0.0265*** | 15.713 | 29.797 | 0.7323 | 19.188 | 29.797 | 0.4795 |
| **At most 1** | 7.474 | 15.494 | 0.5232 | 5.969 | 15.495 | 0.6992 | 4.242 | 15.495 | 0.8831 |
| **At most 2** | 2.017 | 3.841 | 0.1555 | 0.002 | 3.841 | 0.9662 | 0.003 | 3.841 | 0.9522 |

*Table 7a: Spain: Johansen cointegration test - Trace test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. |
| **None** | 24.654 | 21.132 | **0.0153*** | 9.744 | 21.132 | 0.7682 | 14.946 | 21.132 | 0.2927 |
| **At most 1** | 5.457 | 14.265 | 0.6834 | 5.967 | 14.265 | 0.6174 | 4.239 | 14.265 | 0.8333 |
| **At most 2** | 2.017 | 3.841 | 0.1555 | 0.002 | 3.841 | 0.9662 | 0.003 | 3.842 | 0.9522 |

*Table 7b: Spain: Johansen cointegration test - Maximum eigenvalue test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 36.760 | 29.797 | **0.0067*** | 26.073 | 29.797 | 0.1265 | 29.779 | 29.797 | 0.0502 |
| **At most 1** | 10.280 | 15.495 | 0.2598 | 7.048 | 15.495 | 0.5721 | 9.212 | 15.495 | 0.3462 |
| **At most 2** | 0.558 | 3.841 | 0.4550 | 0.548 | 3.841 | 0.4590 | 0.692 | 3.841 | 0.4055 |

*Tabel 8a: Greece: Johansen cointegration test - Trace test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. |
| **None** | 26.480 | 21.132 | **0.0080*** | 19.025 | 21.132 | 0.0961 | 20.567 | 21.132 | 0.0598 |
| **At most 1** | 9.722 | 14.265 | 0.2308 | 6.499 | 14.265 | 0.5500 | 8.520 | 14.265 | 0.3283 |
| **At most 2** | 0.558 | 3.841 | 0.4550 | 0.548 | 3.841 | 0.4590 | 0.692 | 3.841 | 0.4055 |

*Tabel 8b: Greece: Johansen cointegration test - Maximum eigenvalue test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 36.178 | 29.797 | **0.0080*** | 12.868 | 29.797 | 0.8975 | 16.613 | 29.797 | 0.6685 |
| **At most 1** | 10.472 | 15.495 | 0.2462 | 4.489 | 15.495 | 0.8604 | 7.157 | 15.495 | 0.5594 |
| **At most 2** | 2.841 | 3.841 | 0.0919 | 0.089 | 3.841 | 0.7658 | 0.091 | 3.841 | 0.7627 |

*Table 9a: Ireland: Johansen cointegration test - Trace test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. |
| **None** | 25.706 | 21.132 | **0.0106*** | 8.379 | 21.132 | 0.8791 | 9.456 | 21.132 | 0.7941 |
| **At most 1** | 7.631 | 14.265 | 0.4174 | 4.400 | 14.265 | 0.8149 | 7.066 | 14.265 | 0.4813 |
| **At most 2** | 2.841 | 3.841 | 0.0919 | 0.089 | 3.841 | 0.7658 | 0.091 | 3.841 | 0.7627 |

*Table 9b: Ireland: Johansen cointegration test - Maximum eigenvalue test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. | Trace Statistic | Critical Value | Prob. |
| **None** | 45.461 | 29.797 | **0.0004*** | 23.014 | 29.797 | 0.2454 | 27.682 | 29.797 | 0.0860 |
| **At most 1** | 18.335 | 15.495 | **0.0182*** | 7.117 | 15.495 | 0.5640 | 9.539 | 15.495 | 0.3179 |
| **At most 2** | 2.207 | 3.841 | 0.1374 | 0.027 | 3.841 | 0.8684 | 0.026 | 3.841 | 0.8706 |

*Table 10a: Portugal: Johansen cointegration test - Trace test*

| | Government + Consumption | | | Government + Investment | | | Consumption + Investment | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. | Max Eigen | Critical Value | Prob. |
| **None** | 27.126 | 21.132 | **0.0063*** | 15.897 | 21.132 | 0.2309 | 18.143 | 21.132 | 0.1246 |
| **At most 1** | 16.128 | 14.265 | **0.0251*** | 7.090 | 14.265 | 0.4786 | 9.512 | 14.265 | 0.2460 |
| **At most 2** | 2.207 | 3.841 | 0.1374 | 0.027 | 3.841 | 0.8684 | 0.026 | 3.841 | 0.8706 |

*Table 70b:Portugal: Johansen cointegration test - Maximum eigenvalue test*

Table 7 - 10: Johansen cointegration test. The test is performed upon the volume of imports and upon the combinations government and consumption, government and investment, and consumption and investment. The upper part of the tables show the outcome of the trace test, while the lower parts show the outcome of the maximum eigenvalue test. A star (*) rejects the null hypothesis, indicating the presence of a cointegrating relationship. The tests are performed upon the volume of imports originating from Spain (table 7), Greece (table 8), Ireland (table 9) and Portugal (table 10).

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Intercept** | 194.456 | 36.807 | -351.513 | -2536.346 |
| **Government** | -23.332*** | -17.210*** | 29.899*** | 128.925*** |
| **Consumption** | 15.501*** | 15.359*** | -17.794** | -35.238 |
| **Trend** | -0.036 | -0.047** | -0.019 | -0.195 |

*Table 11a: Long-run cointegrating equation with the inclusion of a trend.*

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Imports** | -0.036 | -0.021 | -0.026 | -0.006 |
| **Government** | 0.029*** | 0.031*** | -0.016*** | -0.003*** |
| **Consumption** | 0.002 | 0.006 | -0.004* | -0.001* |

*Table 81b: Error correction coefficients with the inclusion of a trend.*

Table 11: Outcome of the VECM where government expenditures and private consumption are regressed upon the volume of imports originating from the four peripheral countries. A trend is included.

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Intercept** | 471.102 | 336.993 | -263.539 | -513.047 |
| **Government** | -32.121*** | -24.201*** | 29.572*** | 39.740*** |
| **Consumption** | 13.895*** | 11.025*** | -20.816*** | -21.656** |

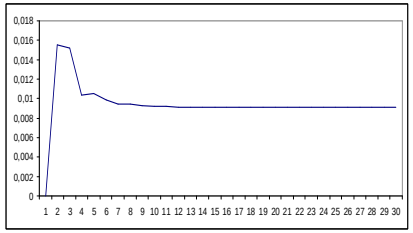
*Table 92a: Long-run cointegrating equation without the inclusion of a trend.*

| | Spain | Greece | Ireland | Portugal |
|---|---|---|---|---|
| **Imports** | -0.002 | 0.020 | -0.036 | -0.022 |
| **Government** | 0.018*** | 0.018*** | -0.017*** | -0.009*** |
| **Consumption** | 0.003 | 0.006** | -0.004 | -0.002 |

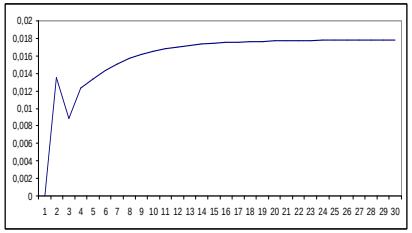
*Table 102b: Error correction coefficients without the inclusion of a trend.*

Table 12: Outcome of the VECM where government expenditures and private consumption are regressed upon the volume of imports originating from the four peripheral countries. A trend is not included.

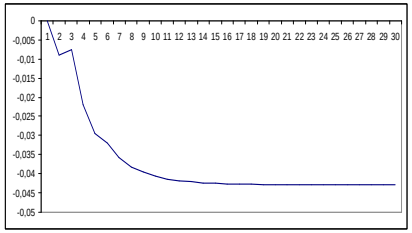
Spain



Greece



Ireland



Portugal

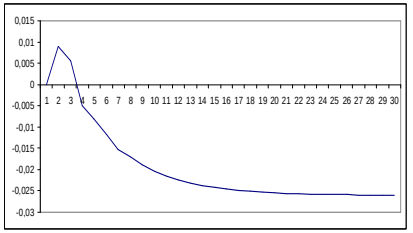
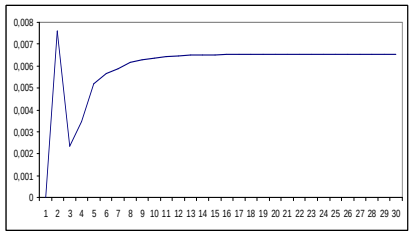
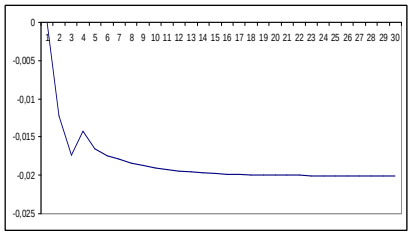


*Figure 5a: Government expenditures*

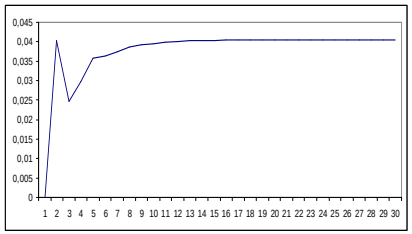
Spain



Greece



Ireland



Portugal

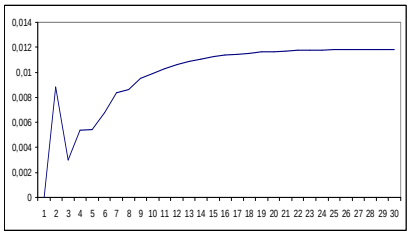
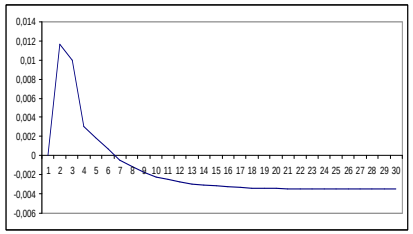


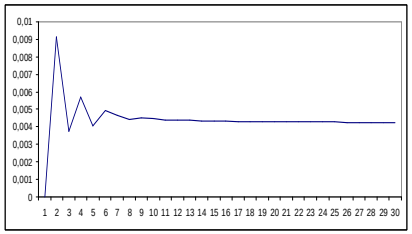
*Figure 5b: Private consumption*

Figure 5: Response functions of the volume of imports originating from the four peripheral countries after an impulse of government expenditure (figure 5a) and private consumption (figure 5b). A trend is included.

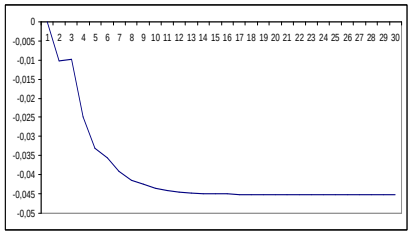
Spain



Greece



Ireland



Portugal

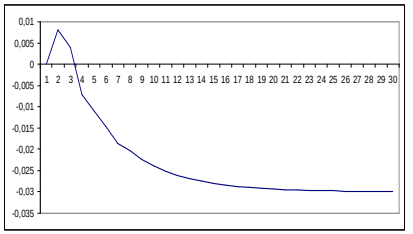
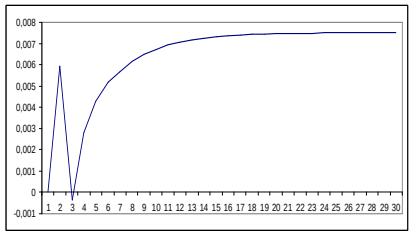
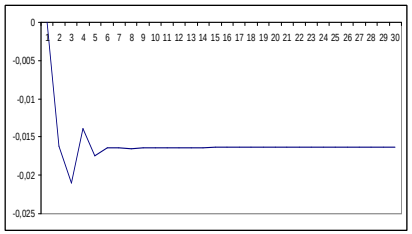


*Figure 6a: Government expenditures*

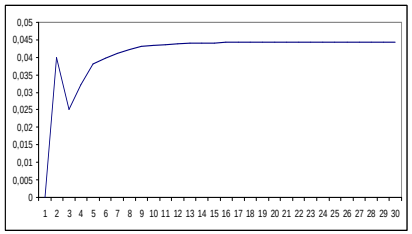
Spain



Greece



Ireland



Portugal

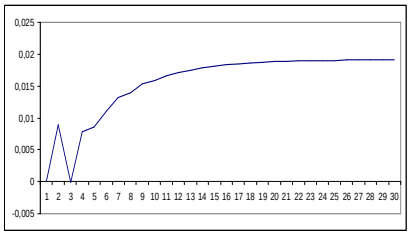


*Figure 6b: Private consumption*

Figure 6: Response functions of the volume of imports originating from the four peripheral countries after an impulse of government expenditure (figure 6a) and private consumption (figure 6b). A trend is not included.

# Appendix B

***Phillips-Ouliaris Critical Values***

Phillips and Ouliaris tabulated critical values for the ADF *t*-statistic. These values are defined for three different cointegrating regressions, which accordingly takes account of three different trend variables. This distinction is fundamental since the asymptotic distribution differs according to the different trend variables in the cointegrated regression. The critical values are computed according to the following formula's:

1. $Y_{1,t} = \beta' Y_{2,t} + \mu_t$
2. $Y_{1,t} = \alpha + \beta' Y_{2,t} + \mu_t$
3. $Y_{1,t} = \alpha + \delta_t + \beta' Y_{2,t} + \mu_t$

where $\alpha$ is a constant, $\delta$ a trend and $\mu$ the error term. The corresponding critical values are shown in the table below.

| | **Regression A** | | | **Regression B** | | | **Regression C** | | |
|---|---|---|---|---|---|---|---|---|---|
| **N** | **1%** | **5%** | **10%** | **1%** | **5%** | **10%** | **1%** | **5%** | **10%** |
| **1** | 3.39 | 2.76 | 2.45 | 3.96 | 3.37 | 3.07 | 4.36 | 3.8 | 3.52 |
| **2** | 3.84 | 3.27 | 2.99 | 4.31 | 3.77 | 3.45 | 4.65 | 4.16 | 3.84 |
| **3** | 4.30 | 3.74 | 3.44 | 4.73 | 4.11 | 3.83 | 5.04 | 4.49 | 4.20 |
| **4** | 4.67 | 4.13 | 3.81 | 5.07 | 4.45 | 4.16 | 5.36 | 4.74 | 4.46 |
| **5** | 4.99 | 4.40 | 4.14 | 5.28 | 4.71 | 4.43 | 5.58 | 5.03 | 4.73 |

*Source: Maddala and Kim (1998)*